Hydro One Networks Inc.
483 Bay Street
7th Floor South Tower
Toronto, Ontario M5G 2P5
HydroOne.com

Frank D'Andrea
Vice President, Reliability Standards
and Chief Regulatory Officer
T 416.345.5680
C 416.568.5534
frank.dandrea@HydroOne.com

BY EMAIL AND RESS

May 16, 2022

Ms. Nancy Marconi
Registrar
Ontario Energy Board
Suite 2700, 2300 Yonge Street
P.O. Box 2319
Toronto, ON M4P 1E4

Dear Ms. Marconi,

EB-2021-0110 – Custom IR Application (2023-2027) for Hydro One Networks Inc. Transmission and Distribution – Inflation Interrogatory Responses

Hydro One's responses to interrogatories are attached here and have been submitted to the Ontario Energy Board's ("OEB") Regulatory Electronic Submission System.

Hydro One's response to I-14-O-LPMA-037 will be submitted shortly.

Where a current interrogatory requested Hydro One to update a previously filed interrogatory, Hydro One has attached the updated interrogatory and included two headers. The first header, in red font, indicates the current information related to this round of interrogatory responses. The second header, in black font, indicates the previously filed information related to the original filing.

Please do not hesitate to contact me should you have questions.

Sincerely,

Frank D'Andrea

Frank D'Andrea

cc: EB-2021-0110 parties

O - STAFF INTERROGATORY - 357

Reference:

Exhibit O-1-2, Page 1

EB-2006-0088 *Report of the Board on Cost of Capital and 2nd Generation Incentive Regulation for Ontario's Electricity Distributors*, December 20, 2006, Pages 26 to 31

EB-2007-0673 *Report of the Board on 3rd Generation Incentive Regulation for Ontario's Electricity Distributors*, July 15, 2008, Pages 8 to 11

EB-2010-0379 *Report of the Board on Rate Setting Parameters and Benchmarking under the Renewed Regulatory Framework for Ontario's Electricity Distributors*, November 21, 2013 (corrected December 4, 2013), Pages 5 to 10 and Appendix, Page i

EB-2021-0212 Procedural Order No. 1 / Schedule B, Preliminary Calculations of 2022 Inflation Factors for 2022 Non-Cost of Service Rate Adjustment Applications: Fact Sheet of Statistics Canada and Bank of Canada Data and Description of Possible Alternative Inflation Indices for 2022 Rates Compiled by Ontario Energy Board Staff (OEB Staff Fact Sheet), August 27, 2021

EB-2021-0212 Decision and Order, November 18, 2021

Preamble:

At the first reference, Hydro One states that it is using the Ontario Consumer Price Index (CPI) as the basis for its inflation assumptions in the current application.

At the second reference (EB-2006-0088), it is stated by the OEB that:

> In a consultation regarding a review of the cost of capital of Ontario's electricity distributors and the development of a second generation IRM plan for adjusting electricity distribution rates annually, the OEB adopted a price cap adjustment formula. The issue of the inflation factor, termed a "price escalator" during the consultation was considered, with various statistics being considered.

In the Report of the Board on Cost of Capital and 2nd Generation Incentive Regulation for Ontario's Electricity Distributors, the OEB stated:[1]

> Macroeconomic (e.g., national or provincial gross domestic or consumer product indices) or industry-specific indices can be used to proxy inflation in an incentive regulation formula. Staff's consultant, Dr. Lowry, prepared a report for the Board on incentive regulation entitled "Second-Generation Incentive Regulation for Ontario Power Distributors" (PEG Report). A table from that report is reproduced on the next page [of the Report of the Board]. The table summarizes a survey of formulas approved in other jurisdictions and shows that the macroeconomic GDP-IPI is the prevalent inflation proxy used by North American regulators for gas and electric utilities.
>
> …
>
> With regard to use of the Consumer Price Index (CPI) rather than GDP-IPI, the Board agrees with Dr. Lowry that GDP-IPI is preferable to the CPI because it tracks a more relevant set of goods and services used as inputs for production by businesses, including electricity distributors. CPI tracks the prices of consumer goods and services, whereas GDP-IPI is a broader measure of inflation that covers other relevant sectors of the economy such as capital equipment. Therefore, the Board will use the GDP-IPI as the inflation proxy for the 2nd Generation IRM.

In the third reference (EB-2007-0673), the OEB retained the GDP-IPI as the inflation factor for 3rd Generation IRM, per the policies established in the EB-2007-0673 Report of the Board on 3rd Generation Incentive Regulation for Ontario's Electricity Distributors, issued July 15, 2008, although options for multi-factor inflation escalators were considered.

At the fourth reference (EB-2010-0379), which was the consultation for the development of 4th Generation IRM under the Renewed Regulatory Framework for Electricity Distributors, the OEB adopted the current 2-factor Input Price Index, stating:

> In the Draft Report, the Board proposed a 2-factor IPI methodology to track inflation and help mitigate volatility. The methodology included:
>
> 1. A labour sub-index comprised of the average weekly earnings for workers in Ontario [footnote omitted]; and

[1] EB-2006-0088 Report of the Board on Cost of Capital and 2nd Generation Incentive Regulation for Ontario's Electricity Distributors, December 20, 2006, pp. 26, 28

> 2. A non-labour sub-index comprised of the Canada GDP-IPI (FDD). [footnote omitted] The GDP-IPI is the federal government's featured index of inflation in the domestic economy's final goods and services. It covers inflation in the prices of capital equipment used by industry as well as inflation in consumer product prices. This broad coverage makes it stable and, for a macroeconomic measure, reasonably reflective of inflation in the prices of distributor inputs. [footnote omitted]
>
> **The Board will adopt the 2-factor IPI methodology.** The Board acknowledges stakeholders' concerns with excluding a capital sub-index however the Board finds that the 2-factor IPI is the most appropriate approach at this time because of a lack of confidence in the proposed approaches for addressing the concerns which arise from introducing the capital sub-index. [Emphasis in original][2]

Page i of Appendix A to the Report of the Board lists alternatives considered and the reasons for their rejection by the OEB. OEB staff notes that CPI is not listed and was not considered during the consultation by the OEB.

At the fifth reference (EB-2021-0212), the OEB Staff Fact Sheet, that was Schedule B to Procedural Order No. 1, data on CPI was provided, along with some discussion:

> The most common measure of inflation familiar to the lay public is the Consumer Price Index (CPI). This is the measure most frequently reported by government, and in the media.
>
> CPI is a measure of inflation as experienced by end consumers, based on a typical basket of goods and services that they purchase. CPI is measured and reported monthly, and aggregated into quarterly and annual statistics. CPI is available for a total basket of goods (All items) and for various sub-components. The basket of goods is fixed for a period of time, so that CPI measures price inflation of that basket of goods, and is updated every five years. In this sense, CPI is a general measure of inflation.

[2] EB-2010-0379 Report of the Board on Rate Setting Parameters and Benchmarking under the Renewed Regulatory Framework for Ontario's Electricity Distributors, November 21, 2013 (corrected December 4, 2013), pp. 7-8

…

> Although CPI is not typically used as a measure of inflation directly related to the utility sector, for Informational purposes OEB staff has provided data on CPI (All items), CPI-trim, CPI-median and CPI-common in Appendices G and H, as these sub-indices may be informative for understanding and assessing the reasonableness of the inflation factor update.[3]

In the sixth reference (the EB-2021-0212 Decision and Order), the OEB adopted retention of the current 2-factor IPI for the inflation measure for electricity transmission revenue requirement adjustment plans and for electricity and natural gas distribution rate adjustment plans for 2022.

OEB staff's understanding is that other than a PBR plan for Consumers Gas noted in the first reference, the OEB has not adopted CPI as an inflation measure for formulaic adjustments of rates. Instead, and consistent with most other North American jurisdictions, macroeconomic measures such as GDP price indices are used, or are used as components of multi-factor indices, to be representative of input price inflation experienced by businesses.

Interrogatory:

a) Please provide Hydro One's reasons for proposing to use Ontario CPI as the basis for the inflation update proposal in Exhibit O / Tab 1 on a conceptual basis.

b) Please indicate if Hydro One believes that Ontario CPI is preferable to the 2-factor IPI (and with sector-specific weights for each of Distribution and Transmission) that the OEB has adopted from, respectively the EB-2010-0379 Board Report and the EB-2018-0218 Decision and Order. Please explain your response.

c) Please state which other inflation statistics and data sources (e.g., Consensus Forecasts, Conference Board of Canada) were considered by Hydro One and why were each rejected.

Response:

a) Hydro One, like other Ontario utilities, relied on the Ontario Consumer Price Index (CPI) as one of its planning assumptions for inflation to forecast future costs. The same approach was used in Hydro One's last transmission rate application (EB-2019-0082), as described in section

[3] EB-2021-0212 Procedural Order No. 1 / Schedule B, Preliminary Calculations of 2022 Inflation Factors for 2022 Non-Cost of Service Rate Adjustment Applications: Fact Sheet of Statistics Canada and Bank of Canada Data and Description of Possible Alternative Inflation Indices for 2022 Rates Compiled by Ontario Energy Board Staff, August 27, 2021, pp. 18-19

2.1 of the transmission system plan. Neither the Ontario Energy Board nor parties to the proceeding took issue with this approach in that proceeding. In the current application, Hydro One used the Ontario CPI to provide a reasonable estimate of future costs in its investment plan, as outlined in SPF Section 1.7.

As part of the current inflation update, Hydro One substituted its original Ontario CPI assumptions of 2.0% per year with revised Ontario CPI assumptions as provided by Scotia, which will be updated for actuals or the most recent forecast at the draft rate order stage. As outlined in Exhibit O-01-02, the update involves a mechanistic de-escalation of the plan amounts to remove the original inflation assumption of 2.0% per year to the base year of 2020. The plan was then re-escalated using the revised inflation rates listed for each of 2021 (3.5% - actual), 2022 (4.5% - forecast), and 2023 (3.3% - forecast) for capital and OM&A, and by 2.0% for years 2024 through 2027 for capital.

b) Yes, Hydro One believes that Ontario CPI is preferable to the 2-factor IPI method referenced by OEB staff as used in the context of Hydro One's original application and the current update. CPI is a well-established inflation metric that represents broad cost trends across the economy and is widely used by governments, businesses, financial markets and the central bank.

Hydro One notes that the use of Ontario CPI for planning purposes better reflects the overall inflationary pressures that are being experienced by many of its customers. As a result, using Ontario CPI as a basis for planning has required Hydro One to manage its plans for capital and OM&A within the inflationary limits experienced by its customers even though the inflationary pressures for particular aspects of Hydro One's business may be exceeding that inflation level (as evident from Exhibit O-01-02 Section 2.2). Because of the need to forecast inflationary effects for the forecast bridge year and for the 2023-2027 plan period, Ontario CPI enables Hydro One to use a forecast that captures current economic circumstances.

The references provided by OEB staff, above, relate to OEB determinations on inflation factors used in an incentive rate-setting framework to formulaically adjust rates after the capital and OM&A envelopes and the associated revenue requirement are established for a utility's first test year. Here, Hydro One has used Ontario CPI to establish appropriate forecasts for its 2023 OM&A and 2023-2027 capital.

Hydro One is not proposing any changes to the inflation factors used for annual adjustments under the Custom IR framework. These should continue to be based on the OEB's 2-factor IPI with sector-specific weights for each of Transmission and Distribution as detailed in Exhibits A-04-02 and A-04-03, respectively.

In any event, the Ontario CPI and OEB's 2-factor IPI are largely aligned. Over 2007-2021, the average Ontario CPI was 1.85% and the average OEB 2-factor IPI for distribution was 1.79%.

c) Please refer to part a) above for further discussion. Other inflation factors have not been considered as the approach was an update to the planning parameter of Ontario CPI.

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Reference:

Exhibit O-1-2, Attachment 1, Page 1, Scotia Global Economics Report

Preamble:

At the above reference, it is stated that:

> Canada's inflation rate averaged 3.4% in 2021 in what was a marked acceleration from 0.7% in 2020 during the first year of the pandemic. Ontario's inflation rate performed similarly in that it accelerated from 0.6% in 2020 to 3.5% in 2021. Year-end rates of inflation hit 4.8% y/y for Canada and 5.2% y/y for Ontario

Interrogatory:

a) Please state the inflation adjustments that were incorporated into Hydro One's 2020 rate and revenue requirement adjustment applications for both transmission and distribution.

b) Please discuss the extent to which Scotiabank Global Economics considers that at least part of the 2021 Ontario CPI annual percentage change reflects a rebound from the low CPI inflation observed in 2020 due to COVID lockdown restrictions.

c) Please provide Hydro One's views as to the extent that the 2020 inflation adjustments incorporated into its 2020 applications over-compensated it for inflation in that year.

Response:

a) *Response from Hydro One:*
For Distribution as part of the 2020 Annual Update application, the OEB approved an inflation factor of 2.0%, or 1.55% after considering the 0.45% productivity factor.

For Transmission, 2020 represented the rebase year and costs were established on cost of service, forward test year approach, as part of the 2020-22 Transmission Application. As a result, there was no adjustment required as part of the Custom IR framework.

b) *Response from Scotiabank:*
We estimate that inflation in 2021 would have been about 1.9% if the CPI trend had been restored to something typical of the past decade instead of 2020. Instead, it was 3.5%. Therefore, inflation in 2021 was materially higher than the inflation rate that we would have

seen in 2021 if the only considerations were the soft prices of 2020 and the restoration of a longer-term price trend.

c) *Response from Hydro One:*

Rates set by the OEB are established on a forecast basis based on the best information available at the time the OEB approves them. Under current rate setting frameworks, utilities are expected to manage variations in actual results relative to forecast amounts for a multitude of factors, not just inflation, once rates are approved by the OEB. Hydro One notes that its current Custom IR framework includes mechanisms such as the Earnings Sharing Mechanism which protect customers from over-earnings above 100 basis points.

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Reference:

Exhibit O-1-1, Page 3
Exhibit O-1-2, Page 4
Exhibit O-1-2, Attachment 1, Page 2

Preamble:

On the first two references above, Hydro One notes that it used a Scotiabank Global Economics January 2022 forecast as the basis for its proposed inflationary adjustments of 4.5% for 2022 and 3.3% for 2023. Hydro One notes that Scotiabank Global Economics increased its forecasts for CPI (Ontario) to 6.3% (2022) and 2.2% (2023), which is also noted on page 2 of Exhibit O / 1 / 2 Attachment 1.

In Attachment 1 to Exhibit O / Tab 1 / Schedule 2, Hydro One provides a copy of Scotiabank Global Economics March 2022 report. On page 2, reference is made to a Scotiabank Global Economics January report for Hydro One.

Interrogatory:

a) Please provide a copy of the Scotiabank Global Economics report for January 2022 that Hydro One is using as the basis for its proposed inflationary adjustments as documented in the March 31, 2022 Inflationary Update.

b) On page 4 of Exhibit O / 1 / 2, Hydro One states that it engaged Scotiabank Global Economics to produce forecasts of Ontario CPI for 2022 and 2023, and was provided with a January forecast on February 11, 2022, and the March forecast on March 31, 2022. Are these Scotiabank Global Economics reports customized for Hydro One's engagement, or are these generic reports that can be subscribed to?

c) Other than Canadian and Ontario CPI, what other inflation statistics does Scotiabank Global Economics analyze and report on? Were these other measures considered, and, if so, why did Hydro One select CPI (Ontario) as the inflation statistic to use for the inflationary adjustment?

Response:

a) *Response from Hydro One:*
The Scotiabank Global Economics report for January 2022 that Hydro One is using as the basis for its proposed inflationary adjustments (which will be subject to confirmation and

adjustment as further described in Exhibit O-01-02 Section 2.5.2) is included as Attachment 1 to this interrogatory. Page six of this report contains the Ontario Total CPI, annual average, forecasts of 4.5% for 2022 and 3.3% for 2023.[1]

b) *Response from Hydro One:*

Attachment 1 to Exhibit O-01-02 (also referenced as Scotia Report in the March 31, 2021 submission) is a customized Scotiabank Global Economics report produced for Hydro One to explain historical inflation and to provide rationale for the inflation forecasts including to provide explanations to a series of questions that broadly relate to why inflation surpassed many forecasters' expectations over 2021 and where Scotiabank expects inflation to go over 2022-27.

Scotiabank Global Economics March forecasts for CPI (Ontario) of 6.3% (2022) and 2.2% (2023) is included as Attachment 2 to this interrogatory. Page six of this report contains the Ontario Total CPI, annual average, forecasts for 2022 and 2023.[2] Both January forecast provided in Attachment 1 and March forecast provided in Attachment 2 are disclosed on an equal dissemination basis and are in the public domain. Anyone can subscribe to these Scotiabank forecasts or go to their web site to obtain them.

c) *Response from Scotiabank:*

Scotiabank forecasts inflation for Canada and the ten individual provinces, the US, Mexico, UK, Eurozone, Germany, France, China, India, Japan, South Korea, Australia, Thailand, Brazil, Colombia, Peru, Chile and Argentina. They forecast CPI for each of these countries. For Canada we also forecast three measures of 'core' inflation that are conventionally utilized. For the US we also forecast core CPI, and the Federal Reserve's preferred PCE and core PCE inflation measures. For Canada, CPI is widely used by governments, businesses, financial markets and the central bank.

Response from Hydro One:

Hydro One's rationale for selecting CPI (Ontario) as the inflation statistic to use for the inflationary adjustment is discussed in the response to O-Staff-357, part a).

[1] This report can also be found on Scotiabank's publicly accessible website through the following link: https://www.scotiabank.com/content/dam/scotiabank/sub-brands/scotiabank-economics/english/documents/forecast-tables/forecast_20220119.pdf

[2] This report can also be found on Scotiabank's publicly accessible website through the following link: https://www.scotiabank.com/content/dam/scotiabank/sub-brands/scotiabank-economics/english/documents/forecast-tables/forecast_20220311.pdf

Scotiabank

GLOBAL ECONOMICS

SCOTIABANK'S FORECAST TABLES

January 19, 2022

Inflation Forcing Hands

- **Despite a clear, but temporary, negative impact of Omicron on economic activity, it is clear that inflationary pressures are larger than earlier assessed and require a more robust monetary policy response.**
- **In Canada, we expect a 25bps move on January 26 followed by 150bps of additional tightening for the remainder of the year, for a total increase of 175bps this year. The policy rate should hit 2% by the end of 2022. Despite that path, the real policy rate would remain negative through the year.**
- **In the United States, we forecast a rate liftoff in March, and foresee a total increase of 175bps in 2022. A less robust labour market in the United States and a need to fully taper asset purchases explain the slightly less aggressive path for the Federal Reserve than the Bank of Canada.**
- **In both countries, inflation would remain uncomfortably high through 2023 even if rates rise as we predict.**

With inflation on the rise and capacity pressures evident in a broad range of sectors, we now believe monetary policy settings in Canada and the United States will tighten sooner and to a greater extent in 2022 than earlier forecast (chart 1). The simple reality is that the very serious public health impacts of Omicron and the associated economic consequences do not outweigh the pressing need to withdraw monetary stimulus. Moreover, the economic impacts of Omicron are almost certain to be temporary, with lost ground made up rapidly once it passes, as was the case in previous COVID waves. As a consequence, we are scaling back our 2022 forecasts for growth in both the US and Canada, though first quarter growth rates will be the most substantially affected by the virus.

In Canada, economic momentum remains strong. Growth in the final quarter of 2021 is likely to have hit around 5.5%, well above our earlier forecasts despite the impacts of the BC floods and landslides and Omicron-related impacts late in the quarter. Though Omicron is expected to shave about 5 percentage points from the quarterly growth rate in Q1-2022, we nevertheless expect growth of 0.4% in that quarter. Much of the lost output in the first quarter will be made up in the second quarter or beyond, resulting in growth of 3.7% in 2022, followed by an expansion of 3.3% in 2023.

Many signs continue to suggest the economy is near or has already hit capacity constraints. The labour market was very robust in the final months of the year: Employment was well above pre-pandemic levels in December, the unemployment rate just a touch above where it was pre-pandemic, and the participation rate just a touch below pre-pandemic levels. Worker scarcity is now a critical challenge for firms, as the number of job vacancies and the job vacancy rate are at the highest levels since data have been collected. While there is mixed evidence of wage increases at present, it is clear that wages will need to rise substantially this year.

As a result of the views above, and some new research looking at **the impact of supplier delivery times on Canadian inflation**, we expect that inflationary pressures will be more persistent than in earlier forecasts, with total CPI inflation averaging 4.3% in 2022 and 3.2% in 2023. If we are right, inflation would be well outside the BoC's inflation control range this year and remain outside it next year. Indeed, recent BoC surveys confirm that inflation is a key worry for both firms and households. That may be an indication that inflation expectations are in need of more active management by the BoC.

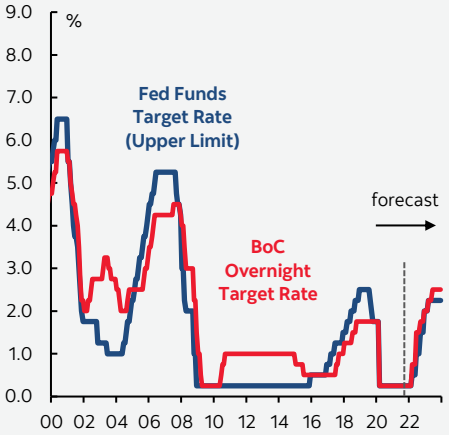
The inflation outlook requires a more rapid withdrawal of stimulus than we have been forecasting. This is all the more important in light of the de facto, and inappropriate,

Contributors

Jean-François Perrault
SVP & Chief Economist
Scotiabank Economics
416.866.4214
jean-francois.perrault@scotiabank.com

Chart 1

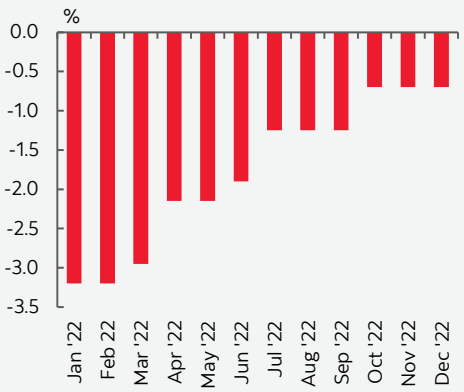
Fed & Bank of Canada Policy Rates



Sources: Scotiabank Economics, Haver Analytics.

Chart 2

BoC Real Policy Rate*



*Calculated as BNS BoC rate forecast minus BNS rolling 1-yr ahead CPI forecast.
Sources: Scotiabank Economics

increase in monetary stimulus that has been provided in the last few months as inflation forecasts have been ramped up despite unchanged policy rates, leading to a fall in the real policy rate (chart 2). With an interest rate increase almost fully priced in January, a pass by the BoC might actually loosen monetary conditions further if the CAD were to depreciate in response. We now forecast a 25bps increase in January, followed by a similar move in March and a 50bps move in April. A total of 175bps of tightening this year is expected, followed by another 50bps next year for year-end policy rates of 2% this year and 2.5% in 2023. Even with this pace of tightening, the real policy rate would remain negative at the end of this year.

In principle, the BoC is still operating under the guidance it had provided earlier that it would only raise its policy rate when the output gap is closed in Q2 or Q3, though Governor Macklem did not repeat this guidance in his December speech. Circumstances are such that we believe a move is necessary in January despite that guidance, which needs to be scrapped whether they move or not. Moreover, the BoC is also likely to raise its own inflation forecast in the Monetary Policy Report even if it scales back its growth forecast for 2022 on account of a temporary growth hit from Omicron. This would make absence of policy action in January all the more striking.

As robust as the economic case for movement next week is, there is a chance that the BoC chooses to delay action until there is less uncertainty regarding COVID. This is the only plausible explanation they could use to move later in the quarter, but as is made clear above, we think the inflation outlook means the BoC does not have the luxury to have greater clarity on the public health front before changing its policy. Moreover, early moves in the policy rate stand a greater chance of impacting the spring real estate market, a perhaps not altogether unwelcome development from the BoC's perspective.

We do not anticipate a linear move in policy rates as the year progresses. There will be 50bps moves and there will be pauses. The first of these 50bps moves could come in March or April. We have settled on April for the moment on the premise that economic data available in March will reflect the impacts of Omicron currently being felt. By April, there should be indicators showing the rebound underway from the current wave of the pandemic, giving Governor Macklem and his colleagues greater confidence that the economy requires a more rapid pace of stimulus withdrawal.

The Federal Reserve is also expected to raise interest rates substantially this year. We are now forecasting 175bps of tightening in the US, with a rate liftoff at their March meeting. Inflation has clearly spooked key FOMC members, with Chair Powell even noting that inflation was the greatest risk to achieving the full employment mandate in the US. The Fed must first completely taper its purchases before hiking, leading to a lag in relation to the BoC's moves. Additionally, given the Fed's dual mandate and the fact that US employment outcomes far lag those in Canada, there is slightly less urgency to the Fed acting. Hence our view that they move in March vs. a January lift off in Canada.

International

	2010–19	2019	2020	2021e	2022f	2023f	2010–19	2019	2020	2021e	2022f	2023f
	Real GDP (annual % change)						Consumer Prices (y/y % change, year-end)					
World (based on purchasing power parity)	3.7	2.8	-3.1	6.2	4.3	3.8						
Canada	2.3	1.9	-5.2	4.6	3.7	3.3	1.7	2.1	0.8	4.7	3.9	2.7
United States	2.3	2.3	-3.4	5.6	3.9	3.3	1.7	2.0	1.2	6.7	4.8	3.1
Mexico	2.7	-0.2	-8.3	5.3	1.9	1.7	4.0	2.8	3.2	7.4	4.5	3.7
United Kingdom	2.0	1.7	-9.4	6.8	4.5	2.2	2.1	1.3	0.6	4.8	3.5	2.2
Eurozone	1.4	1.6	-6.5	5.7	4.2	2.7	1.3	1.3	-0.3	4.7	1.8	1.3
Germany	2.0	1.1	-5.0	3.2	4.0	2.2	1.3	1.5	-0.3	5.4	1.9	1.6
France	1.4	1.8	-8.0	7.9	4.1	2.1	1.2	1.5	0.0	3.3	1.5	1.3
China	7.7	6.0	2.3	8.1	5.1	5.3	2.7	4.5	0.2	1.5	2.3	2.4
India	7.0	4.7	-7.1	9.0	7.0	7.0	6.8	7.4	4.6	5.6	5.0	4.6
Japan	1.2	0.0	-4.7	2.0	2.5	1.3	0.6	0.8	-1.2	0.9	1.0	1.0
South Korea	3.3	2.2	-0.9	4.0	3.0	2.6	1.7	0.7	0.5	3.7	2.5	2.3
Australia	2.6	1.9	-2.3	4.1	3.0	2.8	2.1	1.8	0.9	3.0	2.4	2.5
Thailand	3.6	2.3	-6.1	1.2	4.4	4.0	1.5	0.9	-0.3	2.2	1.5	2.0
Brazil	1.4	1.2	-3.9	4.9	1.0	2.4	5.9	4.3	4.5	10.1	5.8	3.5
Colombia	3.7	3.3	-6.8	9.6	4.5	3.7	3.9	3.8	1.6	5.6	4.5	3.1
Peru	4.5	2.2	-11.1	13.3	2.6	2.8	2.9	1.9	2.0	6.4	4.2	3.0
Chile	3.3	1.0	-5.8	12.0	3.5	2.0	3.2	3.0	3.0	7.2	4.5	3.0
Argentina	1.4	-2.0	-9.9	9.2	1.8	1.4	26.1	53.8	36.1	50.9	36.9	30.6

Commodities

	(annual average)					
WTI Oil (USD/bbl)	74	57	39	68	71	72
Brent Oil (USD/bbl)	82	64	43	70	75	75
WCS - WTI Discount (USD/bbl)	-18	-14	-12	-13	-15	-16
Nymex Natural Gas (USD/mmbtu)	3.39	2.53	2.02	3.84	3.75	3.28
Copper (USD/lb)	3.10	2.73	2.80	4.23	4.25	4.25
Zinc (USD/lb)	1.02	1.16	1.03	1.36	1.50	1.40
Nickel (USD/lb)	7.00	6.31	6.25	8.37	8.50	8.00
Iron Ore (USD/tonne)	101	93	109	160	115	100
Metallurgical Coal (USD/tonne)	179	185	127	204	250	175
Gold, (USD/oz)	1,342	1,393	1,771	1,799	1,850	1,700
Silver, (USD/oz)	21.64	16.21	20.48	25.15	25.00	23.00

Sources: Scotiabank Economics, Statistics Canada, BEA, BLS, IMF, Bloomberg.

North America

	2010–19	2019	2020	2021e	2022f	2023f	2010–19	2019	2020	2021e	2022f	2023f
	Canada (annual % change, unless noted)						United States (annual % change, unless noted)					
Real GDP	2.3	1.9	-5.2	4.6	3.7	3.3	2.3	2.3	-3.4	5.6	3.9	3.3
Consumer spending	2.5	1.4	-6.1	5.4	7.0	3.0	2.2	2.2	-3.8	8.1	4.2	3.4
Residential investment	2.5	-0.3	4.3	14.6	-6.5	0.4	4.5	-0.9	6.8	9.2	0.0	2.9
Business investment*	2.9	1.6	-10.5	-0.5	2.2	6.5	5.2	4.3	-5.3	7.3	2.6	2.9
Government	1.1	0.8	0.9	4.9	1.7	1.5	-0.1	2.2	2.5	0.8	3.5	3.4
Exports	3.5	2.3	-9.7	1.4	7.8	5.7	3.8	-0.1	-13.6	3.5	4.1	4.8
Imports	3.7	0.4	-10.8	6.6	9.9	6.1	4.3	1.1	-8.9	13.3	5.4	4.2
Inventories, contribution to annual GDP growth	0.1	0.1	-1.8	0.7	0.4	0.7	0.2	0.1	-0.6	-0.2	0.4	0.0
Nominal GDP	4.0	3.4	-4.5	12.1	7.0	6.8	4.0	4.1	-2.2	9.9	9.5	6.3
GDP deflator	1.7	1.5	0.7	7.2	3.2	3.4	1.7	1.8	1.2	4.1	5.5	2.9
Consumer price index (CPI)	1.7	1.9	0.7	3.4	4.3	3.2	1.8	1.8	1.3	4.7	5.7	3.7
Core inflation rate**	1.7	1.9	1.7	2.4	3.1	2.9	1.6	1.7	1.4	3.3	3.7	2.6
Pre-tax corporate profits	6.3	-0.6	-1.9	30.6	-0.6	5.2	5.7	2.7	-5.2	25.2	7.1	4.1
Employment	1.3	2.2	-5.1	4.8	3.7	1.7	1.5	1.3	-5.7	2.7	2.9	1.4
Unemployment rate (%)	6.9	5.7	9.6	7.4	5.4	4.9	6.2	3.7	8.1	5.4	4.0	3.9
Current account balance (CAD, USD bn)	-57.0	-47.0	-39.4	7.1	-14.8	-25.2	-409	-472	-616	-824	-911	-943
Merchandise trade balance (CAD, USD bn)	-13.6	-18.4	-39.8	8.9	2.6	1.7	-763	-862	-922	-1096	-1170	-1228
Federal budget balance (FY, CAD, USD bn) ***	-18.7	-39.4	-327.7	-144.5	-58.4	-43.9	-829	-984	-3,129	-2,800	-1,099	-747
percent of GDP	-1.0	-1.8	-14.9	-5.8	-2.2	-1.6	-4.8	-4.6	-15.0	-12.2	-4.4	-2.8
Housing starts (000s, mn)	201	209	220	273	220	199	0.99	1.29	1.40	1.57	1.53	1.50
Motor vehicle sales (000s, mn)	1,816	1,913	1,566	1,668	1,745	1,922	15.7	16.9	14.5	15.0	15.5	17.6
Industrial production	2.4	-0.2	-8.1	4.9	4.0	3.7	1.7	-0.8	-7.2	5.6	3.6	2.4
	Mexico (annual % change)											
Real GDP	2.7	-0.2	-8.3	5.3	1.9	1.7						
Consumer price index (year-end)	4.0	2.8	3.2	7.4	4.5	3.7						
Current account balance (USD bn)	-19.7	-4.0	26.2	0.5	-6.2	-8.5						
Merchandise trade balance (USD bn)	-5.6	5.4	34.0	-10.5	-9.8	-12.4						

Sources: Scotiabank Economics, Statistics Canada, CMHC, BEA, BLS, Bloomberg. *For Canada it includes capital expenditures by businesses and non-profit institutions.
** US: core PCE deflator; Canada: average of 3 core measures published by the BoC. *** In order to align with US reporting, as of the August 2020 issue of Scotiabank's Forecast Tables, Canadian Federal and Provincial Budget Balances for FY2020/21 are noted in calendar year 2020, FY2021/22 in calendar year 2021.

Quarterly Forecasts

	2020	2021				2022				2023			
Canada	Q4	Q1	Q2	Q3	Q4e	Q1f	Q2f	Q3f	Q4f	Q1f	Q2f	Q3f	Q4f
Real GDP (q/q ann. % change)	9.1	4.9	-3.2	5.4	5.5	0.4	7.1	4.6	3.8	3.2	2.6	1.7	1.9
Real GDP (y/y % change)	-3.1	0.3	11.8	4.0	3.1	2.0	4.6	4.3	3.9	4.6	3.5	2.8	2.3
Consumer prices (y/y % change)	0.8	1.4	3.3	4.1	4.7	4.5	4.3	4.3	3.9	3.7	3.4	3.0	2.7
CPI-common (y/y % change)*	1.4	1.4	1.8	1.8	2.0	2.3	2.6	2.7	2.8	2.8	2.8	2.7	2.7
Average of new core CPIs (y/y % change)	1.7	1.8	2.3	2.6	2.8	3.0	3.1	3.2	3.2	3.1	3.0	2.8	2.7
CPIXFET (y/y % change)	1.1	1.0	2.1	3.0	3.4	3.5	3.8	3.7	3.7	3.6	3.3	3.2	3.0
Unemployment Rate (%)	8.8	8.4	8.0	7.2	6.2	6.2	5.5	5.2	4.9	4.8	4.8	4.9	5.0
United States													
Real GDP (q/q ann. % change)	4.5	6.3	6.7	2.3	5.5	1.6	5.5	3.9	4.0	3.3	2.8	2.2	2.0
Real GDP (y/y % change)	-2.3	0.5	12.2	4.9	5.2	4.0	3.7	4.1	3.7	4.1	3.5	3.1	2.6
Consumer prices (y/y % change)	1.2	1.9	4.8	5.3	6.7	6.6	5.9	5.4	4.8	4.3	3.9	3.5	3.1
Total PCE deflator (y/y % change)	1.2	1.8	3.9	4.3	5.6	5.4	5.1	4.8	4.2	3.8	3.5	3.1	2.8
Core PCE deflator (y/y % change)	1.4	1.7	3.4	3.6	4.6	4.4	3.9	3.6	3.0	2.8	2.6	2.5	2.5
Unemployment Rate (%)	6.8	6.2	5.9	5.1	4.2	4.0	4.0	4.0	4.0	4.0	3.9	3.9	3.8

* Refers to BoC's common component of CPI inflation, average of 3 core measures published by the BoC, CPI ex. food, energy and indirect taxes. Sources: Scotiabank Economics, Statistics Canada, BEA, BLS, Bloomberg.

Central Bank Rates

	2020	2021				2022				2023			
	Q4	Q1	Q2	Q3	Q4	Q1f	Q2f	Q3f	Q4f	Q1f	Q2f	Q3f	Q4f
Americas						(%, end of period)							
Bank of Canada	0.25	0.25	0.25	0.25	0.25	0.75	1.50	1.75	2.00	2.25	2.50	2.50	2.50
US Federal Reserve (upper bound)	0.25	0.25	0.25	0.25	0.25	0.50	1.00	1.50	2.00	2.25	2.25	2.25	2.25
Bank of Mexico	4.25	4.00	4.25	4.75	5.50	6.00	6.50	6.75	6.75	6.75	6.75	6.75	6.75
Central Bank of Brazil	2.00	2.75	4.25	6.25	9.25	11.00	12.00	12.00	12.00	12.00	11.25	10.50	9.50
Bank of the Republic of Colombia	1.75	1.75	1.75	1.75	3.00	4.50	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Central Reserve Bank of Peru	0.25	0.25	0.25	1.00	2.50	4.00	4.25	4.50	4.50	4.50	4.50	4.50	4.50
Central Bank of Chile	0.50	0.50	0.50	1.50	4.00	6.25	6.25	6.25	6.00	5.50	5.00	4.50	3.50
Central Bank of Argentina	38.00	38.00	38.00	38.00	38.00	44.00	46.00	48.00	46.00	44.00	40.00	38.00	36.00
Europe													
European Central Bank MRO Rate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
European Central Bank Deposit Rate	-0.50	-0.50	-0.50	-0.50	-0.50	-0.50	-0.50	-0.50	-0.50	-0.50	-0.50	-0.50	-0.50
Bank of England	0.10	0.10	0.10	0.10	0.25	0.50	0.75	0.75	1.00	1.00	1.25	1.25	1.25
Asia/Oceania													
Reserve Bank of Australia	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.25	0.50	0.75	1.00
Bank of Japan	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10
People's Bank of China	3.85	3.85	3.85	3.85	3.80	3.80	3.75	3.75	3.75	3.75	3.75	3.75	3.75
Reserve Bank of India	4.00	4.00	4.00	4.00	4.00	4.00	4.25	4.50	4.75	5.00	5.25	5.25	5.25
Bank of Korea	0.50	0.50	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.50	2.50
Bank of Thailand	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.75	1.00	1.25	1.50

Currencies and Interest Rates

Americas						(end of period)							
Canadian dollar (USDCAD)	1.27	1.26	1.24	1.27	1.26	1.22	1.21	1.20	1.20	1.22	1.22	1.23	1.23
Canadian dollar (CADUSD)	0.79	0.80	0.81	0.79	0.79	0.82	0.83	0.83	0.83	0.82	0.82	0.81	0.81
Mexican peso (USDMXN)	19.91	20.43	19.94	20.64	20.53	20.13	20.82	21.21	21.52	21.69	21.87	21.84	22.21
Brazilian real (USDBRL)	5.19	5.63	4.97	5.44	5.57	5.68	5.71	5.72	5.68	5.65	5.57	5.48	5.40
Colombian peso (USDCOP)	3,428	3,663	3,755	3,809	4,065	4,054	3,933	3,770	3,755	3,750	3,690	3,650	3,600
Peruvian sol (USDPEN)	3.62	3.74	3.87	4.13	4.00	3.80	3.75	3.85	3.80	3.75	3.80	3.75	3.70
Chilean peso (USDCLP)	711	719	734	810	852	800	800	790	780	770	760	750	750
Argentine Peso (USDARS)	84.15	91.99	95.72	98.74	102.74	116.20	124.80	144.60	162.00	192.00	189.00	181.00	178.00
Europe													
Euro (EURUSD)	1.22	1.17	1.19	1.16	1.14	1.12	1.10	1.09	1.08	1.08	1.09	1.09	1.10
UK pound (GBPUSD)	1.37	1.38	1.38	1.35	1.35	1.33	1.34	1.36	1.38	1.38	1.38	1.40	1.40
Asia/Oceania													
Japanese yen (USDJPY)	103	111	111	111	115	113	115	116	118	118	118	120	120
Australian dollar (AUDUSD)	0.77	0.76	0.75	0.72	0.73	0.70	0.70	0.72	0.72	0.72	0.72	0.74	0.74
Chinese yuan (USDCNY)	6.53	6.55	6.46	6.44	6.36	6.30	6.40	6.50	6.30	6.20	6.20	6.10	6.10
Indian rupee (USDINR)	73.1	73.1	74.3	74.2	74.3	72.0	74.0	76.0	72.0	70.0	70.0	68.0	68.0
South Korean won (USDKRW)	1,087	1,132	1,126	1,184	1,189	1,160	1,180	1,200	1,160	1,140	1,140	1,120	1,120
Thai baht (USDTHB)	30.0	31.2	32.1	33.8	33.4	32.0	33.0	34.0	32.0	31.0	31.0	30.0	30.0
Canada (Yields, %)													
3-month T-bill	0.07	0.09	0.14	0.12	0.19	0.95	1.60	1.85	2.15	2.35	2.50	2.50	2.50
2-year Canada	0.20	0.22	0.45	0.40	0.95	1.90	2.10	2.25	2.40	2.55	2.55	2.55	2.55
5-year Canada	0.39	0.99	0.98	1.10	1.26	2.10	2.20	2.35	2.50	2.60	2.60	2.60	2.60
10-year Canada	0.68	1.56	1.39	1.51	1.42	2.15	2.30	2.40	2.55	2.65	2.65	2.65	2.65
30-year Canada	1.21	1.98	1.84	1.99	1.68	2.20	2.40	2.50	2.65	2.70	2.70	2.70	2.60
United States (Yields, %)													
3-month T-bill	0.08	0.01	0.04	0.03	0.06	0.55	1.10	1.60	2.05	2.25	2.25	2.25	2.25
2-year Treasury	0.12	0.16	0.25	0.53	0.73	1.30	1.60	1.85	2.15	2.30	2.30	2.30	2.30
5-year Treasury	0.36	0.94	0.89	0.96	1.26	1.80	1.90	2.00	2.25	2.35	2.35	2.35	2.35
10-year Treasury	0.91	1.74	1.47	1.49	1.51	2.00	2.10	2.25	2.40	2.45	2.45	2.45	2.40
30-year Treasury	1.64	2.41	2.09	2.04	1.90	2.25	2.30	2.40	2.50	2.55	2.55	2.50	2.45

Sources: Scotiabank Economics, Bloomberg.

The Provinces

(annual % change except where noted)

Real GDP	CA	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC
2010–19	2.3	1.0	2.2	1.2	0.7	1.9	2.3	2.1	2.2	2.6	2.9
2019	1.9	3.3	4.7	3.0	1.3	2.8	2.0	0.4	-1.1	-0.1	3.1
2020	-5.2	-5.4	-1.7	-2.5	-3.2	-5.5	-5.1	-4.6	-4.9	-7.9	-3.4
2021e	4.6	2.6	3.3	3.6	3.5	6.1	4.3	3.9	4.1	5.1	4.3
2022f	3.7	2.2	2.8	2.6	2.5	3.1	3.8	3.5	4.4	4.4	4.5
2023f	3.3	2.8	2.6	2.1	1.9	3.2	3.4	3.3	3.6	3.7	3.6
Nominal GDP											
2010–19	4.0	3.5	4.2	2.9	2.8	3.8	4.1	3.8	3.3	3.6	4.6
2019	3.4	2.3	6.6	3.7	2.4	4.7	3.7	0.7	-0.4	1.5	4.6
2020	-4.5	-10.7	0.9	0.7	-1.3	-2.4	-2.8	-1.4	-6.6	-16.1	-0.5
2021e	12.1	15.9	7.8	8.9	9.2	11.0	11.0	9.0	14.4	18.1	12.0
2022f	7.0	5.7	4.8	4.7	4.5	6.1	6.9	6.1	8.3	8.5	8.4
2023f	6.8	5.9	5.5	4.9	4.6	6.7	7.0	5.9	6.6	6.8	7.3
Employment											
2010–19	1.3	0.6	1.5	0.3	0.0	1.2	1.4	0.9	0.8	1.2	2.0
2019	2.2	1.1	3.3	2.3	0.8	2.0	2.8	1.0	1.9	0.7	3.0
2020	-5.1	-5.7	-3.2	-4.7	-2.6	-4.8	-4.8	-3.7	-4.7	-6.6	-6.6
2021	4.8	2.8	3.6	5.4	2.5	4.1	4.9	3.5	2.6	5.1	6.6
2022f	3.7	2.4	2.8	2.9	2.8	3.5	3.9	3.3	3.8	4.0	3.8
2023f	1.7	0.9	1.6	1.8	1.6	1.6	1.8	1.6	1.8	2.0	1.9
Unemployment Rate (%)											
2010–19	6.9	13.3	10.6	8.7	9.4	7.1	7.0	5.6	5.3	6.2	6.1
2019	5.7	12.3	8.7	7.4	8.1	5.1	5.6	5.3	5.6	7.0	4.7
2020	9.6	14.1	10.4	9.8	10.0	8.9	9.6	8.0	8.4	11.4	8.9
2021	7.4	12.9	9.2	8.4	9.0	6.1	8.0	6.4	6.5	8.7	6.5
2022f	5.4	11.4	7.8	6.9	7.6	4.4	5.7	4.5	4.5	6.4	4.8
2023f	4.9	10.9	7.3	6.4	7.0	4.1	5.0	4.1	4.0	5.6	4.4
Total CPI, annual average											
2010-19	1.7	2.0	1.6	1.7	1.8	1.5	1.9	1.8	1.8	1.7	1.6
2019	1.9	1.0	1.2	1.6	1.7	2.1	1.9	2.3	1.7	1.7	2.3
2020	0.7	0.2	0.0	0.3	0.2	0.8	0.6	0.5	0.6	1.1	0.8
2021	3.4	3.7	5.1	4.1	3.8	3.8	3.5	3.2	2.6	3.2	2.8
2022f	4.3	4.0	4.7	4.6	4.7	4.6	4.5	4.1	3.4	4.0	3.5
2023f	3.2	3.0	3.6	3.6	3.6	3.4	3.3	3.1	2.9	3.0	2.6
Housing Starts (units, 000s)											
2010–19	201	2.2	0.8	4.2	2.7	44	70	6.6	6.0	31	34
2019	209	0.9	1.5	4.7	2.9	48	69	6.9	2.4	27	45
2020	220	0.8	1.2	4.8	3.5	53	81	7.3	3.1	24	38
2021e	273	1.2	1.2	5.3	3.9	71	101	7.7	4.2	32	46
2022f	220	1.1	1.1	4.3	3.6	55	75	6.0	4.3	32	38
2023f	199	1.0	1.0	3.8	3.0	48	68	4.5	3.5	30	36
Motor Vehicle Sales (units, 000s)											
2010–19	1,816	33	7	51	41	432	715	55	53	237	194
2019	1,913	31	8	51	41	455	848	58	49	223	216
2020	1,566	27	7	40	35	376	652	47	42	184	178
2021e	1,668	28	8	43	37	403	664	47	41	193	204
2022f	1,745	28	8	45	38	423	695	49	43	202	214
2023f	1,922	29	9	48	40	467	770	53	47	223	236
Budget Balances, (CAD mn)											
2019*	-39,392	-1,383	22	3	49	-523	-8,672	5	-319	-12,152	-321
2020	-327,729	-1,492	-6	-342	409	-7,539	-16,404	-2,117	-1,127	-16,962	-5,468
2021f	-144,500	-595	-61	108	38	-6,847	-21,499	-1,123	-2,708	-5,822	-1,732
2022f	-58,400	-587	-46	-218	-296	-5,547	-19,600	-374	-1,685	-3,277	-5,484

* NL budget balance in 2019 is net of one-time revenue boost via *Atlantic Accord*.

Sources: Scotiabank Economics, Statistics Canada, CMHC, Budget documents; Quebec budget balance figures are after Generations Fund and before Stabilization Reserve transfers.

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GLOBAL ECONOMICS

SCOTIABANK'S FORECAST TABLES

March 11, 2022

Contributors

Jean-François Perrault
SVP & Chief Economist
Scotiabank Economics
416.866.4214
jean-francois.perrault@scotiabank.com

Cereal/Serial Upside Surprises to Inflation Require More Aggressive Response

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Attachment 2

- **Recent US and Canadian economic data suggest once again that we have been underestimating the momentum in these economies.**
- **The Russian aggression is clouding the outlook, however. For commodity importers this is a stagflationary shock. For exporters like Canada, the rise in commodity prices provides a powerful offset to the uncertainty and trade impacts of the conflict.**
- **The conflict is the most recent among a now long list of serial upside shocks to inflation.**
- **Though this is clearly a supply shock, inflation starting points in Canada and the US provide limited flexibility for central banks to look through this most recent development. Modest upward revisions to rate forecasts are necessary to ensure that second round impacts of the conflict don't add further fuel to rising inflation expectations.**
- **In Canada, we now expect the policy rate to rise to 2.5% by the end of this year with a terminal rate of 3% in 2023. In the US, we forecast the Fed will raise its target rate to 2.25% by the end of the year and raise rates by another 25bps in early 2023.**

Russian aggression in Ukraine is complicating the task of central bankers. The uncertainty emanating from developments there, how these developments propagate around the world, and their effect on financial markets and commodities is likely to have vastly differing impacts on economies. Those that are closer to the conflict and more reliant on commodity imports are going to be quite negatively impacted. This is the case for much of Europe. For others, such as Canada, that produce many of the commodities being affected by the conflict, the rising value of exports is a powerful offset to the uncertainty and reduced growth prospects in Europe. For all countries, there is no question that developments in Russia and Ukraine are inflationary.

In Canada and the US, recent economic indicators point to a stronger expansion expected in late 2021 and early 2022. This momentum is leading to an upward revision to growth in Canada for instance, despite the situation in Ukraine. This alone warrants an upward revision to our rate calls. The impact of much higher commodity prices across a broad range of raw materials coming from the Russian aggression should provide a powerful economic boost to Canada. We are, however, offsetting much of that positive impact to take into account heightened uncertainty. This results in forecasted growth in real GDP of 4.3% in 2022 and 3.2% in 2023. That forecast remains below what the BoC had forecast in its January Monetary Policy Report, which Governor Macklem has indicated would likely be revised upwards in its April Monetary Policy Report. So, we are by no means on the optimistic side of forecasters. If we, or the BoC, are correct, the growth to come over the next couple of years will be the strongest 2-year growth period since 1999 if we exclude 2021 given that it was boosted by a COVID rebound.

This exceptionally strong growth environment will add to inflationary pressures, but so will the impact of Russian aggression on commodity prices and associated supply chain disruptions. Assumptions about the conflict and the duration of its effect on commodity prices are of critical importance to the inflation outlook. For the moment, we assume that sanctions peak over the next 12 months and that commodities remain elevated relative to pre-conflict levels for that time. We have no crystal ball, and the disruption could well last much longer, or less long than that. We will adjust our forecasts in time once we have more clarity on the realism of that assumption. An early point of reference is Russia's statement that it would limit or cease exports of raw materials until at least December 31.

The combined impact of greater economic strength in Canada along with the implications of our commodity price assumptions is leading us to significantly raise our inflation forecast. We see year-over-year inflation rising from the 5.1% seen in January to 6.2% in 2022-Q3. For the year, we see total inflation averaging 5.9% in 2022, falling to 3.1% in 2023. Both are clearly quite some distance from the BoC's 2% target.

There is a debate on how central banks should best respond to current inflationary dynamics. In principle, central bankers should look through supply shocks. The impact of the conflict is clearly a supply shock, so by that logic the Bank of Canada and other central banks should largely look through these developments. That would be correct so long as there was no evidence of these shocks leading to second round impacts or rising inflation expectations. With inflation well outside the BoC's 1 to 3 per cent inflation control range, and businesses expecting to increase prices by 4.5% over the next twelve months (according to the CFIB's February Business Barometer, which does not capture the impacts of the Russian aggression), we believe Governor Macklem does not have much flexibility in dealing with additional shocks to inflation. We think the BoC is falling farther and farther behind the curve. As a result, we now predict that it will raise its policy rate by an additional 2 percentage points this year, ending the year at 2.5%. Another 50bps of tightening is forecast for next year, leaving the terminal rate at 3%. This is 50bps higher than our last forecast.

There is no doubt that this is an aggressive call in relation to the views held by others, but we believe the inflation outlook requires such a response. Given the serial upside surprises to inflation in recent months, the balance of risks to inflation and its consequences has shifted up and we consider that a more aggressive policy response would better guard against downside risks associated with higher inflation than a more gradual approach.

A very similar dynamic is in play in the United States, as inflation continues its upward path. As elsewhere in the world, we expect a shift from expenditure on goods to services will relieve some of the upward pressure on inflation, but service price inflation is also trending up now. Much like in Canada, the Fed must weigh current and future inflationary dynamics in the context of rising concern about the consequences of inflation and a potential reduction in the Fed's credibility. For these reasons, we have added 25bps of tightening to our US Fed Funds target rate forecast. We now forecast a 2022 year-end rate of 2.25, followed by an additional 25bps move in early 2023.

International

	2010–19	2019	2020	2021e	2022f	2023f	2010–19	2019	2020	2021e	2022f	2023f
	Real GDP (annual % change)						Consumer Prices (y/y % change, year-end)					
World (based on purchasing power parity)	3.7	2.8	-3.1	6.2	4.1	3.7						
Canada	2.3	1.9	-5.2	4.6	4.3	3.2	1.7	2.1	0.8	4.7	5.8	2.1
United States	2.3	2.3	-3.4	5.7	3.9	3.3	1.7	2.0	1.2	6.7	6.8	3.2
Mexico	2.7	-0.2	-8.2	4.8	1.9	1.7	4.0	2.8	3.2	7.4	4.8	3.7
United Kingdom	2.0	1.7	-9.4	7.5	3.1	1.2	2.1	1.3	0.6	4.8	6.6	2.7
Eurozone	1.4	1.6	-6.5	5.6	3.1	2.2	1.3	1.3	-0.3	4.7	4.6	1.8
Germany	2.0	1.1	-5.0	3.1	2.9	1.9	1.3	1.5	-0.3	5.4	4.9	2.0
France	1.4	1.8	-8.0	7.4	3.0	2.0	1.2	1.5	0.0	3.3	3.4	1.7
China	7.7	6.0	2.3	8.1	5.1	5.3	2.7	4.5	0.2	1.5	2.5	2.2
India	7.0	4.7	-7.1	8.9	7.0	7.0	6.8	7.4	4.6	5.7	5.7	5.4
Japan	1.2	0.0	-4.7	1.9	2.4	1.8	0.6	0.8	-1.2	0.8	1.7	1.0
South Korea	3.3	2.2	-0.9	4.0	3.0	2.6	1.7	0.7	0.5	3.7	2.9	2.3
Australia	2.6	1.9	-2.3	4.8	4.1	2.7	2.1	1.8	0.9	3.5	3.0	2.7
Thailand	3.6	2.3	-6.1	1.6	4.0	4.0	1.5	0.9	-0.3	2.2	4.2	2.4
Brazil	1.4	1.2	-3.9	4.8	1.0	2.4	5.9	4.3	4.5	10.1	5.8	3.5
Colombia	3.7	3.2	-7.0	10.8	4.5	3.7	3.9	3.8	1.6	5.6	5.3	3.3
Peru	4.5	2.2	-11.0	13.3	2.6	2.8	2.9	1.9	2.0	6.4	4.2	3.0
Chile	3.3	1.0	-5.8	12.0	3.5	2.0	3.2	3.0	3.0	7.2	5.4	3.0
Argentina	1.4	-2.0	-9.9	9.6	1.8	2.6	26.1	53.8	36.1	50.9	38.3	30.6

Commodities

	(annual average)					
WTI Oil (USD/bbl)	74	57	39	68	98	82
Brent Oil (USD/bbl)	82	64	43	70	102	85
WCS - WTI Discount (USD/bbl)	-18	-14	-12	-13	-13	-15
Nymex Natural Gas (USD/mmbtu)	3.39	2.53	2.02	3.84	4.01	3.28
Copper (USD/lb)	3.10	2.73	2.80	4.23	4.25	4.25
Zinc (USD/lb)	1.02	1.16	1.03	1.36	1.50	1.40
Nickel (USD/lb)	7.00	6.31	6.25	8.37	8.50	8.00
Iron Ore (USD/tonne)	101	93	109	160	115	100
Metallurgical Coal (USD/tonne)	179	185	127	204	250	175
Gold, (USD/oz)	1,342	1,393	1,771	1,799	1,800	1,700
Silver, (USD/oz)	21.64	16.21	20.48	25.15	24.50	23.00

Sources: Scotiabank Economics, Statistics Canada, BEA, BLS, IMF, Bloomberg.

North America

	2010–19	2019	2020	2021e	2022f	2023f	2010–19	2019	2020	2021e	2022f	2023f
	Canada (annual % change, unless noted)						United States (annual % change, unless noted)					
Real GDP	2.3	1.9	-5.2	4.6	4.3	3.2	2.3	2.3	-3.4	5.7	3.9	3.3
Consumer spending	2.5	1.4	-6.1	5.1	7.7	3.9	2.2	2.2	-3.8	7.9	4.3	3.5
Residential investment	2.5	-0.3	4.3	15.2	-6.5	-1.1	4.5	-0.9	6.8	9.1	0.3	3.0
Business investment*	2.9	1.6	-10.5	1.9	5.7	7.9	5.2	4.3	-5.3	7.4	3.7	3.0
Government	1.1	0.8	0.9	4.8	2.0	2.0	-0.1	2.2	2.5	0.5	2.2	3.1
Exports	3.5	2.3	-9.7	1.4	7.0	4.5	3.8	-0.1	-13.6	3.5	4.2	4.8
Imports	3.7	0.4	-10.8	7.4	9.8	6.2	4.3	1.1	-8.9	13.3	5.4	4.2
Inventories, contribution to annual GDP growth	0.1	0.1	-1.8	0.9	0.4	0.3	0.2	0.1	-0.6	0.0	0.3	0.0
Nominal GDP	4.0	3.4	-4.5	13.1	9.5	6.0	4.0	4.1	-2.2	10.1	10.8	6.9
GDP deflator	1.7	1.5	0.7	8.2	5.0	2.8	1.7	1.8	1.2	4.1	6.7	3.5
Consumer price index (CPI)	1.7	1.9	0.7	3.4	5.9	3.1	1.8	1.8	1.3	4.7	7.7	4.3
Core inflation rate**	1.7	1.9	1.7	2.4	3.7	2.8	1.6	1.7	1.4	3.3	4.7	2.7
Pre-tax corporate profits	6.3	-0.6	-1.9	32.7	2.5	5.2	5.7	2.7	-5.2	25.4	7.5	4.1
Employment	1.3	2.2	-5.1	4.8	4.1	1.3	1.5	1.3	-5.8	2.8	3.3	1.3
Unemployment rate (%)	6.9	5.8	9.6	7.4	5.2	5.1	6.2	3.7	8.1	5.4	3.8	3.8
Current account balance (CAD, USD bn)	-57.0	-47.0	-39.4	1.6	-14.2	-29.3	-409	-472	-616	-824	-867	-869
Merchandise trade balance (CAD, USD bn)	-13.6	-18.4	-39.8	5.2	9.3	5.8	-763	-862	-922	-1096	-1139	-1176
Federal budget balance (FY, CAD, USD bn) ***	-18.7	-39.4	-327.7	-144.5	-58.4	-43.9	-829	-984	-3,129	-2,800	-1,099	-747
percent of GDP	-1.0	-1.8	-14.9	-5.8	-2.1	-1.5	-4.8	-4.6	-15.0	-12.2	-4.3	-2.7
Housing starts (000s, mn)	201	209	218	271	238	227	0.99	1.29	1.40	1.60	1.63	1.60
Motor vehicle sales (000s, mn)	1,816	1,914	1,567	1,669	1,745	1,922	15.7	16.9	14.5	15.0	15.6	17.7
Industrial production	2.4	-0.2	-8.1	5.0	4.3	3.8	1.7	-0.8	-7.2	5.5	3.3	2.4
	Mexico (annual % change)											
Real GDP	2.7	-0.2	-8.2	4.8	1.9	1.7						
Consumer price index (year-end)	4.0	2.8	3.2	7.4	4.8	3.7						
Current account balance (USD bn)	-19.4	-4.0	26.2	-2.3	-7.5	-9.1						
Merchandise trade balance (USD bn)	-5.6	5.4	34.0	-11.5	-11.2	-12.4						

Sources: Scotiabank Economics, Statistics Canada, CMHC, BEA, BLS, Bloomberg. *For Canada it includes capital expenditures by businesses and non-profit institutions.
** US: core PCE deflator; Canada: average of 3 core measures published by the BoC. *** In order to align with US reporting, as of the August 2020 issue of Scotiabank's Forecast Tables, Canadian Federal and Provincial Budget Balances for FY2020/21 are noted in calendar year 2020, FY2021/22 in calendar year 2021.

Quarterly Forecasts

	2020	2021				2022				2023			
Canada	Q4	Q1	Q2	Q3	Q4	Q1f	Q2f	Q3f	Q4f	Q1f	Q2f	Q3f	Q4f
Real GDP (q/q ann. % change)	9.1	4.8	-3.6	5.5	6.7	3.5	5.4	4.6	3.0	3.6	2.7	1.9	1.4
Real GDP (y/y % change)	-3.1	0.2	11.7	3.8	3.3	3.0	5.3	5.0	4.1	4.1	3.4	2.8	2.4
Consumer prices (y/y % change)	0.8	1.4	3.3	4.1	4.7	5.5	5.9	6.2	5.8	4.6	3.3	2.5	2.1
CPI-common (y/y % change)*	1.4	1.4	1.8	1.9	2.0	2.5	3.0	3.4	3.4	3.3	3.1	2.9	2.8
Average of new core CPIs (y/y % change)	1.7	1.8	2.2	2.6	2.8	3.5	3.7	3.9	3.6	3.2	2.9	2.7	2.5
CPIXFET (y/y % change)	1.1	1.0	2.1	3.0	3.2	4.1	4.4	4.7	4.2	3.6	3.2	2.9	2.6
Unemployment Rate (%)	8.9	8.4	7.9	7.2	6.3	5.8	5.3	5.0	4.9	4.9	5.0	5.2	5.4
United States													
Real GDP (q/q ann. % change)	4.5	6.3	6.7	2.3	7.0	1.0	5.4	3.2	4.0	3.6	2.9	2.3	2.0
Real GDP (y/y % change)	-2.3	0.5	12.2	4.9	5.6	4.2	3.9	4.1	3.4	4.0	3.4	3.2	2.7
Consumer prices (y/y % change)	1.2	1.9	4.8	5.3	6.7	8.0	8.1	7.8	6.8	5.6	4.4	3.7	3.2
Total PCE deflator (y/y % change)	1.2	1.8	3.9	4.3	5.5	6.5	6.6	6.3	5.4	4.4	3.4	2.9	2.6
Core PCE deflator (y/y % change)	1.4	1.7	3.4	3.6	4.6	5.6	5.0	4.6	3.7	3.1	2.8	2.6	2.5
Unemployment Rate (%)	6.8	6.2	5.9	5.1	4.2	3.9	3.7	3.7	3.8	3.8	3.8	3.8	3.7

* Refers to BoC's common component of CPI inflation, average of 3 core measures published by the BoC, CPI ex. food, energy and indirect taxes. Sources: Scotiabank Economics, Statistics Canada, BEA, BLS, Bloomberg.

Central Bank Rates

	2020	2021				2022				2023			
	Q4	Q1	Q2	Q3	Q4	Q1f	Q2f	Q3f	Q4f	Q1f	Q2f	Q3f	Q4f
Americas						(%, end of period)							
Bank of Canada	0.25	0.25	0.25	0.25	0.25	0.50	1.25	2.00	2.50	3.00	3.00	3.00	3.00
US Federal Reserve (upper bound)	0.25	0.25	0.25	0.25	0.25	0.50	1.00	1.75	2.25	2.50	2.50	2.50	2.50
Bank of Mexico	4.25	4.00	4.25	4.75	5.50	6.50	7.00	7.25	7.50	7.50	7.50	7.50	7.25
Central Bank of Brazil	2.00	2.75	4.25	6.25	9.25	11.50	12.25	12.25	12.25	12.25	11.25	10.50	9.50
Bank of the Republic of Colombia	1.75	1.75	1.75	1.75	3.00	5.25	6.50	6.50	6.50	6.00	5.50	5.00	5.00
Central Reserve Bank of Peru	0.25	0.25	0.25	1.00	2.50	4.00	4.25	4.50	4.50	4.50	4.50	4.50	4.50
Central Bank of Chile	0.50	0.50	0.50	1.50	4.00	7.00	7.50	7.50	7.50	7.00	6.25	5.50	4.50
Central Bank of Argentina	38.00	38.00	38.00	38.00	38.00	44.00	44.00	46.00	42.00	40.00	38.00	37.00	36.00
Europe													
European Central Bank MRO Rate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.50	0.50
European Central Bank Deposit Rate	-0.50	-0.50	-0.50	-0.50	-0.50	-0.50	-0.50	-0.50	-0.50	-0.25	-0.25	0.00	0.00
Bank of England	0.10	0.10	0.10	0.10	0.25	0.75	1.00	1.25	1.25	1.50	1.50	1.50	1.50
Asia/Oceania													
Reserve Bank of Australia	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.25	0.50	0.75	1.00	1.25
Bank of Japan	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10
People's Bank of China	3.85	3.85	3.85	3.85	3.80	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60
Reserve Bank of India	4.00	4.00	4.00	4.00	4.00	4.00	4.25	4.50	4.75	5.00	5.25	5.25	5.25
Bank of Korea	0.50	0.50	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.50	2.50
Bank of Thailand	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.75	1.00	1.25	1.50	1.75

Currencies and Interest Rates

Americas						(end of period)							
Canadian dollar (USDCAD)	1.27	1.26	1.24	1.27	1.26	1.27	1.21	1.20	1.20	1.22	1.22	1.23	1.23
Canadian dollar (CADUSD)	0.79	0.80	0.81	0.79	0.79	0.79	0.83	0.83	0.83	0.82	0.82	0.81	0.81
Mexican peso (USDMXN)	19.91	20.43	19.94	20.64	20.53	20.13	20.82	21.21	21.52	21.69	21.87	21.84	22.21
Brazilian real (USDBRL)	5.19	5.63	4.97	5.44	5.57	5.68	5.71	5.72	5.68	5.65	5.57	5.48	5.27
Colombian peso (USDCOP)	3,428	3,663	3,755	3,809	4,065	4,054	3,933	3,770	3,755	3,750	3,690	3,650	3,600
Peruvian sol (USDPEN)	3.62	3.74	3.87	4.13	4.00	3.80	3.75	3.85	3.80	3.75	3.80	3.75	3.70
Chilean peso (USDCLP)	711	719	734	810	852	800	800	790	780	770	760	750	750
Argentine Peso (USDARS)	84.15	91.99	95.72	98.74	102.74	114.80	125.90	143.50	140.10	138.00	135.00	132.00	131.00
Europe													
Euro (EURUSD)	1.22	1.17	1.19	1.16	1.14	1.09	1.12	1.10	1.10	1.10	1.10	1.12	1.12
UK pound (GBPUSD)	1.37	1.38	1.38	1.35	1.35	1.32	1.36	1.38	1.38	1.38	1.38	1.40	1.40
Asia/Oceania													
Japanese yen (USDJPY)	103	111	111	111	115	115	115	116	118	118	118	120	120
Australian dollar (AUDUSD)	0.77	0.76	0.75	0.72	0.73	0.73	0.72	0.72	0.74	0.74	0.74	0.76	0.76
Chinese yuan (USDCNY)	6.53	6.55	6.46	6.44	6.36	6.30	6.40	6.40	6.30	6.20	6.20	6.10	6.10
Indian rupee (USDINR)	73.1	73.1	74.3	74.2	74.3	75.0	76.0	76.0	75.0	74.0	74.0	73.0	73.0
South Korean won (USDKRW)	1,087	1,132	1,126	1,184	1,189	1,200	1,220	1,220	1,200	1,180	1,180	1,160	1,160
Thai baht (USDTHB)	30.0	31.2	32.1	33.8	33.4	32.0	33.0	33.0	32.0	31.0	31.0	30.0	30.0
Canada (Yields, %)													
3-month T-bill	0.07	0.09	0.14	0.12	0.19	0.60	1.40	2.20	2.70	3.00	3.00	3.00	3.00
2-year Canada	0.20	0.22	0.45	0.40	0.95	1.55	1.90	2.50	2.90	3.05	3.05	3.05	3.05
5-year Canada	0.39	0.99	0.98	1.10	1.26	1.70	2.10	2.75	3.00	3.10	3.10	3.10	3.10
10-year Canada	0.68	1.56	1.39	1.51	1.42	1.90	2.30	2.95	3.10	3.20	3.20	3.20	3.20
30-year Canada	1.21	1.98	1.84	1.99	1.68	2.20	2.55	3.15	3.20	3.30	3.30	3.30	3.30
United States (Yields, %)													
3-month T-bill	0.08	0.01	0.04	0.03	0.06	0.40	1.20	1.90	2.20	2.30	2.30	2.30	2.30
2-year Treasury	0.12	0.16	0.25	0.53	0.73	1.70	1.90	2.30	2.50	2.60	2.60	2.60	2.60
5-year Treasury	0.36	0.94	0.89	0.96	1.26	1.90	2.25	2.40	2.55	2.65	2.70	2.70	2.70
10-year Treasury	0.91	1.74	1.47	1.49	1.51	1.95	2.35	2.50	2.65	2.75	2.75	2.80	2.80
30-year Treasury	1.64	2.41	2.09	2.04	1.90	2.35	2.50	2.75	2.90	3.00	3.00	3.05	3.05

Sources: Scotiabank Economics, Bloomberg.

The Provinces

(annual % change except where noted)

Real GDP	CA	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC
2010–19	2.3	1.0	2.2	1.2	0.7	1.9	2.3	2.1	2.2	2.6	2.9
2019	1.9	3.3	4.7	3.0	1.3	2.8	2.0	0.4	-1.1	-0.1	3.1
2020	-5.2	-5.4	-1.7	-2.5	-3.2	-5.5	-5.1	-4.6	-4.9	-7.9	-3.4
2021e	4.6	2.7	3.2	3.5	3.4	6.1	4.1	3.8	4.0	5.5	4.4
2022f	4.3	2.4	2.8	2.6	2.5	3.5	4.1	3.5	5.0	5.5	4.8
2023f	3.2	2.8	2.5	2.1	1.9	2.7	3.2	3.3	3.6	4.0	3.6
Nominal GDP											
2010–19	4.0	3.5	4.2	2.9	2.8	3.8	4.1	3.8	3.3	3.6	4.6
2019	3.4	2.3	6.6	3.7	2.4	4.7	3.7	0.7	-0.4	1.5	4.6
2020	-4.5	-10.7	0.9	0.7	-1.3	-2.4	-2.8	-1.4	-6.6	-16.1	-0.5
2021e	13.1	17.0	8.3	8.8	9.1	11.4	11.3	8.9	18.5	23.1	12.1
2022f	9.5	12.1	6.9	5.5	5.5	7.1	8.1	8.6	14.5	15.6	10.0
2023f	6.0	4.9	4.9	4.3	4.0	5.6	6.2	5.7	5.9	6.4	6.7
Employment											
2010–19	1.3	0.6	1.5	0.3	0.0	1.2	1.4	0.9	0.8	1.2	2.0
2019	2.2	1.1	3.3	2.3	0.8	2.0	2.8	1.0	1.9	0.7	3.0
2020	-5.1	-5.7	-3.2	-4.7	-2.6	-4.8	-4.8	-3.7	-4.7	-6.6	-6.6
2021	4.8	2.8	3.6	5.4	2.5	4.1	4.9	3.5	2.6	5.1	6.6
2022f	4.1	2.9	4.0	3.0	2.6	3.6	4.5	3.5	4.1	4.5	3.8
2023f	1.3	0.7	1.2	1.2	1.1	1.2	1.4	1.2	1.5	1.6	1.5
Unemployment Rate (%)											
2010–19	6.9	13.3	10.6	8.7	9.4	7.1	7.0	5.6	5.3	6.2	6.1
2019	5.8	12.3	8.7	7.4	8.1	5.1	5.6	5.3	5.6	7.0	4.7
2020	9.6	14.1	10.4	9.8	10.0	8.9	9.6	8.0	8.4	11.4	8.9
2021	7.4	12.9	9.2	8.4	9.0	6.1	8.0	6.4	6.5	8.7	6.5
2022f	5.2	11.4	7.9	6.9	7.5	4.3	5.5	4.4	4.5	6.1	4.6
2023f	5.1	11.0	7.7	6.7	7.3	4.2	5.3	4.2	4.3	5.8	4.4
Total CPI, annual average											
2010-19	1.7	2.0	1.6	1.7	1.8	1.5	1.9	1.8	1.8	1.7	1.6
2019	1.9	1.0	1.2	1.6	1.7	2.1	1.9	2.3	1.7	1.7	2.3
2020	0.7	0.2	0.0	0.3	0.2	0.8	0.6	0.5	0.6	1.1	0.8
2021	3.4	3.7	5.1	4.1	3.8	3.8	3.5	3.2	2.6	3.2	2.8
2022f	5.9	5.4	7.2	5.7	6.1	5.5	6.3	6.1	5.3	5.6	5.3
2023f	3.1	2.8	3.7	2.8	3.2	2.9	3.3	3.2	2.8	2.9	2.8
Housing Starts (units, 000s)											
2010–19	201	2.2	0.8	4.2	2.7	44	70	6.6	6.0	31	34
2019	209	0.9	1.5	4.7	2.9	48	69	6.9	2.4	27	45
2020	218	0.8	1.2	4.8	3.5	53	81	7.3	3.1	24	38
2021e	271	1.0	1.3	6.0	3.8	68	100	8.0	4.2	32	48
2022f	238	1.2	1.2	4.8	3.7	59	81	6.4	4.5	35	42
2023f	227	1.0	1.0	4.5	3.6	57	76	6.0	4.4	34	39
Motor Vehicle Sales (units, 000s)											
2010–19	1,816	33	7	51	41	432	715	55	53	237	194
2019	1,914	31	8	51	41	455	848	58	49	223	216
2020	1,567	27	7	40	35	376	652	47	42	184	178
2021e	1,669	29	8	45	38	407	664	49	43	196	199
2022f	1,745	29	8	46	39	422	693	51	44	205	208
2023f	1,922	30	9	49	41	466	769	55	47	227	229
Budget Balances, (CAD mn)											
2019*	-39,392	-1,383	22	3	49	-523	-8,672	5	-319	-12,152	-321
2020	-327,729	-1,492	-6	-342	409	-7,539	-16,404	-2,117	-1,127	-16,962	-5,468
2021f	-144,500	-595	-27	108	38	-6,847	-21,499	-1,123	-2,708	-3,207	-483
2022f	-58,400	-587	-93	-218	-296	-5,547	-19,600	-374	-1,685	511	-5,461

* NL budget balance in 2019 is net of one-time revenue boost via *Atlantic Accord*.

Sources: Scotiabank Economics, Statistics Canada, CMHC, Budget documents; Quebec budget balance figures are after Generations Fund and before Stabilization Reserve transfers.

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Reference:

Exhibit O-1-1
Exhibit F-1-1, Page 1

Preamble:

At the first reference, Hydro One has proposed an approach such that, for each of Transmission and Distribution, the incremental revenue requirement due to higher inflation for 2021 to 2023 and for lower load forecasts due to higher CDM forecasts, for each year in the 2023-2027 plan, would be deferred for recovery until 2028.

At the second reference, Hydro One has also proposed that the OEB's approved and issued cost of capital parameters for 2023 be used to update the 2023 revenue requirements for Transmission and Distribution (and, by extension, the 2023 Distribution rates).

OEB staff notes that changes to the cost of capital would also impact on the deferred incremental revenue requirement associated with the inflation and load forecast updates. To be specific, both the cost of capital (primarily the return on equity and the deemed short-term debt rate) and the associated regulatory taxes would change due to updated OEB-approved 2023 cost of capital parameters.

Interrogatory:

a) Assuming that Hydro One's proposal for the deferred incremental revenue requirement is approved as proposed in Exhibit O / Tab 1, at the DRO stage, does Hydro One propose any update to the deferred incremental revenue requirement related to the inflation and load forecast updates due to changes in cost of capital.

b) If the response to a) is in the affirmative, please indicate whether Hydro One proposes that any impacts on the incremental revenue requirement due to the inflation and load forecast updates would be added on to the deferred amounts, or Hydro One would seek to recover any cost of capital-related incremental revenue requirement as part of each year's revenue requirement recovered through approved rates (Uniform Transmission Rates for Hydro One Transmission). Please explain your response, including the rationale for your proposal, and how it would be implemented.

Response:

a) As indicated in Exhibit O-01-04, at p. 4, at the time of the DRO, Hydro One will flow through all other adjustments as required in the ordinary course of the DRO process (in addition to the confirmation and adjusted inflation impacts, if necessary). This would include updates to reflect changes to the cost of capital. As a result of this, the calculation of the deferred revenue requirement related to the load forecast update and the deferred incremental revenue requirement related to the inflation update will be updated to reflect changes to the revenue requirement, including the cost of capital.

b) Please see part a) above and interrogatory response to O-LPMA-042 for further details.

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Reference:

Exhibit A-4-1, Attachment 1
Exhibit O-1-2
Exhibit O-2-1

Preamble:

Clearspring Energy Advisor LLC's (Clearspring's) evidence filed in Exhibit A / Tab 4 / Schedule 1 / Attachment 1 documents the analysis underlying the proposed stretch factors for the Transmission and Distribution Custom Revenue Cap formulae, based on econometric modelling of total cost benchmarking of Hydro One and U.S. transmission and distribution utilities.

Clearspring's evidence contains tables and charts of the cost performance of Hydro One relative to what the estimated model would predict for each historical year and for each forward forecasted year during the 2023-2027 plan. Similar analyses have been provided in Clearspring's evidence filed in previous Custom IR applications for Hydro One and other Ontario electricity utilities.

In Clearspring's evidence filed in this application, Hydro One's Transmission cost benchmarking performance is shown in Table 3 and Figure 7 (pages 25 and 26). Hydro One's Distribution cost benchmarking performance is shown in Table 7 and Figure 10 (pages 36 and 37).

Hydro One filed its evidentiary update on March 31, 2022, for impacts of high inflation due to a variety of reasons, as society and the economy re-open and recover post-pandemic, and for impacts on load forecast due to increased CDM impacts forecasted by the IESO. Hydro One also filed updated evidence for 2021 actuals on April 4, 2022.

OEB staff assume that the following would arise on the Clearspring's econometric analyses, and for each of the Transmission and Distribution cost benchmarking models:

1. Since the model coefficients are estimated on historical actuals for a sample of US utilities and Hydro One, possibly only the 2021 actuals could impact the estimated coefficients. Since Hydro One is only one utility is the sample, and data for US utilities is unchanged, any impact of the model coefficients is likely minimal.

2. The updated load forecast does not impact forecasted costs in the plan years. However, there could be an impact on business condition variables during the plan years, as peak demand (D) and quadratic and cross-product terms involving D with other variables are used in both of the Transmission and Distribution cost benchmarking models. There would be no impact on historical years.

Regardless of Hydro One's proposal to defer recover of incremental revenue requirement due to higher inflation and lower load forecasts associated with increased CDM, Hydro One's inflationary updates imply that OM&A and capital costs will be higher for each year in the plan, compared to the original application.

Interrogatory:

a) Please provide Clearspring's views on the reasonableness of OEB staff's assumptions as described in the three bullets above.

b) Please provide an updated Table 3 and Figure 7 for the Transmission Custom Revenue Cap plan based on the updated evidence filed in Exhibit O / Tab 1 and Exhibit O / Tab 2.

c) Please provide an updated Table 7 and Figure 10 for the Distribution Custom Revenue Cap plan based on the updated evidence filed in Exhibit O / Tab 1 and Exhibit O / Tab 2.

d) Please provide any revisions to the stretch factors that Clearspring would recommend, based on the updated analyses in b) and c), along with Clearspring's reasons for either recommending or not recommending any changes to the Transmission and Distribution stretch factors based on the updated evidence.

Response:

Responses from Clearspring:

a) The assumptions listed above are reasonable.

b) Clearspring updated the Company's transmission spending levels found in the Clearspring dataset by the updated data listed in the Company's inflationary update. OM&A was escalated in 2023 by the proration factor of 1.0525 which is found in Table 3 in Exhibit O, Tab 1, Schedule 2, Page 9. In-Service additions were escalated for the years 2023 to 2027 in the dataset for Hydro One using the Relative Increase ratios found on Table 5 in Exhibit O, Tab 1, Schedule 2, Page 10. The peak demand value for Hydro One was adjusted downwards based on the ratio of "Updated" to "As Filed" found on Table 1 in Exhibit O, Tab 1, Schedule 3, Page

3. The 2021 actuals were updated using the ratio of "Actual" to "As-Filed Forecast" found in Table 2 in Exhibit O, Tab 2, Schedule 1, Page 6.

As explained below, the inflationary update has no material impact on the Company's transmission benchmark score.

The above adjustments from the inflationary updates of the Company will, on their own, tend to increase (make worse) Hydro One Transmission's benchmark scores due to increased spending level and reduced peak demand forecasts. However, Clearspring also updated the input prices and inflationary forecasts within the model. These input price forecasts are from the Conference Board of Canada (CBoC). In the original model, Clearspring used CBoC inflation forecasts from June 2021. Since that time, inflation and inflation forecasts have changed unexpectedly and dramatically.

Updating the inflation expectations in the model mostly counterbalances the inflationary update spending and peak demand forecasts produced by the Company. We note that it appears the CBoC's current inflation projections (as of May 5, 2022) have only partially captured the new inflationary reality. We would expect subsequent inflation forecasts in upcoming months of the CBoC to increase which would lead to a more favorable benchmark score for Hydro One.

In the provided table and figure below, Clearspring made no other changes to our methodology or data except those noted above, enabling a straightforward evaluation of the impact of the inflationary update. During the 2023-2027 CIR period the Company's transmission total cost benchmark score moves from -34.5% to -34.1% due to the inflationary update.

Table 3 - 2003-2027 Transmission Total Cost Benchmark Score for Hydro One (Inflationary Update)

Year	% Difference from Total Cost Benchmark
2003	-64.8%
2004	-67.9%
2005	-70.3%
2006	-69.9%
2007	-67.1%
2008	-69.6%
2009	-66.1%
2010	-64.7%
2011	-62.8%
2012	-57.8%
2013	-59.6%
2014	-56.9%
2015	-52.9%
2016	-51.0%
2017	-50.8%
2018	-47.3%
2019	-46.3%
2020	-46.1%
2018-2020 average score	**-46.6%**
2021	-45.5%
2022	-43.3%
2023	-38.5%
2024	-36.5%
2025	-33.5%
2026	-32.0%
2027	-30.1%
2023-2027 average score	**-34.1%**

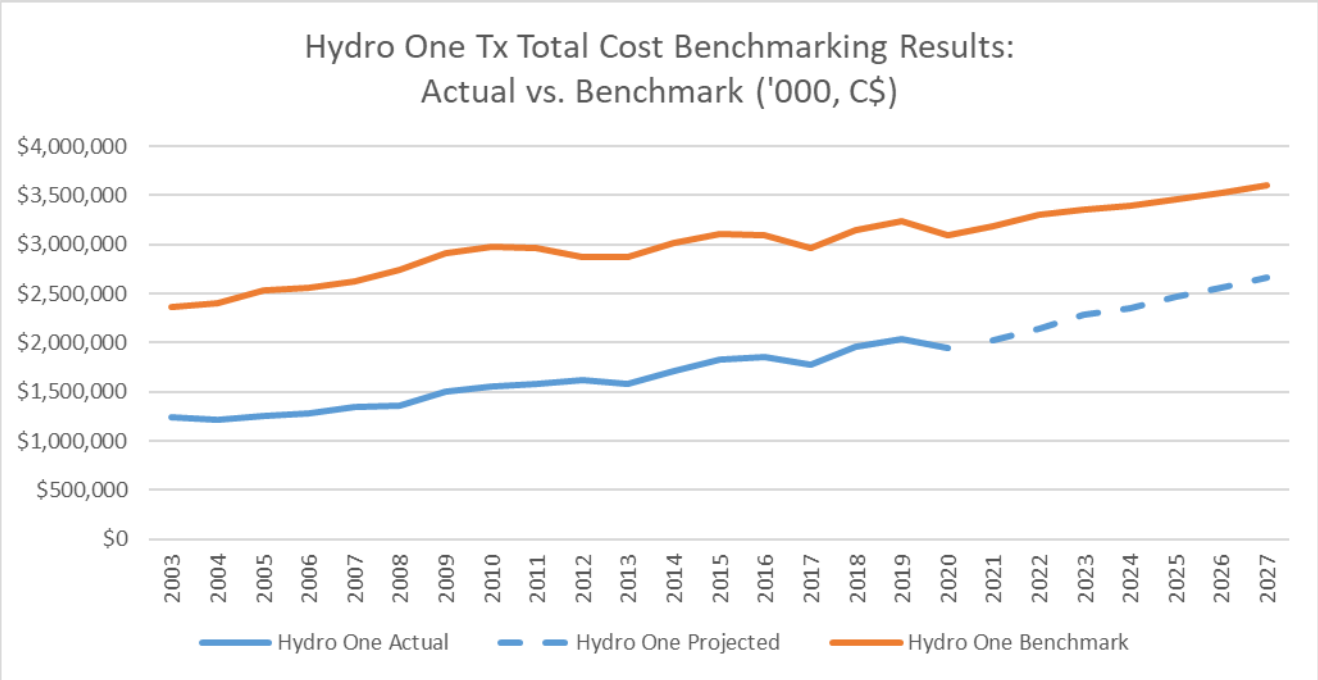


Figure 7: Hydro One Transmission Total Cost Actual vs. Benchmark (Inflationary Update)

c) Clearspring updated the Company's distribution spending levels found in the Clearspring dataset by the updated data listed in the Company's inflationary update. OM&A was escalated in 2023 by the proration factor of 1.0525 which is found in Table 3 in Exhibit O, Tab 1, Schedule 2, Page 9. In-Service additions were escalated for the years 2023 to 2027 in the dataset for Hydro One using the Relative Increase ratios found on Table 5 in Exhibit O, Tab 1, Schedule 2, Page 10. The peak demand value for Hydro One was adjusted downwards based on the ratio of "Updated" to "As Filed" found on Table 6 in Exhibit O, Tab 1, Schedule 3, Page 8. The 2021 actuals were updated using the ratio of "Actual" to "As-Filed Forecast" found in Table 5 in Exhibit O, Tab 2, Schedule 1, Page 10.

As explained below, the inflationary update has no material impact on the Company's distribution benchmark score.

The above adjustments from the inflationary updates of the Company, on their own, will tend to increase (make worse) Hydro One Distribution's benchmark scores due to increased spending level and reduced peak demand forecasts. However, Clearspring also updated the input prices and inflationary forecasts within the model. These input price forecasts are from the Conference Board of Canada (CBoC). In the original model, Clearspring used CBoC

inflation forecasts from June 2021. Since that time, inflation and inflation forecasts have changed unexpectedly and dramatically.

Updating the inflation expectations in the model mostly counterbalances the inflationary update spending and peak demand forecasts produced by the Company. We note that it appears the CBoC's current inflation projections (as of May 5, 2022) have only partially captured the new inflationary reality. We would expect subsequent inflation forecasts in upcoming months of the CBoC to increase which would lead to a more favorable benchmark score for Hydro One.

In the provided table and figure below, Clearspring made no other changes to our methodology or data except those noted above, enabling a straightforward evaluation of the impact of the inflationary update. During the 2023-2027 CIR period the Company's distribution total cost benchmark score moves from +7.0% to +7.8% due to the inflationary update.

Table 7 - 2006-2027 Distribution Total Cost Benchmark Score for Hydro One (Inflationary Update)

Year	% Difference from Total Cost Benchmark
2005	-24.4%
2006	-19.6%
2007	-11.3%
2008	-11.9%
2009	-7.0%
2010	-6.8%
2011	-4.7%
2012	-3.8%
2013	0.8%
2014	4.1%
2015	0.9%
2016	3.4%
2017	2.7%
2018	2.9%
2019	2.7%
2020	1.7%
2018-2020 average score	**2.5%**
2021	1.4%
2022	-2.0%
2023	3.9%
2024	5.9%
2025	8.2%
2026	9.6%
2027	11.1%
2023-2027 average score	**7.8%**

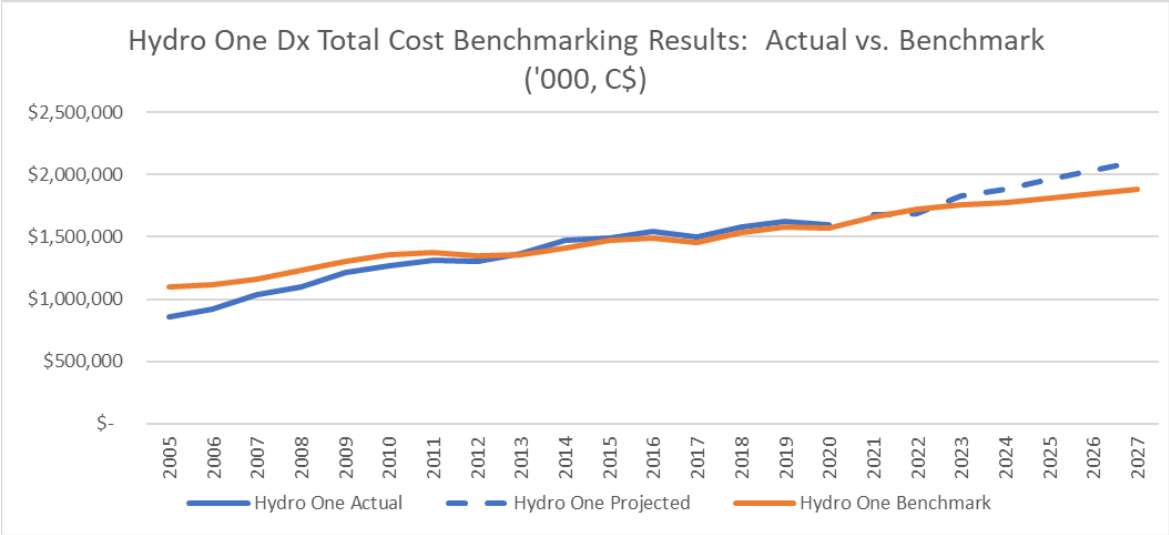


Figure 10: Hydro One Distribution Total Cost: Actual vs. Benchmark (Inflationary Update)

d) The inflationary update does not lead us to different stretch factor recommendations. The inflationary update leads to minimal changes in benchmark results and CBoC inflation forecast updates are likely to further lessen result changes.

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Reference:

Exhibit O-2-1, Attachment 2
Exhibit O-2-1, Attachment 6
Exhibit O-2-1, Attachment 8
Exhibit O-2-1, Attachment 10

Filing Requirements For Electricity Distribution Rate Applications - 2022 Edition for 2023 Rate Applications, Chapter 5 Consolidated Distribution System Plans, April 18, 2022, Page 11

Filing Requirements For Electricity Distribution Rate Applications - 2021 Edition for 2022 Rate Applications, Chapter 5 Consolidated Distribution System Plans, June 24, 2021, Pages 17-18

Filing Requirements For Electricity Transmission Applications, Chapter 2 Revenue Requirement Applications, Pages 13-14

Preamble:

Hydro One has provided, for the transmission and distribution businesses, 2021 actuals for capital and OM&A programs. However, no commentary on variances specific to each program is provided in the update.

Interrogatory:

a) Please provide an updated variance analysis for the 2021 actuals of capital and OM&A programs for the transmission and distribution businesses, as well as the allocated general plant.

Response:

a) 2021 Capital Expenditures

Please see Interrogatories O-SEC-263 and O-SEC-264 for Transmission and Distribution Capital Program Performance Reports for further details and variance analysis for System Access, System Service, and System Renewal investments in 2021. The 2021 variance analysis for General Plant capital expenditures is provided in Attachment 1: General Plant 2021 Capital Performance Report.

Witness: FALTAOUS Peter, SPENCER Andrew, JACKSON Alexander, BERARDI Rob, MARCOTTE Kevin, NG CK, JABLONSKY Donna, REINMULLER Robert, JODOIN Joel, HOLDER Godfrey

2021 OM&A Expenditures for Transmission

The 2021 OM&A results for transmission were $12.8M higher than the forecasted amount. In Exhibit O-02-01, Hydro One provided a variance analysis of the key drivers for material variances with respect to Transmission OM&A programs in 2021 on pages 6 and 7. The material drivers of the variance (>$3M) are presented below:

Transmission OM&A Programs	2021 Forecast ($M)	2021 Actuals ($M)	Difference ($M)	Reference
Other Recovery	-122.1	-107.5	14.6	Please refer to O-SEC-262, which outlines key variances related to project write-offs and incremental COVID-19 costs.
Protection, Control, Monitoring, Metering and Telecommunications (including cybersecurity)	52.2	55.3	3.1	Please refer to O-Staff-374
Power Equipment	45.0	40.1	-4.9	Please refer to O-Staff-374
Property Taxes & Rights Payments	69.1	63.9	-5.2	Please refer to O-Staff-375

2021 OM&A Expenditures for Distribution

With respect to Distribution OM&A programs, Hydro One has provided a high-level variance analysis in Exhibit O-02-01 on pages 10 and 11. For Distribution OM&A program level variance analysis, please refer to interrogatory response O-Staff-376.

GENERAL PLANT – 2021 CAPITAL PROGRAM PERFORMANCE REPORT

1.0 INTRODUCTION

This Capital Performance Report provides an overview of Hydro One's performance in General Plant investments in 2021 for Transmission and Distribution. It addresses both capital expenditures and in-service additions (ISA). This report is organized into two main parts: Section 2.0 presents the performance of General Plant investments allocated to Transmission, and Section 3.0 presents the performance of General Plant investments allocated to Distribution. In each section, the capital performance is presented from the perspective of the overall General Plant OEB category level and at the project and program level.

2.0 CAPITAL PERFORMANCE REPORT FOR GENERAL PLANT INVESTMENTS ALLOCATED TO TRANSMISSION IN 2021

2.1 PERFORMANCE AT THE GENERAL PLANT LEVEL

For Transmission, actual General Plant capital expenditures and ISA are presented relative to those in Hydro One's Draft Rate Order (DRO) in EB-2019-0082.[1] Hydro One's performance in comparison to OEB approved levels is presented below in Table 1.

Table 1 - 2021 Capital Expenditures and In-Service Additions allocated to Transmission ($M)

OEB Category	Capital Expenditures			In-Service Additions		
	OEB Approved ($M)	Actual ($M)	Variance (%)	OEB Approved ($M)	Actual ($M)	Variance (%)
General Plant Allocated to Transmission	94.4	127.7	35.3%	134.5	139.7	3.9%

In 2021, General Plant investments for Transmission were 35.3% ($33.4M) higher than planned for capital expenditures and 3.9% ($5.2M) higher for in-service additions. These variances are mainly driven by the reprioritization of General Plant work among the larger Transmission

[1] Hydro One, Draft Rate Order OEB File No. EB-2019-0082 (May, 28, 2020) – Table 4, page 14 and Table 5, page 18

envelope. This reprioritized work includes a shift in the timing of the construction schedule of the Integrated System Operating Centre (ISOC) from historic years to 2021 and increased investment in Information Solutions which were required to address legacy applications.

Further details on the underlying variances are provided in the following section at the project and program level.

2.2 PERFORMANCE AT THE PROJECT AND PROGRAM LEVEL

This section presents projects and programs with greater than $3M net capital expenditures or in-service additions for planned (at the time of the Transmission DRO) or actual amounts. A variance category is assigned to any projects or programs with material variances from the DRO plan for a specific project or program. For the purposes of this report, a variance is considered material if its absolute value is greater than or equal to $0.5M and greater than or equal to 10% of planned values.

The variance categories assigned to material variances are, as follows:

- **Emergent Needs**: Emergent needs are investments that Hydro One made and in-serviced in 2021 in response to a change of priority due to equipment condition or failure, as well as customer needs.
- **Reprioritization**: Reprioritization includes investments that are accelerated or deferred. Accelerated investments can include projects or programs that need to be completed sooner than planned. As described in SPF Section 1.7, Hydro One adjusts its capital investments through annual planning and in-year redirection processes. In some cases, this results in the acceleration of work when resources are redirected from another delayed project. Alternatively, deferral can occur as a result of increased demand for non-discretionary investments and planned discretionary work is reprioritized as a result.
- **Execution Factors**: Execution factors represent delays encountered during the execution phase of work which can include timing delays that arise as a result of changing conditions, risks and priorities that need to be addressed during execution. As risks materialize, plans are adjusted to accommodate the change and mitigate the overall impact to cost, schedule and

resources. This can change the year in which the project goes in-service but does not necessarily result in a material change to the in-service amount or affect the volume of work completed. Some of the main causes for delays are outage delays or cancellations, material delivery and logistics factors as well as customer needs.

- **Work Definition**: Work definition variances naturally arise as a project's scope, estimated budget and schedule are refined and the project moves from the high-level planning phase to design and estimate, followed by execution. As the project is refined, there may be increases or decreases to the project cost as a result of new or changing information that becomes known during the design and estimation phase or in the execution stage of work.

The project and program variances for Transmission-allocated General Plant investments in 2021 are presented below in Table 2.

Table 2 - 2021 Capital Expenditures and In-Service Additions Greater for General Plant allocated to Transmission ($M)

Functional Area	EB-2019-0082 ISD	2021 Capital Expenditures			2021 In-Service Additions			Variance Explanation
		DRO Plan	Actual	Variance	DRO Plan	Actual	Variance	
Fleet	GP-12 Transport & Work Equipment	9.7	4.9	-4.8	9.7	4.9	-4.8	Execution Factors
	Helicopters	3.2	1.5	-1.7	3.2	1.5	-1.7	Reprioritization
Facilities and Real Estate	GP-10 Facility Accommodation & Improvements Service Centres & Admin	8.8	4.6	-4.2	4.8	4.6	-0.2	Execution Factors
	GP-11 Transmission Facilities & Site Improvements	9.9	11.2	1.2	9.5	10.5	1.0	Emergent Needs
Information Solutions	GP-08 Corporate Services Transformation - HR / Payroll	3.2	8.9	5.8	0.0	0.0	0.0	Work Definition
	MFA Client Tech & Peripheral Refresh	1.5	3.2	1.7	1.5	3.2	1.7	Emergent Needs
	Identity and Access Management	3.0	6.2	3.2	3.1	0.0	-3.1	Work Definition
System Operations	GP-01 Integrated System Operating Centre	25.4	43.7	18.3	80.2	75.4	-4.8	Reprioritization
	GP-03 Network Management System Capital Sustainment	5.4	9.6	4.2	0.0	0.0	0.0	Reprioritization
Operating Infrastructure	GP-02 Grid Control Network Sustainment	0.0	4.2	4.2	2.4	5.4	3.0	Reprioritization
	GP-05 Transmission Non-Operational Data Management System	5.3	0.0	-5.3	0.0	0.0	0.0	Reprioritization
	Magnetometer Installation Project	0.1	0.2	0.2	0.1	4.2	4.1	Execution Factors
Other[2]		18.9	29.6	10.7	20.0	30.0	10.0	
Total		**94.4**	**127.7**	**33.4**	**134.5**	**139.7**	**5.2**	

[2] Other is the net value of other all variances for projects and programs, primarily consisting of variances that fall below the materiality threshold.

The impact of each variance category from a capital expenditure perspective is demonstrated below in Figure 1.

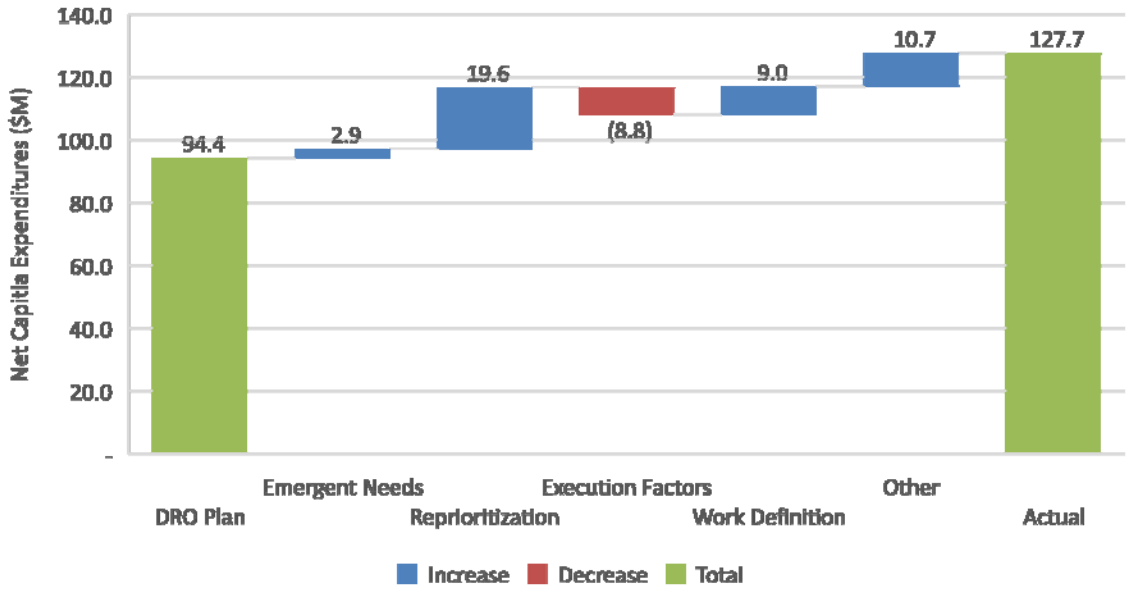


Figure 1: Waterfall chart highlighting the contributions to the 2021 Transmission capital expenditures variance by variance category

Table 2 and Figure 1 demonstrate that approximately half of the $33.4M capital expenditure variance (i.e., +$18.3M) is attributable to the ISOC project, for which the construction schedule was shifted from 2020 to 2021 due to timing of the approval. The ISOC was substantially complete in 2021 and was fully in-service in January 2022.

Other projects and programs contributing to the higher capital expenditures in 2021 include GP-08 Corporate Services Transformation - HR / Payroll (HR Pay Transformation) (+$5.8M), and sustainment investments in GP-03 Network Management System (NMS) (+$4.2M), GP-02 Grid Control Network (+$4.2M) and the Identity and Access Management (IAM) project (+$3.2M). The variance in HR Pay Transformation is primarily driven by changes in work definition. While the costs included in the prior transmission application (EB-2019-0082) were based on initial planning estimations, the design phase indicted additional effort was required for crucial retrofitting on existing systems. NMS and Grid Control Network variances are related to the reprioritization of

work: NMS sustainment work was accelerated to address technical supportability issues with its modelling software, while higher spending in Grid Control Network sustainment was driven by the need to execute work that had been deferred from historical periods. The IAM project was driven by changes in work definition, as discussed in GSP Section 4.9, Section 4.9.2.2:

> *While preparing the detailed design for the project, the Company determined that it would be prudent to expand the scope of the investment to reflect the evolving cyber security landscape and Hydro One's maturing technology environment.*[3]

Other, smaller projects (i.e., investments below threshold) also contributed to the overall positive variance in capital expenditures. These smaller projects are mostly related to Information Solutions investments that were prioritized to ensure continued operations, vendor support, security and reliability of critical systems. This included work required to configure and deploy the new Microsoft 365 Suite, which enabled easy and secure mobile access to remote workers, including field staff.

Increased investments were partially offset by reduced spending in GP-12 Transport and Work Equipment (TWE) (-$4.8M), GP-10 Facility Accommodation & Improvements Service Centres & Admin (-$4.2M) and the Transmission Non-Operational Data Management System (-$5.3M). For TWE, the lower spending was related to vendor delays due to global supply chain issues, including microchip shortages. Similarly, Facilities & Real Estate spending was lower due to supply issues that resulted in the deferral of several projects under Facility Accommodation and Improvements for Service Centres and Admin. The Transmission Non-Operational Data Management System project was deferred due to unavailable resources from the executing line of business in 2021.

The majority of the 3.9% (+$5.2M) variance in in-service additions was driven by a shift in the timing of the in-service for Operating Infrastructure investments. The Magnetometer Installation

[3] Exhibit B-04-01, GSP Section 4.9, Page 8, Lines 26-29

Project (+$4.1M) was originally planned to be in-serviced in 2020, but due to project delays and changes in design due to updated requirements, in-service was achieved in 2021. Additional Grid Control Network sustainment investments (+$3.0M) were in-serviced based on work that had been deferred from historical periods.

The +$5.2M variance above DRO plan was partially offset by lower than planned ISA in TWE (-$4.8M), the ISOC (-$4.8M), and the IAM project (-$3.1M). TWE ISA was lower due to the vendor delays noted above, while the ISOC and IAM variances relate to changes in project timing and work definition. As the ISOC did not achieve full in-service until January 2022, a portion of the ISA related to the data centre has been deferred to 2022. For IAM, changes in the work definition have led to ISA being deferred to 2022.

3.0 CAPITAL PERFORMANCE REPORT FOR GENERAL PLANT INVESTMENTS ALLOCATED TO DISTRIBUTION IN 2021

3.1 PERFORMANCE AT THE GENERAL PLANT LEVEL

For Distribution, the actual General Plant capital expenditures and ISA are presented relative to those in Hydro One's 2020 Annual Update in EB-2019-0043.[4] Hydro One's performance in comparison to OEB approved levels for 2021 are presented below in Table 3.

Table 3 - 2021 Capital Expenditures and In-Service Additions allocated to Distribution ($M)

	Capital Expenditures			In-Service Additions		
OEB Category	**OEB Approved ($M)**	**Actual ($M)**	**Variance (%)**	**OEB Approved ($M)**	**Actual ($M)**	**Variance (%)**
General Plant Allocated to Distribution	95.3	171.1	79.6%	164.1	151.2	-7.9%

[4] Hydro One, EB-2019-0043 2020 Annual Update (August 30, 2019) – Appendix A, page 27 and Appendix B, page 28.

For capital expenditures, General Plant investments are 79.6% ($75.8M) higher than the DRO plan in 2021. This variance is primarily due to the timing of the ISOC and Information Solutions business enablement projects to modernize processes and enhance security.

The 2021 in-service additions are slightly below the DRO plan, primarily due to the timing of transportation and work equipment investment. Further details on the underlying variances are provided in the following section at the project and program level.

3.2 PERFORMANCE AT THE PROJECT /PROGRAM LEVEL

This section presents projects and programs with greater than $3M net capital expenditures or in-service additions for planned (at the time of the 2020 Annual Update) or actual amounts. A variance category is assigned to any projects or programs with material variances from the plan for a specific project or program. For the purposes of this report, a variance is considered material if its absolute value is greater than or equal to $0.5M and greater than or equal to 10% from planned values. The variance categories assigned to material variances are the same as those presented above in Section 2.2.

The applicable 2021 projects and programs for Distribution are presented in **Error! Reference source not found.**.

Table 4 - 2021 Capital Expenditures and In-Service Additions Greater for General Plant allocated to Distribution ($M)

Functional Area	EB-2017-0049 ISD	2021 Capital Expenditures			2021 In-Service Additions			Variance Explanation
		DRO Plan	Actual	Variance	DRO Plan	Actual	Variance	
Fleet	GP-01 Transport and Work Equipment	28.3	16.9	-11.3	28.3	16.9	-11.3	Execution Factors
Facilities and Real Estate	GP-02 Real Estate Facilities Capital	22.5	27.1	4.5	15.1	17.4	2.3	Reprioritization
Information Solutions	GP-04 MFA PC and Printer Hardware	1.0	3.0	2.1	1.0	3.0	2.1	Emergent Needs
	GP-13 HR and Pay Related Technology Investments	1.5	9.0	7.5	1.5	0.0	-1.5	Work Definition
	GP-16 Customer Self Service Technology	2.4	0.0	-2.4	4.9	0.0	-4.9	Work Definition
	Customer Insights - Perform Analytics	2.0	0.0	-2.0	5.0	0.0	-5.0	Work Definition
	Design Optimization and Transformation (DOT)	0.0	23.7	23.7	0.0	0.0	0.0	Reprioritization
	Identity and Access Management	0.4	6.2	5.8	1.7	0.0	-1.7	Work Definition
	AA Replatform - Discovery and Implementation	2.5	0.0	-2.5	5.0	0.0	-5.0	Reprioritization
	Joint Use Permitting Application - Capital	0.0	3.6	3.6	0.0	3.6	3.6	Emergent Needs
System Operations	GP-18 Integrated System Operating Centre - New Facility Development	12.8	42.1	29.4	79.9	74.0	-5.9	Reprioritization
	Restoration Capability Upgrade Project	0.0	4.5	4.5	0.0	4.5	4.5	Reprioritization
Other[5]		21.9	34.8	12.9	21.8	31.7	9.9	
Total		**95.3**	**171.1**	**75.8**	**164.1**	**151.2**	**-12.9**	

[5] Other is the net value of other all variances for projects and programs that fall below the materiality threshold.

The impact of each variance category from a capital expenditure perspective is demonstrated below in Figure 2.

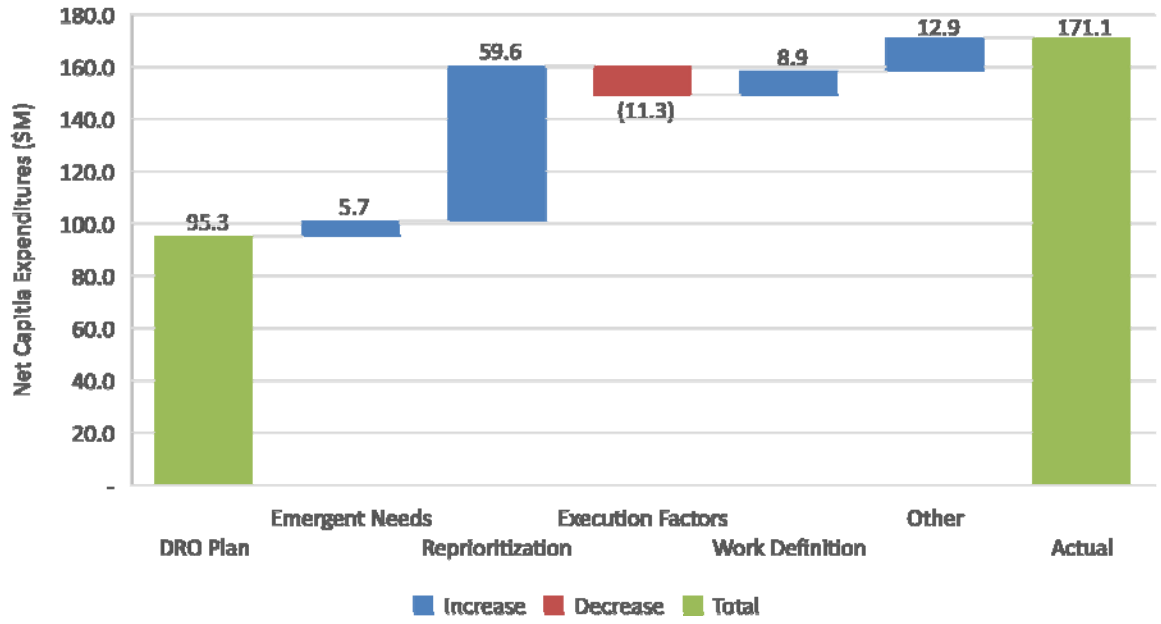


Figure 2: Waterfall Chart Highlighting the Contributions to the 2021 Distribution Capital Expenditures Negative Variance of 20.0% (-$28.6M) by Variance Category

From the information presented in Table 4 and Figure 2, the majority of the capital expenditure positive variance of $75.8M in 2021 is related to the reprioritization of the ISOC (+$29.4M) and the Design Optimization and Transformation (DOT) project ($23.7M), and changes in work definition for GP-13 HR and Pay Related Technology Investments (HR Pay Transformation) (+$7.5M) and IAM (+$5.8M).

The DOT project was developed in 2019 and was not included in the previous rate filing. As discussed in GSP Section 4.9, Section 4.9.2.2:

> *The project replaces Distribution Lines' legacy design and estimating tool to ensure customer cost estimates for new connections and other demand work are more accurate, thereby improving customer experience. It will also make the estimating process faster, easier, and more consistent. By investing in an integrated computer-aided-design (CAD), SAP costing and*

GIS solution, this investment enables Hydro One to improve customer service and increase productivity (see SPF Section 1.4 for details).[6]

The 2021 capital expenditures for HR Pay Transformation and the Identity and Access Management (IAM) project are above the DRO plan due to changes in work definition. For both projects, the DRO Plan was based on early planning estimations. As the scopes were refined during the execution planning phase of the project, it was determined that additional effort was required for each. In the case of the HR and Pay Related Technology Investments, additional effort was required for crucial retrofitting on existing systems. As noted above in Section 2.2, the scope for IAM was expanded to reflect the evolving cyber security landscape and Hydro One's maturing technology environment.

Other items that contributed to the +$75.8M variance include capital variance include GP-02 Real Estate Facilities Capital (+$4.5M), Restoration Capability Upgrade Project (+$4.5M) and Joint Use Permitting Application – Capital (+$3.6M).

The Real Estate Facilities Capital variance was driven by the redirection of funds for the construction of a standalone Operations Centre in Dunnville rather than a satellite facility to the existing Haldimand OC, to better serve surrounding customers and to accommodate for increased staff servicing the region out of an undersized, existing facility.

The Restoration Capability Upgrade was accelerated to 2021 to cover the design and implementation of a new restoration operating model to help reduce outage restoration times. The Restoration Process Upgrade Project is aimed at improving Hydro One's restoration capability over the full lifecycle of unplanned outages (blue sky and storms / emergency). The new processes, organization and enabling enterprise technology will provide annual benefits including improved customer satisfaction, reduced restoration costs and reduced SAIDI.

[6] B-04-01, GSP Section 4.9, Page 8, Lines 4-10

The Joint Use Permitting Application costs relate to the emerging need for Hydro One to be able to effectively receive, manage, and execute requests from business partners such as municipalities and telecom companies to utilize Hydro One's passive infrastructure (e.g. poles and towers). The increase in requests is related to the increasing deployment of high-speed internet by telecom companies. Hydro One's existing manual processes could not keep pace with the required requests in a timely fashion. The spend in 2021 was associated with expanding the original web portal developed in previous years from a single telecom company to all partners across Ontario and increase integration with core systems such as SAP and GIS for schedule automation and status tracking.

These investments are offset by underspending (compared to the DRO plan) in Fleet (-$11.3M). As discussed in Section 2.2, the lower spending was related to vendor delays due to global supply chain issues, including microchip shortages.

For in-service additions, the lower spend in Fleet in 2021 is the also main contributor to the negative $12.9M variance (relative to DRO). Other notable variances in ISA include those seen for GP-16 Customer Self Service Technology (-$4.9M), Customer Insights - Perform Analytics (-$5.0M), AA Replatform - Discovery and Implementation (-$5.0M), and ISOC (-$5.9M).

The in-service variance for GP-16 Customer Self Service Technology was due to work definition changes to two investments. The first investment was overall improvements to the self-service request system, adding new automated service requests, and a data reorganization from the main hydroone.com to provide easier access to digital channels. The second investment was further improved performance of, and customer satisfaction with, our online customer self-serve portal myAccount. This investment included improved self-serve online move-in requests. The in-service variance for Customer Insights – Perform Analytics was also due to work definition changes, as the intended benefits realized by this initiative were achieved through the execution of projects in previous years.

The AA Replatform – Discover and Implementation project was originally targeted to upgrade the existing Asset Analytics platform and determined not to be required based on a small, accelerated investment of $0.6M completed and in-serviced in 2020. The work conducted in 2020 resulted in a minor enhancement

to be completed, including the addition of two additional risk factors, which allowed the system to continue to be utilized without further significant investment at this time. The Asset Analytics system is a component of SAP, which will be assessed for upgrade as part of the overall S/4HANA Transformation.

For the ISOC, a portion of the ISA has been deferred to 2022 (see Section 2.2 above).

The negative ISA variances were partially offset by the Joint Use Permitting Application – Capital (+$3.6M) and the Restoration Capability Upgrade Project (+$4.5M), which were emergent needs/accelerated from future years, as described above for their capital spend.

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O - STAFF INTERROGATORY - 363

Reference:

Exhibit O-1-2, Page 5

Preamble:

At the noted reference, Hydro One states:

> There have been significant market price changes across many commodities that are inputs to Hydro One's costs. Given the nature of Hydro One's business and capital program, the price of essential commodities has a significant impact on our costs. Equipment purchased by Hydro One (i.e. power transformers, breakers and tower steel) is heavily impacted by certain raw materials indices. Essential commodities such as copper, aluminum and steel have undergone price increases and supply shortages. From January 2021 to January 2022, the price of copper has increased by 111.6%. In addition, over the first two months of 2022, key commodities have continued to see significant price increases, including fuel which has seen a price increase of 21%, and aluminum, which has increased by 16%.
>
> In addition to commodity costs, shipping costs have contributed to price inflation in many materials on which Hydro One relies. Global supply chains continue to experience a shortage of shipping containers leaving suppliers with stockpiles of materials and finished products that are unable to be exported internationally. Continuous demand and limited supplies have led to significant price increases for freight-based shipping. Shipping prices are up 103% since January 2021 impacting suppliers who have also been requesting price escalations due to these increases.

Interrogatory:

a) What impact does Hydro One forecast global supply chain issues and market price changes will have in completing its capital plan and OM&A programs during the rate period?

b) What steps has Hydro One taken to minimize the risk of global supply chain issues and market price changes to executing its capital and OM&A programs?

c) What contingency plans (for capital and OM&A programs) are in place if Hydro One experiences global supply chain issues so it can ensure service quality and reliability?

Witness: JESUS Bruno, JACKSON Alexander, BERARDI Rob, JABLONSKY Donna, SPENCER Andrew, NG Chong Kiat

d) How have global supply chain issues impacted capital and OM&A programs related to PCB remediation? Please explain how Hydro One is mitigating supply chain issues to complete all PCB remediation work required by federal *PCB Regulations*, by December 31, 2025.

e) Please provide commentary on how current market price changes and global supply chain issues have influenced Hydro One's strategy for sourcing and storing materials and supplies for work to be completed during the rate period. Further, please provide commentary on how Hydro One will ensure it has the necessary materials and supplies to complete its stated capital and OM&A programs during the rate period in light of these circumstances.

f) How much of the materials and supplies that Hydro One requires to complete capital and OM&A programs during the rate period is currently within Hydro One's possession?

Response:

a) Market price changes and supply chain delays that impact inflation forecasts will place pressure on the execution of the capital plan and OM&A at forecast levels. In order to protect expected unit installation and OM&A work, Hydro One has requested the proposed adjustment to its plan based on the revised inflation forecast. Without that adjustment, market price adjustment and related supply chain delays would impact the units of work that Hydro One could accomplish.

b) In addition to the assurance of supply strategies outlined in Exhibit E-05-02, there are several measures that Hydro One has taken to manage the risk of the global supply chain issues and market price changes, including:

- Increasing inventory levels to ensure a three-month supply of critical materials and supplies
- Negotiating long-term supply agreements to lock in supplier capacity and buffer Hydro One against volatile market price fluctuations. Long-term supply agreements are tied to indices so that as indices decrease, prices paid under contract will follow in the next scheduled adjustment period.
- Increasing efforts to identify alternate suppliers for materials that are currently experiencing disruptions or are forecasted to within the next year
- Build and maintain strategic supplier relationships that keep Hydro One at the forefront of production queues and a preferred customer for suppliers
- Leveraging industry leading approaches to manage supply chain disruptions
- Engaging in group purchasing consortiums to increase buying power

- Establishing a Supply Chain task force with representatives from across Operations, Planning and Supply Chain to proactively identify and address supply chain risks
- Earlier ordering for future work program needs by Business Units to provide better visibility to suppliers about upcoming requirements

These measures help Hydro One secure the supply of materials and services and manage price increases. However, they cannot ultimately shelter HONI from the significant inflationary pressures that have been described in the updated evidence.

c) In the event that the measures discussed above in part b) are not sufficient to manage supply chain delays, Hydro One will review its work program to prioritize activities related to safety, reliability and customer commitments. As required, Hydro One would redeploy material from projects that do not have immediate need of materials or equipment on hand to projects with urgent needs. Where acceptable, the Company would also install refurbished units.

d) Hydro One remains committed to achieving compliance in accordance with the Federal PCB regulation and deadline. To date, the impact of global supply chain issues on the Distribution OM&A and the Transmission and Distribution Capital PCB remediation programs has been immaterial. However, the PCB remediation program relies on capital replacements and supply chain issues may disrupt some component replacements which may impact PCB remediation by the required deadline. For further discussion on Supply Chain mitigation strategies please refer to part b) above.

e) Hydro One's strategies for sourcing and storing materials and supplies for work to be completed during the rate period are described in Exhibit E-05-02. Additional details on how Hydro One manages the impacts of the current market price changes and global supply chain issues are provided in parts b) and c), above.

f) Hydro One does not typically carry multiple years of materials and supplies inventory. Rather, materials and supplies are purchased to meet the volumes and shifting demands of the work programs. As lead times are increasing and disruptions are occurring across many industries, Hydro One has increased its safety stock to ensure three months' supply of critical materials. In addition, Hydro One has issued purchase orders for future bulk orders for some high risk materials and in some cases purchased production time with key suppliers to guarantee availability in the coming years (examples include tower steel, wire and cable). These measures increase Hydro One's ability to respond to customer demands, improve reliability, and increase the likelihood of securing scarce material for future projects.

The type and quantity of material and equipment kept on hand are dependent upon a number of factors including frequency of use and lead time to receive the material. Material that is frequently used or has a long lead time are kept on hand as inventory (Materials and Supplies or Future Use Assets). As supplier lead times are increasing, bulk orders are being placed for future needs and as a result, more material may be on hand for future needs than in previous, less supply-constrained periods of time. Some capital project work is entirely delivered by a third-party contractor, such as Engineering, Procurement and Construction (EPC) contracts, and therefore equipment may be in the possession of the contractor rather than Hydro One.

O - STAFF INTERROGATORY - 364

Reference:

Exhibit O-1-2, Pages 6 to 8

Preamble:

Hydro One states that "…increases in specialized labour throughout 2021 have led to an estimated price escalation for Engineering, Procurement and Construction (EPC) contracts from 8% to 10% in 2022 within the transmission business."

Hydro One states that "…in some cases, suppliers have been motivated to consider the economics of not fulfilling their agreed obligations relative to the costs of contractual performance. As contracts come to the end of their term and new agreements are sourced, new terms and conditions will reflect current market behaviours."

Further, Hydro One notes that it will experience "…a long term, sustained change in pricing, because commodity markets have maintained consistent increases through an extended period of time". As a result, Hydro One indicates that it will "…continue to develop strategies to minimize disruption for high-risk materials and services, in addition to the assurance of supply strategies, as outlined in Exhibit E-05-02."

Interrogatory:

a) Please detail any increases in specialized labour that have been experienced within the distribution business.

b) Please provide details of any changes to the mix of contracted versus internal resources due to increased costs of specialized labour. What are the impacts of these changes to capital and OM&A programs, as originally filed, for the transmission and distribution lines of business?

c) Please provide details on Hydro One suppliers that have not fulfilled their obligations or have provided notice they do not plan to fulfill their obligations, due to cost of contractual performance.

   i. What impacts will these unfulfilled contracts have on capital and OM&A programs completion and costs during the 2022 to 2027 period?
   ii. How have the impacts of the unfulfilled contracts been reflected in the updated evidence?

iii. What steps is Hydro One taking to limit the impact of actual or potentially unfulfilled contracts on capital and OM&A programs

d) As increases in commodity markets are being experienced, please identify and explain Hydro One's 'strategies to minimize disruption for high-risk materials and services' that are in addition to the assurance of supply strategies.

Response:

a) The Distribution work program does not leverage external specialized labour to the same extent as Transmission and has not been materially impacted by the increased specialized labour costs in the market. As described in Exhibit O-01-02, specialized labour costs have been increasing within the Transmission work program, especially within the Engineering, Procurement and Construction (EPC) contracts.

b) Hydro One has not changed its execution strategy to use external delivery partners, discussed in TSP Section 2.10 sub-section 2.10.4.1, in DSP Section 3.10 subsection 3.10.4.1, Exhibit E-03-05 Section 5, and Interrogatory B1-SEC-059.

c) The majority of suppliers have been able to fulfill their contractual obligations. Rather, some suppliers have indicated their inability to fulfill their contractual obligations under the same terms (i.e., lead time or price). Some suppliers have been highly impacted by material shortages and increasing costs and have requested price increases over and above what is allowed in their contract. In cases where Hydro One cannot switch to an alternative source of supply or a substitute product, the Company has permitted longer delivery lead times or temporary price increases. In the latter cases, Hydro One has tied any price increases to relevant, independent market data such as commodity indexes. These contract price changes are executed only a temporary basis, with agreements with suppliers to revert to original contract prices if the same indexes show a decline within the existing contract period. This has resulted in paying higher amounts for products and services, rather than having obligations to supply material or services go unfulfilled.

i. As noted above, Hydro One has not had material or services needs go unfulfilled due to suppliers refusing to fulfill contractual obligations due to cost of contractual performance

ii. Hydro One does not anticipate the 2022-27 work program will be impacted by unfulfilled contracts.

iii. Hydro One is taking the following steps to minimize potential disruptions to the supply of materials and services due to supplier contract performance risk:
   - Technical teams are reviewing substitute products that may use different components that have lower cost pressures.
   - Expanding the supply base by establishing contracts with regionally diverse suppliers, to give options when region specific cost pressures arise (e.g., import tariffs, transportation disruptions).
   - Negotiating temporary contract price increases with suppliers that are justified through external market data such as commodity indexes. These price increases are reviewed regularly, and prices will decrease in correlation with the indexes that justified the price increase.
   - Advanced ordering of long lead materials and equipment, to allow suppliers to purchase input materials and lock in prices to protect both the supplier and Hydro One from future commodity price increases.

d) Please refer to O-Staff-363, part b) for the steps that Hydro One has taken to minimize the risk of global supply chain issues and market price changes.

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O - STAFF INTERROGATORY - 365

Reference:

Exhibit O-1-2, Attachment 1, Page 4
March 23, 2022 OEB Bulletin re: Smart Meter Supply Constraints

Preamble:

At the first reference, the Scotiabank Capital Inflation Report, dated March 31, 2022, highlights that damaged supply chains have played a role in driving inflation. This is exemplified through Scotiabank noting that "…it will take time to clear resulting backlogs across multiple types of products" and that "[t]he supply side has also been unable to keep up with demand side pressures on prices in a more general and broader sense beyond electronics components."

On March 23, 2022, the OEB issued a bulletin setting out OEB staff's position that it will not take compliance action against electricity distributors who, despite exercising due diligence, are unable to obtain smart meters due to current supply constraints.

Interrogatory:

a) What impact does Hydro One forecast the availability of electronics will have in completing its capital and OM&A programs during the rate period?

b) What steps has Hydro One taken to minimize the risk of equipment availability due to electronics shortages to executing capital and OM&A programs?

c) What contingency plans (for capital and OM&A programs) are in place if Hydro One is not able to secure the required equipment?

d) For each question above, please provide specific details for these specific budget items.

i. D-SA-04 Metering Sustainment and D-SR-12 Advanced Meter Infrastructure 2.0
ii. D-SS-05 Worst Performing Feeders
iii. G-GP-01 Transport and Work Equipment and G-GP-02 Helicopter Renewal

e) Similar to the nature of the March 23, 2022 bulletin, has Hydro One received any accommodations from other oversight / regulatory / compliance bodies? If so, please provide

details of the accommodations in the table below. Where possible, please provide supporting copies / documentation of the accommodation(s) that Hydro One has been afforded.

Oversight / Regulatory / Compliance Body	Accommodation(s) Provided	Overview of How Hydro One has Accounted for Accommodation(s) in its Capital and OM&A Programs During the Rate Period

Response:

a) Please refer to Interrogatory O-Staff-363, part a).

b) In addition to the steps outlined in O-Staff 363, part b), Hydro One has undertaken the following:
- Replacements are being actively deferred, where possible, in order to place priority on critical needs.
- Hydro One reviews inventory weekly in order to reforecast the inventory draw down estimates.
- Hydro One has installed refurbished units where acceptable and is currently reviewing multiple options of backup supply.

c) Please refer to Interrogatory O-Staff-363, part c) for contingencies with respect to supply chain, which are inclusive of electronics and electronic equipment. Hydro One is making efforts to forecast and secure electronic equipment purchases through the supply chain assurance and risk strategies identified therein. To maintain the integrity of its capital and OM&A programs, Hydro One will continue to manage equipment supply risk through methods identified in part b) of the response above. See response in part d) below for contingency plans related to specific investments.

d) i) D-SA-04 Metering Sustainment and D-SR-12 Advanced Meter Infrastructure 2.0

a) Please see response to Interrogatory O-Staff-363, part a) for Hydro One's overall assessment of the supply chain risk for the rate period. Although supply pressures exist for electronic components in AMI equipment, manufacturers manage long lead times to ensure continuity of supply and consequently no impact is forecast on executing metering sustainment or AMI 2.0 programs for the rate period.

b) In addition to the steps Hydro One takes in managing global supply chain risks discussed in response to O-Staff-363, part b):
   - For its metering sustainment program, Hydro One has been working very closely with its primary AMI 1.0 vendor for some time to ensure sufficient meter supply to address increasing AMI 1.0 failures through weekly supply management meetings and providing frequent longer-term metering supply forecasts. For its AMI 2.0 program, Hydro One has recently finalized a 20-year capacity and pricing agreement with its vendor.

c) In the event supply strategies are not sufficient to mitigate potential supply delays, metering contingency plans generally involve prioritizing work related to safety, billing reliability, and customer commitments for both capital and OM&A programs and include a combination of:
   - refurbishing meters when feasible;
   - increasing the use of manual meter reading for non-communicating meters;
   - requesting deferments in meter compliance sampling programs;
   - investigating the use of alternative meter platforms; and
   - working early and closely with the AMI 2.0 vendor to provide long-term AMI equipment forecasts aligned with deployment plans.

<u>ii) D-SS-05 Worst Performing Feeders</u>

a) Please refer to Interrogatory O-Staff-363, part a).

b) Please refer to Interrogatory O-Staff-363, part b). In addition, Hydro One works directly with the manufacturers of the devices to ensure adequate supply to meet deployment schedules.

c) In addition to the response in part c) above, Hydro One would also consider sourcing the devices from alternate vendors.

iii) G-GP-01 Transport and Work Equipment and G-GP-02 Helicopter Renewal

a) Please refer to Interrogatory O-Staff-363, part a).

b) Please refer to part b), above.

c) To ensure completion of capital and OM&A programs, Fleet will continue to sustain required fleet complement by maintaining existing assets until new equipment delivery. Fleet will also leverage rentals (if available) to manage any shortfalls during peak program demands. As a contingency plan, fleet will extend lifecycle by maintaining major components, where possible, and retain assets to bridge long lead-time situations.

The helicopter renewal program is currently unaffected by the challenges presented by the shortfall in electronics components. The aircraft manufacturer manages its long lead times to ensure continuity of supply.

Should supply chain issues for electronics negatively impact the delivery of replacement aircraft, Helicopter Services will liaise with the manufacturer to develop alternate solutions and will retain and extend the life cycle of the retiring assets to ensure operational capabilities remain unaffected.

e) Hydro One has not received any accommodations from other oversight / regulatory / compliance bodies.

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Reference:

Exhibit O-1-2, Page 17

Filing Requirements For Electricity Distribution Rate Applications - 2022 Edition for 2023 Rate Applications, Chapter 2 Cost of Service, April 18, 2022, 2.1.8

Filing Requirements For Electricity Distribution Rate Applications - 2021 Edition for 2022 Rate Applications, Chapter 2 Cost of Service, June 24, 2021, 2.1.8

EB-2010-0379, Report of the Board on Performance Measures for Electricity Distributors: A Scorecard Approach

Filing Requirements For Electricity Transmission Applications, Chapter 2 Revenue Requirement Applications, 2.6

Preamble:

At the noted reference, Hydro One states that:

> If the forecast inflation rates for 2022 and 2023 at the time of DRO are higher than the forecasts used in this evidence update (i.e. 4.5% for 2022 and 3.3% for 2023), then the following process is proposed:
>
> - The revenue requirement will be updated to reflect the new inflation rate, but will not exceed a prescribed inflation cap (the "Inflation Forecast Cap").
>
> - Hydro One proposes an Inflation Forecast Cap of 10% cumulative inflation over 2022 and 2023. For clarity, a 10% cumulative inflation means the sum of inflation in 2022 and 2023 equals 10%. For example, inflation of 7.0% in 2022 and 3.0% in 2023 results in cumulative inflation of 10%.
>
> - If the cumulative inflation for 2022 and 2023 exceeds 10%, Hydro One will aim to manage its work program to the capped amount through investment reprioritization and redirection and will adjust the outcomes outlined in TSP Section 2.5 and DSP Section 3.5 accordingly.

The 2022 and 2023 Chapter 2 Filing Requirements for Electricity Distribution Rate Applications outlines the OEB's use of the scorecard approach to facilitate performance monitoring and benchmarking of distributors under the renewed regulatory framework (RRF).

The Chapter 2 Filing Requirements reference the *Report of the Board on Performance Measures for Electricity Distributors: A Scorecard Approach* which "sets out the OEBs policies on the measures to be used to assess a distributors effectiveness and continuous improvement in achieving the four outcomes which form the basis of the RRF Report."

Interrogatory:

a) If the cumulative inflation were to exceed 10%, how would Hydro One manage its work program to the capped amount through reprioritization and redirection? Will the process differ from the process outlined in the System Plan Framework (SPF)? If so, provide detailed explanations of the process in comparison to the SPF.

b) Please identify the specific capital and OM&A programs for the transmission and distribution businesses that would be targeted for reprioritization and redirection if the Inflation Forecast Cap exceeds the cumulative 10%. In the response, please include detailed reasoning for why the programs would be reprioritized and redirected.

c) Does the proposal to "adjust outcomes outlined in TSP Section 2.5 and DSP Section 3.5" mean that Hydro One is proposing to adjust the targets in its scorecard if this circumstance occurs?

   i. If so, which targets would be subject to change?
   ii. If not, please explain in more detail.
   iii. Explain the process Hydro One proposes for seeking approval to changes to its performance targets?
   iv. How does the proposal to "adjust outcomes outlined in TSP Section 2.5 and DSP Section 3.5" meet the requirements of the Chapter 2 Filing Requirements for Electricity Distribution Rate Applications and the OEB polices outlined in *Report of the Board on Performance Measures for Electricity Distributors: A Scorecard Approach*?
   v. Why does Hydro One propose this methodology rather than the ±300 basis point earnings dead band approach?

Response:

a) If the cumulative inflation for 2022 and 2023 exceeds 10%, Hydro One will aim to manage its work program to the capped amount through the investment reprioritization and redirection process outlined in Exhibit B-01-01, SPF Section 1.7, page 30.

b) Hydro One would need to re-run and re-engage its prioritization process for candidate investments as described in Exhibit B-01-01, SPF Section 1.7 to determine the reductions and deferrals that would be required to respond to inflation exceeding the 10% threshold. Such an assessment would be dependent on the actual level of inflation above the proposed 10% threshold.

In general, a range of investments that are not deemed "mandatory" (e.g., driven by regulatory or compliance obligations, third party requests, etc.) may be impacted by the prioritization process.

c) i.-iv.

At the time of filing the Draft Rate Order, should the cumulative impact of inflation exceed the proposed 10% threshold, the investment plans would be updated according to the approved capital and OM&A envelopes through the prioritization process described in Exhibit B-01-01, SPF Section 1.7. Accordingly, the outcomes and scorecards would be updated to align with the approved capital and OM&A at that time. This approach is appropriate and consistent with the intent of the OEB's scorecard objectives.

v. Hydro One has filed this Application establishing its 2023 test year using a cost of service approach (see Exhibit A-04-01) and updated this Application (Exhibit O) to reflect updated costs related to inflation so as to appropriately account for the cost to provide transmission and distribution services. On this basis, it is not appropriate that the utility's return on equity be repurposed to account for inflation related costs, as the return on equity provides a utility with the opportunity to earn a fair return.

Hydro One has proposed a 10% cumulative inflation Forecast Cap over 2022 and 2023 which is reasonable and appropriate to balance the objectives and benefits of the proposed investment plans and the costs to deliver them.

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Reference:

Exhibit O-2-1, Page 2

Preamble:

At the reference, it is stated that:

> With respect to 2022, Hydro One plans to manage its in-service additions in 2022 within the total envelopes set out in its pre-filed evidence for both transmission and distribution…. If necessary, Hydro One will leverage its internal redirection and reprioritization processes to manage within its planned total envelopes reflected in its pre-filed evidence for both transmission and distribution.

Interrogatory:

a) Please explain how work that is redirected or reprioritized in 2022 will impact the 2023-2027 capital expenditure plan. Will work that is not completed in 2022 be added to the 2023-2027 plan? If so, how will this be accommodated? If not, when will this work be carried out?

Response:

a) Hydro One plans to manage its capital and in-service additions in 2022 to remain within the total envelopes set out in its as-filed evidence for both transmission and distribution and, as necessary, will leverage its internal redirection and reprioritization processes to accomplish this. Accordingly, Hydro One expects that the opening rate bases for 2023 remain appropriate. However, Hydro One is experiencing external pressures from a variety of factors, including factors that are both demand and inflation related. To the extent that these pressures prevent Hydro One from remaining within the as-filed 2022 envelopes for transmission and distribution, adjustments will be made to the capital and in-service additions over the 2023-2027 rate period.

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Reference:

Exhibit O-2-1, Attachment 7, Appendix 2-AB, Distribution Capital Expenditure Summary

Interrogatory:

a) Please complete a version of table 2-AB for the Acquired Utilities for 2021.

Response:

a) Please see update below, for B-03-01, Section 3.9 Attachment 3, Table 1, which contains the update requested.

Table 1 - Historical and Forecast Expenditures ($M)

	Historical			Forecast	Actuals	Forecast
LDC/Category	**2018**	**2019**	**2020**	**2021**	**2021**	**2022**
Haldimand County Hydro Inc.						
System Access	1.8	1.5	1.9	2.7	1.7	2.9
System Renewal	1.6	1.3	1.3	1.7	0.9	2.1
System Service	0.1	0.0	0.1	0.1	0.3	0.5
General Plant	-	-	-	-	-	-
Sub Total	**3.5**	**2.8**	**3.2**	**4.5**	**2.9**	**5.5**
Norfolk Power Distribution Inc.						
System Access	1.0	1.4	0.7	1.6	1.2	1.6
System Renewal	0.9	0.9	2.0	3.1	0.8	2.6
System Service	0.1	0.0	0.0	0.2	0.0	0.2
General Plant	-	-	-	-	-	-
Sub Total	**2.0**	**2.3**	**2.6**	**4.9**	**2.0**	**4.4**
Woodstock Hydro Services Inc.						
System Access	1.0	0.9	0.9	1.2	0.6	1.3
System Renewal	0.8	0.5	1.6	2.0	1.3	1.4
System Service	0.0	0.0	0.0	0.3	0.0	0.3
General Plant	-	-	-	-	-	-
Sub Total	**1.8**	**1.4**	**2.5**	**3.5**	**1.9**	**3.1**
Grand Total	**7.3**	**6.4**	**8.3**	**12.9**	**6.8**	**13.0**

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Reference:

Exhibit O-2-1, Attachment 8, Appendix 2-AA, Distribution Capital Projects Table

Interrogatory:

a) Actual 2021 capital expenditures in New Load Connections, Upgrades and Cancellations were higher than forecast.

   i. What items specifically were responsible for the increased costs; new load connection, upgrades, and / or cancellations and by how much?
   ii. What is Hydro One's process for verifying that project-specific capital contributions are determined in a consistent fashion?
   iii. How much of the increase was due to higher equipment costs? What is Hydro One doing to mitigate this during the 2022 to 2027 period given current circumstances?

b) Actual 2021 Metering Sustainment Costs expenditures were higher than forecast.

   i. Please explain the driver(s) for the increased costs; increased material costs, increased scope or other factors.
   ii. How many smart meter failures did Hydro One experience in 2021? Please break down the meter failures by manufacturer, model and component that failed.
   iii. Please provide details on any difficulties Hydro One has faced procuring and receiving smart meter inventory?
   iv. Has Hydro One experienced cost increases for smart meters? If so, how much have costs increased by, and what is Hydro One doing to manage costs during the 2022 to 2027 period.
   v. Does Hydro One have commitments from suppliers to provide the required volumes of smart meters for the test period sustainment activities as well as the AMI 2.0 program?
   vi. What is Hydro One's contingency plan for maintaining metering and billing services if meter procurement cannot meet the demand for faulted meter replacements?

c) Actual 2021 Joint Use and Relocations expenditures were higher than forecast.

   i. How much of the increase is attributable to telecommunications expansions and / or work? Please provide a commentary on the amount of this work that was in the rural areas.

ii. How much of the increase is due to increased equipment and contracting costs?
iii. How many poles were replaced in this program in 2021?

d) Actual 2021 PCB expenditures were lower than forecast.

i. Please explain the reason for the underspend.
ii. What impact will the underspend have on the 2022 and test period expenditures?
iii. Please provide details of any program changes for the test period required to complete the program and meet legal requirements.

e) Actual 2021 Pole Sustainment Program expenditures were lower than forecast.

i. Please explain the driver(s) for the lower costs.
ii. How many poles were replaced and refurbished in this program in 2021 compared to plan?
iii. What is the impact of the reduced pole replacement expenditures in 2021 on the pole replacement program and replacement and refurbishment volumes in the test period?

Response:

a)

i. For 2021, new connection net cost exceeded forecast by $56.0M, service upgrade net cost exceeded forecast by $15.3M, and service cancellations net cost exceeded forecast by $0.1M.
ii. Project-specific costs are estimated using standard costs for each construction sub-component/activity required to make the specific connection, including labor and work equipment, material costs, and overheads. Labour and equipment hourly rates are updated annually, and material costs are updated on a continual basis based on Moving Average Price cost. For lies along connections, technicians follow Hydro One's connection cost policy when determining which costs are included in the basic connection (provided at no cost to the customer) and which costs must be paid by the customer. Where expansion is required to make the connection, estimated project costs and forecast connections are run through Hydro One's standard economic evaluation to determine the required capital contribution. Supervising staff review each design, including cost responsibility, for both lies along and expansion connections prior to issuing the contract to the customer.
iii. Please refer to interrogatory response I-22-O-SEC-261 for a review of the increases due to higher equipment costs. Please refer to interrogatory response I-01-O-Staff-363, part

for a discussion on what steps Hydro One has taken to minimize the risk of supply chain issues and market price changes to executing its capital and OM&A programs.

b)

i. Please refer to the updated Capital Performance report in interrogatory response I-22-O-SEC-264, Attachment 1. See section 3.1, Meter Infrastructure Sustainment (D-SA-02).
ii. Hydro One experienced 32,770 meter failures in 2021. The majority of the failures (95%) were Trilliant mass market meters and failed primarily due to loss of communication.
iii. Although there are supply pressures associated with AMI 1.0 meter procurement, Hydro One has worked very closely with the AMI 1.0 meter vendor for a number of years to address projected inventory needs associated with AMI 1.0 meter failures. Consequently, Hydro One has been able to maintain supply to meet requirements.
iv. Hydro One did not see any significant cost increases in 2021 as we have a pre-negotiated commitment on future forecasted volumes to offset any significant inflationary pressure. Please refer to interrogatory response I-01-O-Staff-363, part b) for a discussion on what steps Hydro One has taken to minimize the risk of supply chain issues and market price changes in executing its capital and OM&A programs.
v. Hydro One has commitments from the AMI 1.0 vendor Trilliant to supply meters through 2030 and has negotiated a 20-year supply agreement with an AMI 2.0 vendor.
vi. Please refer to interrogatory response O-Staff-365 parts (d)(i) subsection c for presentation of metering contingency plans.

c)

i. This program's budget is based on historic total program expenditures and therefore there is no specific budget expenditure for telecommunication expansions/work to compare forecast or actuals against budget. Telecom expansions/work made up approximately 47% and 38% of net expenditures in 2020 and 2021 respectively. Poles replaced under this program are not tracked/reported based on rural or urban classification.
ii. Please refer to interrogatory response I-22-O-SEC-261.
iii. As per the Capital Performance Report update in I-22-O-SEC-264, Attachment 1, 1,355 poles were replaced under the Joint Use and Relocation program in 2021.

d)

i. For details of the underspend in PCB equipment replacement, please see the Capital Performance Report update in I-22-O-SEC-264, Attachment 1
ii. Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed

As discussed in Exhibit O-02-01, notwithstanding external pressures including demand and inflation, Hydro One intends to manage within the planned total envelopes reflected in its pre-filed evidence for both transmission and distribution. To the extent demand and financial pressures on the 2022 work program prevent Hydro One from remaining within the 2020-2022 envelope, adjustments will be made over the 2023-2027 rate period to maintain forecast capital expenditure levels.

iii. See d), ii. above.

e)

i. The reason for the 2021 actuals being lower than forecast was in year redirection to partially offset increases in demand driven work.

2021	Forecast	Actuals
Pole Refurbishment	2,000	1,877
Pole Replacement	7,050	5,344

ii. Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed As discussed in Exhibit O-02-01, notwithstanding external pressures including demand and inflation, Hydro One intends to manage within the planned total envelopes reflected in its pre-filed evidence for both transmission and distribution. To the extent demand and financial pressures on the 2022 work program prevent Hydro One from remaining within the 2020-2022 envelope, adjustments will be made over the 2023-2027 rate period to maintain forecast capital expenditure levels

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Reference:

Exhibit O-2-1, Attachment 4, Appendix 2-AA, Capital Projects and Programs for General Plant

Interrogatory:

a) Actual 2021 Fleet expenditures were lower than forecast.

i. Please explain the reason for the underspend.
ii. How many vehicles and items of work equipment were replaced compared to plan, by type?
iii. What impact will the underspend have on capital and maintenance budgets for the test period?
iv. If the underspend was related to vehicle availability from manufacturers, what steps is Hydro One taking to meet its capital plan for 2022 and the test period?

Response:

a)

i. While orders were placed, vendor delays due to global supply chain issues, including microchip shortages, has resulted in final purchases for 2021 being delayed into 2022.

ii.

Type	Actual	Budget
Light & Heavy (Non-PTO)	126	136
Heavy PTO	15	47
MISC & Trailer	3	62
Off Road	5	0
Total	149	245

iii. 2021 deferrals will be included in the 2022 planned expenditure. This will have no incremental impact in the budget for the test period.

iv. Fleet is working with equipment vendors to provide multi-year investment schedule to ensure Hydro One manufacturing slots are secured, and Hydro One will commit earlier to ensure assets requiring longer lead-time delivery are acquired and delivered in their target test years.

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Reference:

Exhibit O-2-1, Page 3

Preamble:

At the above reference it is stated that:

> In 2021, System Access investments were $58.6 million above the OEB approved amount of $11.3 million. This variance was primarily driven by the need to respond to load customer connections and upgrades, and third party driven secondary land use and relocation requests.

Interrogatory:

a) Please identify the specific investments that contributed to the variance. For each investment, please provide the plan amount from the EB-2019-0082 application, and the variance. For investments that were not included in the EB-2019-0082 application, please provide a description of the investment consistent with the level of information contained in EB-2019-0082 investment descriptions.

Response:

a) Please see Interrogatory O-SEC-263 Attachment 1 for the Transmission Capital Program Performance Report - 2021.

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Reference:

Exhibit O-2-1, Page 4
EB-2019-0082, ISD SS-13
Exhibit I-1-B2-Staff-094
Exhibit I-1-B2-Staff-096

Preamble:

At the first reference it is stated that:

> In 2021, System Service investments were $70.5M above the OEB-approved amount of $148.2M, largely driven by investments in response to system needs identified through bulk system and regional planning processes. The variance is primarily due to the increased scope, complexity and cost associated with the Lakeshore TS project as well as scheduled extensions and increased costs associated with delays to NextBridge's East-West Tie line construction, which were beyond Hydro One's control.

The response to part b) at the third reference states that:

> The need date for Lakeshore TS was identified by the IESO as mid-2022 in the IESO letter dated January 31, 2019. Subsequently, Hydro One received a IESO letter, dated June 11, 2019 for the double circuit 230kV transmission [line] between Chatham and Lakeshore with a need date of 2025. In light of the discrete need dates, the scope of work directly associated with the connection of a new double circuit transmission line is managed and tracked separately such that costs are prudently managed and paced as the needs evolve.

The response to part g) at the third reference states that:

> The scope reflected in EB-2019-0082, ISD SS-13 consisted of two discrete stages of work comprised of the following sub-projects in the Leamington area:
>
> Stage 1: Station work
> a) Build a new 230kV switching station at Leamington Junction and sectionalize the existing 230kV circuits (C21J, C22J, C23Z and C24Z). Connect this new switching station to the existing tap to Leamington TS; and
> b) Build a new 75/125MVA, 230/27.6kV DESN station with twelve feeders at Leamington Junction.

Stage 2: Line Work

a) Build a new 230kV transmission line, approximately 50 km long, from Chatham SS to the new switching station at Leamington Junction; and
b) Modify Chatham SS to connect the new line into the 230kV switchyard.

The response to part h) at the third reference states that:

> The initial scope of Lakeshore TS, as included as part of EB-2019-0082, ISD SS-13, was based on preliminary information and assumptions from discussions with the IESO. The preliminary scope that informed the high level planning allowance noted in ISD SS-13 for the Lakeshore TS portion comprised of twelve (12) 230kV breakers, protection and control facilities, and re-termination of the circuits; with no assumptions made for real estate. The high level planning allowance for that portion of the project was $69 million.
>
> Since that time, Hydro One worked closely with the IESO to define the scope of the required switching facilities at Lakeshore TS in line with the need identified in the IESO letter; and the project has undergone extensive project definition … in order to meet reliability and operability requirements, the scope of Lakeshore TS expanded to include a total of twenty-two (22) 230kV breakers, 230kV reactive compensation, re-configuration of transmission lines, work at remote stations to support the implementation of the special protection system, and necessary real estate requirements for the new station and transmission facilities. The variance due to the updated scope, complexity and cost for the project is a $104 million difference from the preliminary information in EB-2019-0082, ISD SS-13.

Interrogatory:

a) Please identify the "investments in response to system needs identified through bulk system and regional planning processes" that drove the increase in System Service investments in 2021. Please reference the supporting bulk system and regional planning reports and ensure that they are all filed on the record of this application. For each investment, please provide the plan amount from the EB-2019-0082 application, and the variance.

b) Please breakdown the $70.5 million System Service variance into the variance attributable to each project.

c) Please describe the reactive compensation that was added to the scope of Lakeshore TS.

d) Please provide the point in time when the scope changed from a 12-breaker configuration to a 22-breaker configuration.

e) Please explain what drove the scope change that resulted in the scope changing from a 12-breaker configuration to a 22-breaker configuration. Does the 22-breaker configuration include the connection of additional elements not contemplated in EB-2019-0082 ISD SS-13? If so, please explain what the additions were, and how they affected the number of breakers required.

f) Please provide a single line diagram of the 12-breaker configuration of Lakeshore TS that was planned at the time of the EB-2019-0082 application, showing the terminations (i.e., C21J, C22J, C23Z, C24Z, etc).

g) Please provide a single line diagram of the 22-breaker configuration of Lakeshore TS that is under construction, showing the terminations.

h) Please describe the size of the land footprint acquired as part of the EB-2019-0082 ISD SS-13 investment relative to the size of Lakeshore TS. Please provide a site plan of the station layout within the land footprint acquired. If additional land was acquired, beyond what is required for Lakeshore TS, please explain how much additional land was acquired, and why.

i) Please complete the following table to separate the costs provided in Table 1 of EB-2019-0082 ISD SS-13, p. 4 into costs for Stages 1a, 1b, 2a and 2b, as described in the response to Exhibit I / Tab 1 / Schedule B2-Staff-094, part g).

($ Millions)	Prev. Years	2020	2021	2022	2023	2024	Future Years	Total
Stage 1.a								
Stage 1.b								
Stage 2.a								
Stage 2.b								
Gross Investment Cost	4.9	4.9	9.7	59.1	63.8	63.8	10.0	216.2

j) Please explain how the "high level planning allowance" of $69 million for Lakeshore TS that is described in Exhibit I / Tab 1 / Schedule B2-Staff-094, part h) is consistent with the information provided in the table from part i) of this question.

k) Please complete the following table, like the table from part i) of this question, showing the actual expenditures for "previous years", 2020, and 2021.

($ Millions)	Prev. Years	2020	2021
Stage 1.a			
Stage 1.b			
Stage 2.a			
Stage 2.b			
Gross Investment Cost			

l) Please explain how the $104 million variance described in Exhibit I / Tab 1 / Schedule B2-Staff-094, part h) is consistent with the information provided in the table from part k) of this question, or indicate if the variance has changed.

m) Please provide a breakdown of the in-service addition amounts for Lakeshore TS by year in a similar format to the one used in response to Exhibit I-22-C-SEC-175. In addition, please provide a description of the station equipment that will enter service in each year. When will the circuit breakers and other equipment that is required for the connection of the new double-circuit 230 kV Chatham-Lakeshore become an in-service addition?

n) Has the scope for the 230 kV Lakeshore TS, which is currently under construction, incorporated any work required for the connection of a 500 kV line between Longwood TS and Lakeshore TS, as described in response to Exhibit I / Tab 1 / Schedule B2-Staff-096, part c)? If yes, please explain what the work is and why it is being undertaken now.

o) Will it be necessary to acquire additional land for the Lakeshore TS 500 kV switchyard? What will be the cost? Which project will this cost be part of?

Response:

a) The following investments in response to system needs identified through bulk system and regional planning processes in the System Service category were the main contributors to the increase in 2021:

ISD Ref	Project	EB-2019-0082 2021 Plan ($M)	2021 Actual ($M)	Variance ($M)
EB-2019-0082, SS-04	East-West Tie Connection	24.1	36.4	12.3
EB-2019-0082, SS-13	Leamington Area Transmission Reinforcement	20.0	92.4	72.4
	Total:	**44.1**	**92.4**	**84.7**

- **East-West Tie Connection:** The East-West Tie Expansion was identified as a priority transmission project in the 2010 and 2013 Long-Term Energy Plans. On December 1, 2017, the IESO published, "*Updated Assessment of the Need for the East-West Tie Expansion*" which recommend the East-West Tie expansion as the preferred and recommended solution to meeting Northwest supply needs. The referenced assessment is provided as Attachment 1. Please see EB-2019-0082, ISD SS-04 for further details.

- **Leamington Area Transmission Reinforcement:** The need for transmission reinforcement, including the construction of Lakeshore TS is detailed in the IESO Bulk Study Report, "*Need for Bulk Transmission Reinforcement in the Windsor-Essex Region*" published on June 13, 2019 and is included in Interrogatory B2-Staff-071, part a). Please see EB-2019-0082, ISD SS-13 for further details.

b) Please see Interrogatory O-SEC-263 Attachment 1 for the Transmission Capital Program Performance Report, Section 1.2 for further details and variance analysis for System Service investments in 2021.

c) Hydro One views the requested information as not material to the updated evidence. Nevertheless, Hydro One is providing the requested information because it is readily available. Two capacitor banks rated 195 MX at 249.4kV were added to the scope of Lakeshore TS.

d) Hydro One views the requested information as not material to the updated evidence. Nevertheless, Hydro One is providing the requested information because it is readily available. The scope evolved from an initial 12-breaker design to the current 22-breaker

design around the Summer of 2019 as new requirements for the additional 230kV line between Chatham SS and Lakeshore TS were issued by IESO.

e) Hydro One views the requested information as not material to the updated evidence. Nevertheless, Hydro One is providing the requested information because it is readily available. The Transmission System Plan in EB-2019-0082 was developed before the full scope and requirements of Lakeshore TS had been defined by the IESO. Discussions with the IESO throughout 2019, increased the complexity of the required facilities and the scope was refined to the current 22-breaker design to accommodate the construction of the new 230kV double circuit line between Chatham SS and Lakeshore TS. The 22-breaker configuration does not include the connection of additional elements not contemplated in EB-2019-0082 ISD SS-13.

f) In Procedural Order Number 5 (PO5), the Commission stated: "The OEB is providing for written interrogatories on Hydro One's application update. Parties are to only file interrogatories pertaining to the evidence filed by Hydro One on March 31, 2022 and April 8, 2022. Such interrogatories are not to be used as an opportunity for further exploration and questioning of evidence previously filed in this proceeding." This interrogatory is related to Hydro One's original evidence, does not seek clarification or information on Hydro One's updated evidence and is outside the scope of interrogatories permitted by PO5. Hydro One respectfully declines to respond to this interrogatory.

g) Please see part f).

h) Hydro One views the requested information as not material to the updated evidence. Nevertheless, Hydro One is providing the requested information because it is readily available. Approximately 319 acres of land were acquired as part of the EB-2019-0082 ISD SS-13 investment in July 2020. Lakeshore TS occupies approximately 45 acres and South Middle Road TS occupies 4 acres (also contemplated in SS-13). The additional land was acquired to facilitate the expansion of Lakeshore TS to support future transmission reinforcements that were anticipated including the 500kV single circuit transmission line between Longwood TS and Lakeshore TS (formally published in September 2021 in the IESO's West of London Bulk Planning Study titled "Need for Bulk System Reinforcements West of London" - included as part (f) in Interrogatory B2-Staff-094). Please see part f) regarding the site plan.

i) Please see part f).

j) Please see part i).

k) Please see the table below for gross actual expenditures associated with each stage.

($ Millions)	Prev. Years	2020	2021
Stage 1.a (Lakeshore TS)	1.4	44.4	92.4
Stage 1.b (South Middle Road TS)	-	6.3	24.3
Stage 2.a (Chatham x Lakeshore Line)*	-	-	-
Stage 2.b (Chatham x Lakeshore Line – Chatham SS Modifications)	-	-	-
Gross Investment Cost	1.4	50.7	116.7

**Costs for the Chatham x Lakeshore transmission circuits are expected to be owned by and included in the rate base of a newly licensed partnership. These assets will not form part of Hydro One's rate base and, as such, the associated capital expenditures have been excluded.*

l) The $104M variance described in Interrogatory B2-Staff-094, part h) has not changed as it is the variance between the forecast project total relative to the forecast provided in EB-2019-0082, ISD SS-13 ($69M) for Stage 1.a (Lakeshore TS), whereas part k) shows the actual expenditures incurred to date.

m) Hydro One views the requested information as not material to the updated evidence. Nevertheless, Hydro One is providing the requested information because it is readily available. Lakeshore TS is expected to be in-service in 2022. For further information regarding the station facilities for the new double circuit 230kV Chatham-Lakeshore line please see Exhibit B-02-01, TSP Section 2.11, ISD T-SS-07.

n) No, however please see part h) with respect to the acquisition of land.

o) No, please see part h).

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Updated Assessment of the Need for the East-West Tie Expansion

Submitted to the Ministry of Energy

December 1, 2017

ieso
Connecting Today.
Powering Tomorrow.

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1.0 KEY FINDINGS/RECOMMENDATIONS

This report has been prepared in response to the August 4, 2017 direction from the Minister of Energy ("Minister") requesting the IESO to prepare an updated need assessment, similar in scope to the previous update reports prepared for the Ontario Energy Board ("OEB"). This report confirms the rationale for the East-West Tie ("E-W Tie") Expansion project based on updated information and study results. This project continues to be the IESO's recommended option to maintain a reliable and cost-effective supply of electricity to the Northwest for the long term.

The E-W Tie Expansion project provides approximately $200 million in net cost savings compared to the least-cost local generation alternative. The IESO also considered high and low sensitivities on a number of key parameters, such the assumed cost of the generation alternative. Based on the sensitivities tested for the Reference outlook, the E-W Tie Expansion project, compared to the least-cost local generation option, ranges from a net cost savings of approximately $500 million to a net cost of just under $100 million.

The IESO continues to recommend an in-service date of 2020 for the E-W Tie Expansion project. Discussions with the transmitters confirmed their ability to meet this date, dependent on timely regulatory approvals. The IESO will continue to support the implementation of the project and monitor electricity supply and demand in the Northwest until the E-W Tie Expansion project comes into service.

2.0 INTRODUCTION

The Ontario Government's 2010[1] and 2013[2] Long-Term Energy Plans ("LTEP") have both identified the expansion of the E-W Tie transmission line as a priority project. The E-W Tie Expansion project is intended to increase the transfer capability into the Northwest by adding a new transmission line roughly parallel to the existing E-W Tie transmission line, which extends between Wawa and Thunder Bay.[3]

The Minister's letter to the OEB of March 29, 2011 was the impetus for the OEB undertaking a designation process to select the most qualified and cost-effective transmitter to undertake development work for the E-W Tie project. Early in that proceeding (EB-2011-0140), the OEB

[1] Ontario's 2010 Long-Term Energy Plan: Building Our Clean Energy Future, Figure 12, page 47.

[2] Ontario's 2013 Long-Term Energy Plan: Achieving Balance, page 52.

[3] The route deviates from that of the existing E-W Tie by travelling around Pukaskwa National Park rather than through, and travelling north of Loon Lake and west of Ouimet Canyon Provincial Park.

requested that the former Ontario Power Authority ("OPA")[4] – now the Independent Electricity System Operator ("IESO") and hereinafter referred to as the IESO – provide a report documenting the preliminary assessment of the need for the E-W Tie Expansion. In response, the IESO filed its original report in June 2011, titled "Long Term Electricity Outlook for the Northwest and Context for the East-West Tie Expansion" ("June 2011 Report"). As a result of the designation proceeding, Upper Canada Transmission, Inc. (o/a "NextBridge Infrastructure") was selected as the proponent to develop the E-W Tie.

The OEB's Phase 2 Decision and Order Regarding Reporting by Designated Transmitter, and the subsequent update due to the deferral of the in-service date from 2018 to 2020, dated September 26, 2013 and January 22, 2015[5] respectively, required the IESO to provide updates to the OEB on the need for the E-W Tie Expansion. In response, three previous E-W Tie reports were prepared by the IESO for the OEB: i) the first update report, was filed in October 2013, titled "Updated Assessment of the Rationale for the East-West Tie Expansion" ("October 2013 Report"); ii) the second update report titled "Assessment of the Rationale for the East-West Tie Expansion" was filed with the OEB on May 5, 2014 ("May 2014 Report"); and iii) the third update report titled "Assessment of the Rationale for the East-West Tie Expansion" was filed on December 15, 2015 ("December 2015 Report").

Following the December 2015 Report, the former Ontario Minister of Energy, Bob Chiarelli, issued a letter to the OEB stating that the E-W Tie Expansion continues to be the IESO's recommended alternative to maintaining a reliable and cost-effective supply of electricity in Northwestern Ontario for the long term and that the government had accordingly issued an Order in Council ("OIC") on March 10, 2016 declaring that the E-W Tie Expansion was needed as a priority project. Consequently, on December 6, 2016, the OEB issued an additional revision to their Phase 2 Decision and Order Regarding Reporting by Designated Transmitter relieving the IESO of the obligation of completing a 2016 need update report.

On July 31, 2017, NextBridge and Hydro One Networks Inc. ("Hydro One") filed Leave to Construct ("LTC") applications[6] with the OEB for the E-W Tie Expansion project. Their

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[4] On January 1, 2015, the Ontario Power Authority ("OPA") merged with the Independent Electricity System Operator ("IESO") to create a new organization that combines the OPA and IESO mandates. The new organization is called the Independent Electricity System Operator. Any assessments prior to January 1, 2015 were provided by the former OPA.

[5] OEB Decision and Order Regarding Reporting by Designated Transmitter dated September 26, 2013, page 4, and January 22, 2015, page 5.

[6] The OEB assigned file numbers EB-2017-0182 and EB-2017-0194 to the NextBridge and Hydro One applications respectively.

applications included new evidence provided by the IESO related to the preferred staging of the project's station facilities. Staging the construction of the station facilities was recommended to reduce the cost of the project, by deferring costs until the facilities are needed. The OIC, issued under the authority of section 96.1(1) of the *Ontario Energy Board Act, 1998*, satisfies the usual need requirement for obtaining section 92 approval.

The project costs included by NextBridge in its LTC application are higher than what was assumed in the IESO's December 2015 Report. Therefore, on August 4, 2017 the Minister requested the IESO to prepare an updated need assessment, consistent with the scope of previous need assessments requested by the OEB. The 2017 LTEP, published in October 2017, also addressed the need to review all options for meeting capacity needs in the Northwest to ensure ratepayers are protected as the E-W Tie Expansion project continues to be developed.[7]

This report provides an updated assessment of the E-W Tie Expansion project, reflecting changes that have taken place since the December 2015 Report, namely revised project costs and an updated demand and supply outlook for the Northwest.

3.0 CHANGES TO THE PLANNING ASSUMPTIONS

Major changes to the planning assumptions since the December 2015 Report are identified here in order to provide context for the updated results and the information presented in subsequent sections of this report.

Cancellation of TransCanada's Energy East Pipeline Project

The December 2015 Report included demand associated with TransCanada's Energy East project, in both the Reference and High demand outlooks. On October 5, 2017, TransCanada announced the termination of the Energy East project.[8] As a result, the anticipated demand associated with the Energy East project is no longer considered in any of the demand outlooks.

The Energy East project accounted for approximately 110 MW of peak demand and 1 TWh of energy demand in the December 2015 Report's Reference demand outlook.

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[7] Ontario's 2017 Long-Term Energy Plan: Delivering Fairness and Choice, page 39.

[8] "TransCanada Announces Termination of Energy East Pipeline and Eastern Mainline Projects", https://www.transcanada.com/en/announcements/2017-10-05-transcanada-anounces-termination-of-energy-east-pipeline-and-eastern-mainline-projects/.

Updated Load Supply Needs

The analysis in the December 2015 Report included a westbound E-W Tie limit of 155/175 MW[9] based on the thermal limitation of the underlying 115 kV circuit from Marathon TS to Lakehead TS. It is assumed that this limit remains the planning limit for the existing E-W Tie. This limit, however, relies on support from Manitoba following contingencies on the E-W Tie. The magnitude of support required is the highest for the loss of the E-W Tie from Wawa TS to Marathon TS since that contingency separates Northwestern Ontario from the rest of the province and leaves it connected only to Manitoba and Minnesota.

Relying on short-term support from neighbouring jurisdictions is an assumption made when operating the system province-wide. However, this support should not be relied on for an extended period of time without an agreement with the neighboring jurisdiction. The current practice is to operate the system such that we're not counting on this support for more than 30 minutes following a disturbance.[10]

The requirement to return the flow on the Manitoba and Minnesota interfaces to zero, or to the scheduled flow, within 30 minutes following a contingency on the E-W Tie is a requirement that is now being included in this update report when determining whether the Northwest has adequate resources to reliably meet its outlook for demand.

Staging of Station Facilities

In September 2014, as a result of the findings of the May 2014 Report , the IESO wrote a letter to the OEB recommending the deferral of the in-service date of the E-W Tie Expansion from 2018 to 2020. The letter indicated that the additional time would allow for the optimization of equipment and system design, including the staged construction of station facilities. Prior to Hydro One's LTC application being filed in July 2017, the IESO worked closely with Hydro One to evaluate the technical and economic feasibility of different staging alternatives for the required station facilities. The IESO's evidence outlines the staging alternatives that were compared and the rationale behind the recommended staged implementation of the station facilities.

[9] The planning limit for the existing E-W Tie is a thermal limitation, 155 MW reflects summer conditions and 175 MW reflects winter conditions.

[10] Market Manual 7.4: IESO Grid Operating Policies

The recommended staging includes an initial stage that provides 450 MW of transfer capability, with a station facility cost of $147 million. The second stage would be implemented only once the full 650 MW transfer capability of the line is needed, at an additional cost of $60 million.

Updated Transmission Cost Estimates

For this update, the IESO used the updated capital cost estimates for the new line and the station upgrades that the transmitters filed with the OEB on July 31, 2017 in their LTC applications. Based on its filed evidence, NextBridge estimates a cost of $777 million for the E-W Tie line, an increase from the previous planning estimate of $500 million used in the December 2015 Report. NextBridge has stated that the cost increase reflects unbudgeted costs, new scope requirements, other unforeseeable factors such as the delay to the in-service date, and development phase project refinements.

As previously outlined, the cost of the station facilities required for the 650 MW E-W Tie Expansion project is approximately $207 million, up from the previous planning estimate of $150 million. This estimate accounts only for costs directly attributable to the E-W Tie Expansion project. As outlined in the IESO's evidence filed with the OEB in support of Hydro One's LTC application, facilities required to address the existing high voltage problem at Lakehead TS are required regardless of whether the E-W Tie project proceeds and are not considered as part of the cost of the E-W Tie station facilities.

The total project cost for the initial 450 MW stage is $924 million, and implementing the full 650 MW would increase overall costs to $984 million.

4.0 NORTHWEST DEMAND OUTLOOK

Throughout the planning and development of the E-W Tie Expansion project, the IESO has held regular discussions with stakeholders, customers and communities in the Northwest and the IESO continues to monitor developments that may affect electricity demand in the region. The demand outlook in this report reflects updated information and engagement which has taken place since the Minister's request for the IESO to provide a need update. Engagement with stakeholders and communities in the Northwest continues to provide valuable insight into the status of future developments. The IESO's outlook considers the likelihood of identified projects proceeding under three potential economic outlooks.

The Reference, Low and High demand outlooks reflect the inherent uncertainties related to industrial development in the Northwest. As noted in the previous three need update reports, Northwest electrical demand is dominated by large, industrial customers and can fluctuate significantly in response to changing economic and market conditions. The Northwest remains

a winter-peaking region, in contrast to Southern Ontario, where electricity demand usually peaks during the summer months.

In this update, the demand outlook has materially decreased in magnitude. This is driven by two significant developments: a continued decline in historical demand in the Northwest and the cancellation of TransCanada's Energy East Pipeline project and its subsequent removal from the Reference and High demand outlooks.[11]

4.1 Historical Northwest Demand

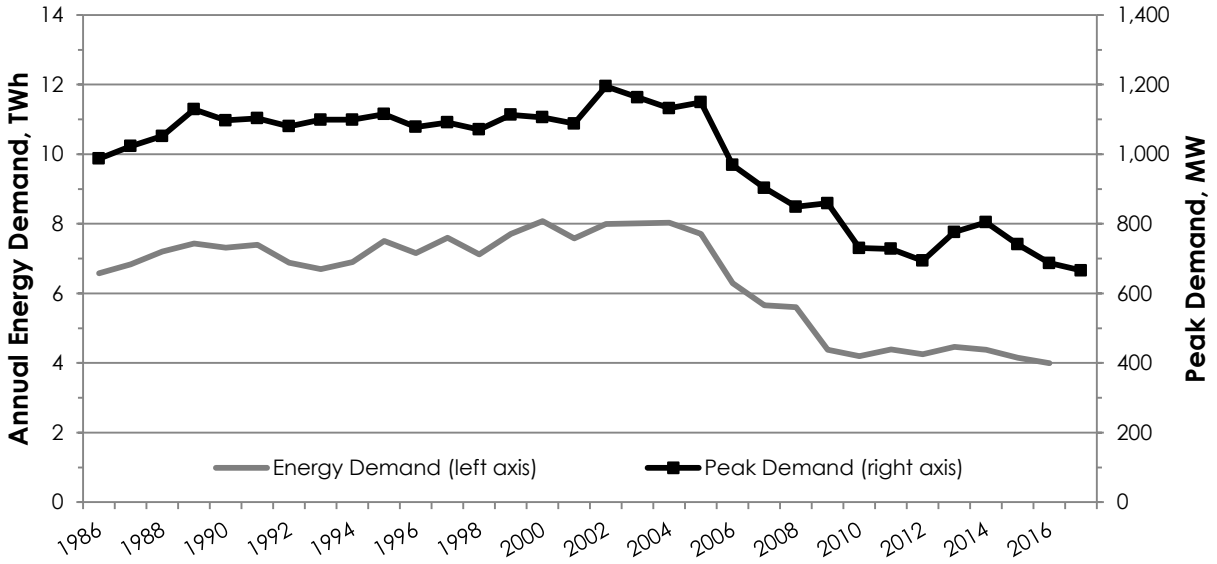
Historical electricity demand in the Northwest is presented in Figure 1 below. This update includes actual energy and peak demand data from 2015 and 2016 and preliminary data from 2017, which was not available when the December 2015 Report was prepared. While the winters of 2013 and 2014 saw an increase in demand in the Northwest, this was primarily driven by extreme low temperatures in the Northwest caused by a southward shift of the North Polar Vortex.[12] This resulted in a higher than average electric heating demand, driving winter peak demand to its highest level in five years.

Historical data now available for 2015 and 2016 and preliminary data available for 2017 shows a continuation of the declining trend for electrical demand in the Northwest due to the impacts of continued population decline, conservation, distributed generation and continued decline of the pulp and paper industry. This provides a lower starting point than in the December 2015 Report.

[11] The Energy East project was never included in the Low demand scenario.

[12] "Thunder Bay has coldest winter in 35 years, stats say", http://www.cbc.ca/news/canada/thunder-bay/thunder-bay-has-coldest-winter-in-35-years-stats-say-1.2580059.

Figure 1. Historical Northwest Electricity Demand



4.2 Drivers of Northwest Demand

The IESO continues to work with interested parties to understand the drivers of demand in the Northwest, engaging with stakeholders such as Common Voice Northwest ("CVNW"), mining companies, industry associations, and the Ontario Ministry of Northern Development and Mines. The updated outlook reflects changes in the status of developments throughout the Northwest.

In comparison to the December 2015 Report, the Northwest demand outlook has been impacted by a few key factors including: updated information on the status of mining developments; cancellation of TransCanada's proposed Energy East project; and continuing decline in the pulp and paper sector.

Mining Sector

The IESO has continued to engage mining companies with developments in Ontario and review technical documents to understand the feasibility, timing, and likelihood of potential mining developments. Factors such as commodity prices, access to capital and environmental considerations are indicators of potential growth in the sector. A mining project in the Fort Frances area has advanced to construction and initial production, and various other projects throughout the region have had success raising capital and advancing both their feasibility and environmental assessments. However, several other projects have experienced set-backs due to factors such as low commodity prices. The demand outlook considers the latest available information on the location, size, and stage of development of mining projects in the Northwest.

Pulp and Paper Sector

Ontario's pulp and paper sector has been in decline for over 10 years and this decline has continued since the December 2015 Report was published. While there is potential for demand stabilization, a return to the demand levels of a decade ago is considered unlikely.

TransCanada Energy East Pipeline

Demand associated with the Energy East Pipeline project which was previously included in both the Reference and the High demand outlooks has been removed.

Remote Communities

Connection of remote communities is assumed to begin in 2024, a delay of four years compared with the December 2015 Report.

Other Components of the Demand Outlook

Minimal or no change has been made to account for the remaining components of the Northwest demand outlook since the December 2015 Report:

- Forestry sector
- Natural growth in residential, commercial and other industrial sectors

The IESO continues to work with local distribution companies ("LDCs") to implement the Conservation First Framework, consistent with both the 2013 and 2017 LTEPs and the March 31, 2014 Conservation First Directive from the Ministry of Energy to the IESO. LDC progress towards meeting the conservation targets was tracked through Conservation and Demand Management ("CDM") Plans and evaluation, measurement and verification ("EM&V") activities, and the conservation assumptions for the Northwest were updated accordingly.

4.3 Northwest Demand Outlooks

An updated demand outlook for the Northwest was developed, taking into account the impacts of the drivers described above. Consistent with the previous three update reports, the IESO has represented demand growth uncertainty in the region by developing three outlooks to explore the robustness and flexibility of options to meet the need in the Northwest under a range of outcomes. Key aspects of the outlooks are as follows:

- **Reference demand outlook -** In this outlook, mining sector demand includes proposed mines that have passed significant development milestones. Mining loads are assumed to persist for the expected lifetime of the proposed developments. This outlook assumes

modest growth in the forestry sector in the short term and assumes stabilization of the pulp and paper sector.

- **High demand outlook -** This outlook considers the impact of stronger and faster development in the mining sector which could potentially be driven by factors such as increased commodity prices. This outlook also reflects modest growth in the forestry sector and the stabilization of the pulp and paper sector.
- **Low demand outlook -** This outlook describes a more restrained outlook in the mining sector and continuing decline in the pulp and paper sector.

The demand assumptions for Remote Communities, residential, commercial and other industries (other than those mentioned above) are the same in each outlook. The Energy East Pipeline project is not included in any outlook.

The resulting Northwest peak and annual energy demand outlooks, net of savings from planned conservation, are shown below in Figure 2 and Figure 3. The Reference demand outlook shows demand in the Northwest increasing quickly in the medium term, due to advancing mining developments that are expected to come online, followed by more gradual growth in the long term. The range between the High and Low outlooks reflects the uncertainty in the assumptions underlying the electricity demand growth in the Northwest.

For comparison, the Reference outlook prepared for the December 2015 Report has also been included in Figures 2 and 3. The current Reference outlook has a slower near-term growth rate than the December 2015 Reference outlook and is lower in the long term due to the continued decline in Northwest historical electrical demand and the cancellation of the Energy East Pipeline project.

Figure 2. Northwest Net Peak Demand Outlooks

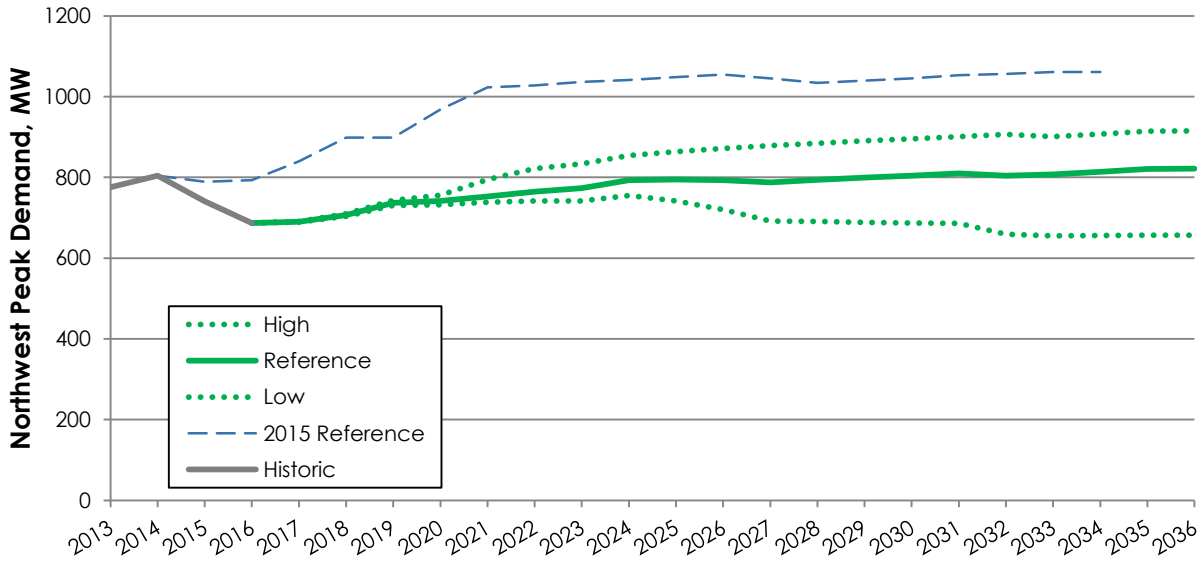
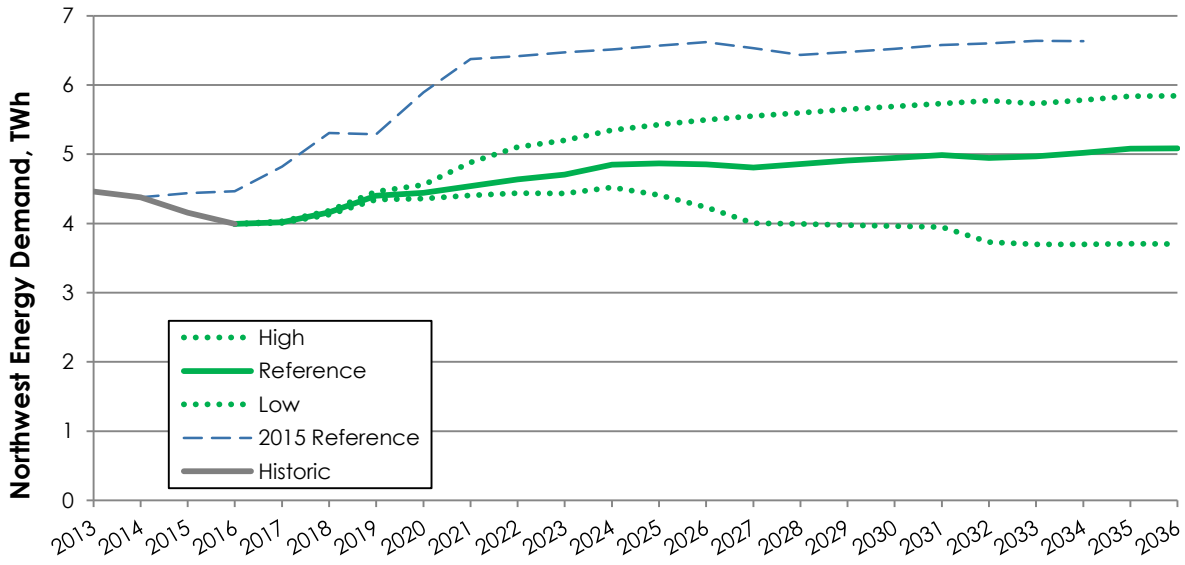


Figure 3. Northwest Net Energy Demand Outlooks



5.0 EXISTING RESOURCES TO SUPPLY NORTHWEST DEMAND

The Northwest relies upon both internal resources (generation located in the Northwest) and external resources (generation outside the Northwest accessed through existing ties) to meet its electricity supply and reliability requirements. An update on the Northwest supply outlook since the December 2015 Report is provided below.

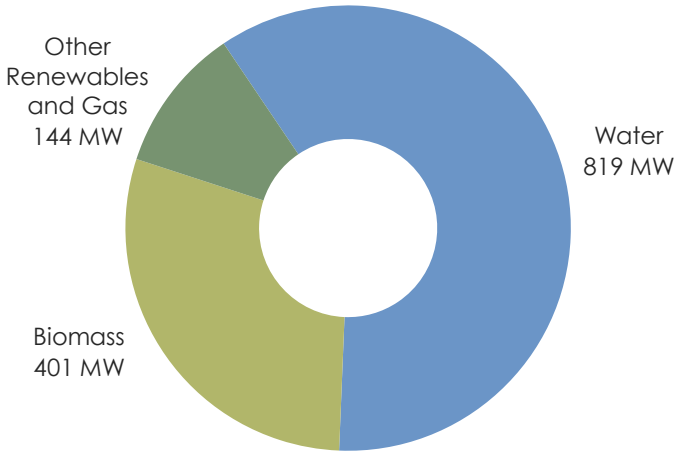
5.1 Internal Resources in the Northwest

The IESO has updated its assumptions regarding supply resources in the Northwest, where new information is available. The following material changes have been made since the December 2015 Report:

- Improved representation of water resources in the Northwest to better reflect run-of-river limitations.
- Incorporation of additional historical water data for the Northwest to better inform the probability of low water conditions.
- Some small-scale distribution-connected generation that began operation prior to 2017 is now included in the demand outlook as embedded generation; these resources have been removed from the supply-side model.

The installed capacity of internal resources in the Northwest for the year 2018 is approximately 1,360 MW and is shown by fuel type in Figure 4.

Figure 4. Northwest Internal Resources - Installed Capacity



5.2 External Resources Supplying the Northwest

Additional supply is provided to the Northwest through the existing E-W Tie; a 230 kV double-circuit transmission line that extends between Wawa TS and Lakehead TS, linking the Northwest system to the rest of Ontario.

The E-W Tie planning limit, consistent with the December 2015 Report, is 155/175 MW which respects the loss of the E-W Tie from Marathon TS to Lakehead TS. Staying under this limit ensures that, following contingencies on the E-W Tie, voltage levels in the Northwest are within

acceptable ranges, and equipment, including the Manitoba and Minnesota ties, stays within thermal limits.

However, as previously discussed, this E-W Tie planning limit relies on support from Manitoba following contingencies on the E-W Tie, which cannot be counted on for more than 30 minutes. As a result, there must be sufficient capacity in the Northwest to not only adequately supply the expected demand in the Northwest while staying under this planning limit, but also to reduce flows on the Manitoba and Minnesota ties to zero (or the scheduled transfer level) within 30 minutes.

For example, following the loss of the E-W Tie from Wawa TS to Marathon TS, the Northwest will be separated from the rest of Ontario and power will automatically flow from Manitoba and Minnesota to supply the Northwest. Action must then be taken to re-dispatch resources within the Northwest to return to scheduled flow levels and there must be sufficient capacity in the Northwest to do so.

6.0 THE NEED FOR ADDITIONAL SUPPLY FOR THE NORTHWEST

As described in previous reports, the outlook for supply needs in the Northwest comprises both capacity and energy components. The IESO updated its assessment of resource adequacy in the Northwest system, which is described below.

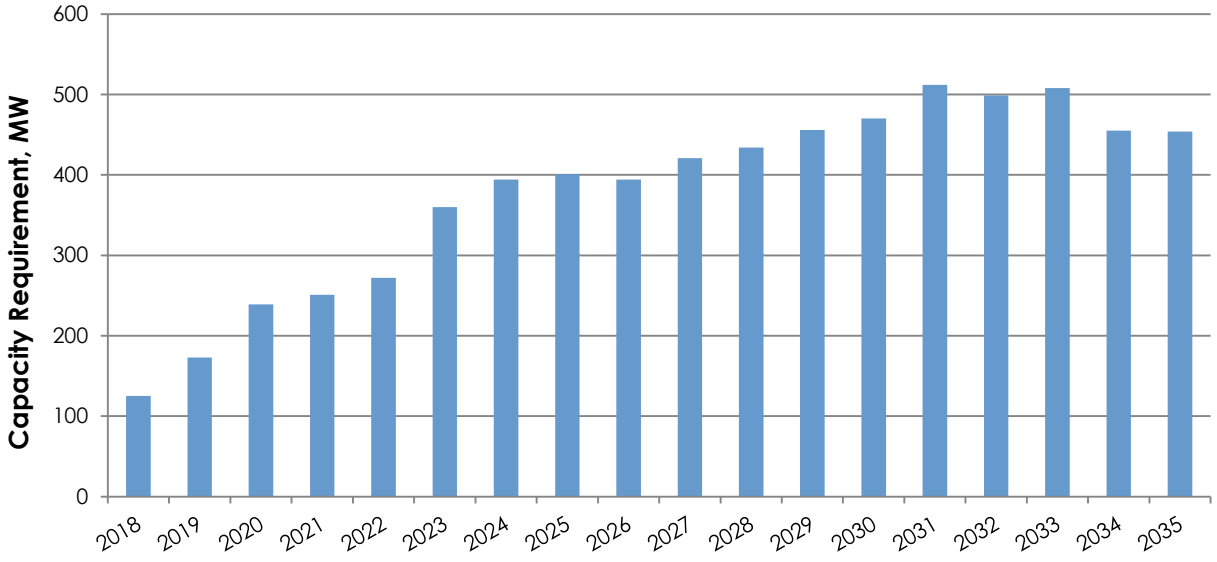
6.1 Capacity Adequacy Requirement

Consistent with the December 2015 Report, the IESO conducted a reliability assessment using a probabilistic approach to determine capacity requirements in the Northwest. As water conditions have a strong impact on overall supply availability in the Northwest, the probabilistic approach reflects a range of water conditions.

The updated capacity need, based on the Reference demand outlook with no E-W Tie Expansion, is shown in Figure 5. A 100 MW capacity need already exists today, and this need continues to grow to approximately 240 MW by the original 2020 in-service date. By 2022, the capacity need exceeds 260 MW, and grows to approximately 400 MW by 2024. The need for additional capacity increases to about 500 MW by 2035 as demand continues to grow and as supply changes.

As noted in earlier need update reports, there is a projected capacity need in the interim years before the E-W Tie Expansion in-service date, based on an assessment of applicable planning criteria. The near-term need is higher than in the December 2015 Report because it includes the capacity needed to reduce the flow from Manitoba to zero (or the scheduled flow level) following a contingency on the E-W Tie.

Figure 5. Expected Incremental Northwest Capacity Requirement under Reference Demand

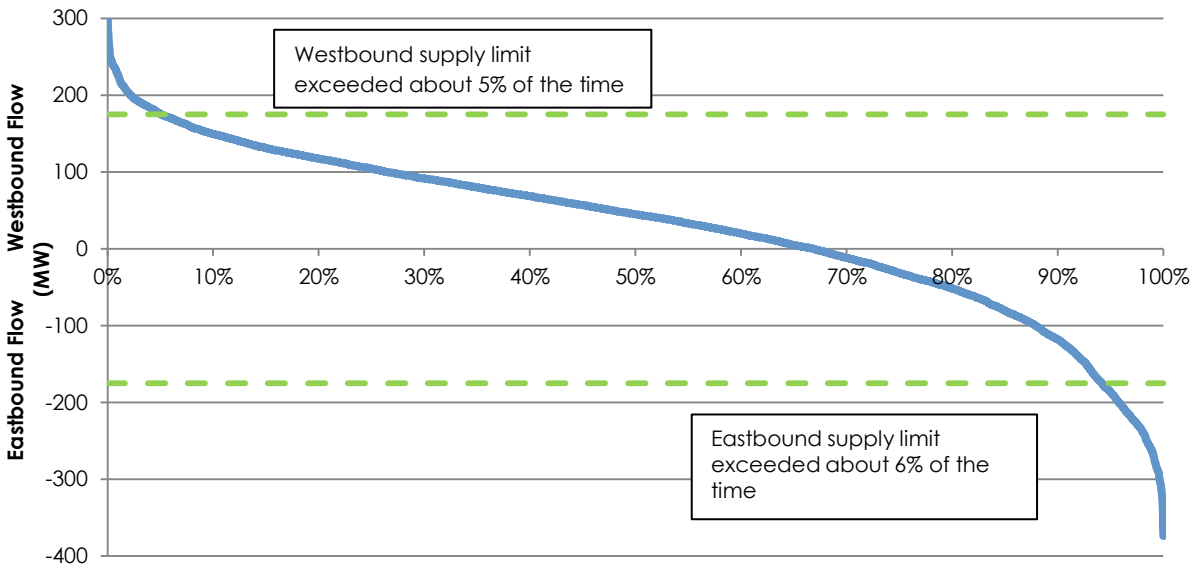


6.2 Energy Requirement

The expected energy requirement in the Northwest is defined by the energy demand outlook, as well as the supply capabilities of local generation and the existing E-W Tie. Figure 6 provides an updated E-W Tie flow duration curve, for all hours of the year 2023,[13] based on the updated Reference demand outlook and median water conditions. In this update, expected westbound flows exceed the existing E-W Tie capability approximately 5% of the time. This is based on application of the winter rating of 175 MW throughout the year. Applying the more restrictive limit of 155 MW during the summer months would result in a higher level of westbound congestion. Eastbound congestion is expected to occur approximately 6% of the time in 2023. The westbound energy requirement is expected to increase with the demand outlook over the planning horizon.

[13] The year 2023 has been shown for illustrative purposes. The energy assessment was carried out for years 2022 to 2035.

Figure 6. Unconstrained Flow and Planning Limits on the Existing E-W Tie for the Year 2023



7.0 ANALYSIS OF ALTERNATIVES TO MEET NORTHWEST SUPPLY NEEDS

In this updated need assessment, a number of alternatives to the E-W Tie Expansion were assessed taking into consideration updated information since the December 2015 Report. The two lowest cost options to meet the Northwest capacity and energy needs were identified to be: i) meeting Northwest needs through the addition of new local natural gas-fired generation, and ii) expanding the existing E-W Tie. These options are described further below:

(1) **No E-W Tie Expansion -** In this option, all of the identified capacity and energy needs are met through the addition of new natural gas-fired simple cycle gas turbine ("SCGT") generation in the Northwest, with the size of units and the timing of installation defined to meet the needs as they arise during the planning period. Under the Reference demand outlook, a total of 500 MW of generation is added. As in the previous update, it was assumed that, due to the difficulty and cost associated with obtaining firm gas service in the Northwest, all new-build natural gas-fired generation utilizes on-site reserve fuel.

(2) **E-W Tie Expansion -** In this option, the E-W Tie Expansion project provides a foundation for meeting the Northwest needs, with additional generation installed to meet any incremental supply requirements. In this update, a staged implementation of the E-W Tie Expansion was adopted, with the interim 450 MW E-W Tie stage and the final stage, to provide the full 650 MW transfer capability, added as required to meet the

capacity needs throughout the study period. Under the Reference demand outlook only the interim stage of the E-W Tie Expansion is required.

The assumptions and the results of the economic analysis comparing these two options are presented in section 7.1. As in the previous update reports, the economic analysis includes an assessment of the sensitivity of the results to changes in key variables to better understand their impact on the economic merits of both options.

No E-W Tie Expansion Option – Other Considered Alternatives

A number of the non-gas options for meeting Northwest needs were discussed in the May 2014 and December 2015 Reports. These were re-examined in the IESO's 2017 assessment. These options include utilizing existing biomass resources in the Northwest, building new non-emitting generation including storage, and firm imports from Manitoba. Although opportunities may exist to develop these resources to meet future provincial electricity needs, they were found to be insufficient for meeting the identified need in the Northwest due to technical and economic considerations.

New non-emitting resources such as wind and/or storage were also considered in this assessment. These were identified to be uneconomic for meeting Northwest needs relative to new natural gas-fired generation, and additional investments in transmission would be required to connect these resources. In addition, without expansion of the bulk transmission system, additional non-emitting generation resource development in the Northwest would increase surplus energy and congestion during periods of increased energy production from existing hydroelectric resources.

The use of the existing Manitoba intertie for either a short-term deferral of the need, or as part of an integrated solution for the long term, was also revisited. As discussed in the December 2015 Report, without major system expansion, only about 150-200 MW of firm capacity imports from Manitoba can be accommodated before running into constraints on the transmission system between Kenora and Dryden. Due to the magnitude of the need, firm Manitoba imports alone would not be sufficient to meet Northwest needs and would need to be paired with other resources.

7.1 Cost-Effectiveness Comparison of Generation and Transmission Alternatives

Consistent with previous E-W Tie Expansion need update reports, an economic analysis of the E-W Tie Expansion and the lowest cost generation option was conducted and their relative net present value ("NPV") was compared. A sensitivity analysis was performed to test the robustness of the results under a variety of conditions. Among the sensitivities tested were the

Reference, Low and High demand outlooks, ranges in the cost of the generation and transmission alternatives, and other cost-related assumptions.

Changes in assumptions since the December 2015 Report are as follows:

- The Reference demand outlook was updated as per the changes identified in section 4.3. Sensitivities to test the impacts of the updated Low and High demand growth outlooks on the NPV were performed.
- Existing supply resources were updated as described in section 5.
- Operating conditions were used in the energy assessment to better reflect the potential economic impact of each option.
- The transmission costs for the E-W Tie Expansion were assumed to be $777 million for the line and $207 million for the stations (see section 3). A portion of the station cost is deferred consistent with the staged expansion of the E-W Tie included in this update. The second stage is only required under the High demand outlook.
- The study period extends to 2051, when the first asset replacement decision is expected; this decision is associated with the generation alternative. Sensitivities of a 20-year and 70-year study period were assessed based on the typical planning horizon and the lifetime of a transmission line, respectively.
- Natural gas prices were assumed to be an average of $5.80/MMBtu throughout the study period – inclusive of carbon price. Sensitivities were assessed with the combined gas and carbon price ranging from $4.50/MMBtu to $10.50/MMBtu.
- The USD/CAD exchange rate was assumed to be 0.78. Sensitivities were assessed for 0.67 and 1.
- Additional sensitivities were analyzed including +20% and -15% for transmission capital costs, a +/- 75 MW margin of error on the capacity need analysis, and the impacts of electricity trade on energy prices.
- The NPV of all cash flow is expressed in 2017 $CDN.

The following assumptions remain unchanged from the December 2015 Report:

- The NPV analysis was conducted using a 4% real social discount rate. Sensitivities at 2% and 8% real social discount rate were also performed.
- The assessment is performed from an electricity ratepayer perspective.
- Median-water hydroelectric energy output was used for energy simulation in the economic analysis.
- Dual-fuel gas-fired generation was assumed to be added to the Northwest due to natural gas fuel supply limitations. Oil was assumed as the on-site reserve fuel. Other

options, such as compressed natural gas and liquefied natural gas stored on site, were also considered. However, these are expected to be higher cost than oil back-up.

- A sensitivity of +/- 25% was assessed on the capital and ongoing fixed costs for generation in the Northwest.
- The life of the station upgrades was assumed to be 45 years; the life of the line was assumed to be 70 years; and the life of the generation assets was assumed to be 30 years.
- New capacity in the Northwest and the rest of Ontario was added, as required, to satisfy Northeast Power Coordinating Council, Inc. ("NPCC") resource adequacy criteria.[14] These capacity needs were determined as described in section 6.1.

Under the Reference case assumptions, the E-W Tie Expansion project is approximately $200 million lower in net present cost compared to the no-expansion alternative. To test the robustness of this result against uncertainty in the assumptions, the IESO considered high and low sensitivities on a number of key parameters, of which changes to the demand outlook, discount rates, and assumed cost of the generation alternative had the largest impacts. Based on the sensitivities tested, the E-W Tie Expansion project, compared to new gas-fired generation in the Northwest, ranges from a net cost savings of approximately $500 million to a net cost of about $100 million.

The E-W Tie Expansion provides additional benefits, beyond meeting the reliability requirements of the Northwest, which are unique to a transmission solution. These include system flexibility, removal of a barrier to resource development, reduced congestion payments, reduced line losses, increased economic imports from Manitoba, decreased carbon emissions, and improved operational flexibility. These benefits are additive to the economic benefits and form an important part of the rationale for the project.

8.0 COMMUNITY INPUT

Stakeholder and community input is an important aspect of the planning process. Providing opportunities for input throughout the IESO's planning processes enables the views and preferences of stakeholders throughout the community to be considered in the development of demand outlooks and in the consideration and development of different alternatives to address identified needs.

[14] NPCC Regional Reliability Reference Directory # 1. Design and Operation of the Bulk Power System.

As part of the E-W Tie need update process, stakeholders throughout the Northwest were contacted to provide input into the outlook for electricity demand. The stakeholders directly involved included mining customers and other large industrial power consumers, CVNW, the Ministry of Northern Development and Mines, Union Gas Limited, TransCanada PipeLines Limited, and Thunder Bay Hydro Electricity Distribution Inc. Stakeholder input helped inform the status of developments in the region and their associated demand impacts. The list of stakeholders contacted throughout the development of the demand outlooks was consistent with previous update reports. The IESO also received written feedback from a variety of stakeholders, speaking to their continued support for the East-West Tie Expansion.

Finally, the IESO hosted a planning forum in Thunder Bay in October 2017 where stakeholders once again voiced their support for the project. Some have provided recommendations regarding alternatives to be considered for meeting Northwest capacity needs. Stakeholders at the forum also commented that the chosen solution should have the flexibility to accommodate demand uncertainty, decreasing the impediment to additional developments.

9.0 CONCLUSIONS AND RECOMMENDATIONS

The IESO's updated assessment of Northwest capacity needs and the options to address them demonstrates that the E-W Tie Expansion project continues to be the preferred option for meeting Northwest supply needs under a range of system conditions.

The IESO continues to recommend an in-service date of 2020 for the E-W Tie Expansion project. Discussions with the transmitters confirmed their ability to meet this date, dependent on timely regulatory approvals. The IESO will continue to support the implementation of the project and monitor electricity supply and demand in the Northwest until the E-W Tie Expansion project comes into service.

O - STAFF INTERROGATORY - 373

Reference:

Exhibit I-1-B2-Staff-070
Exhibit B-2-1, TSP Section 2.11, T-SA-05, Page 1

Preamble:

The first reference above asked about $38.5 million that Hydro One requested in the as-filed TSP evidence to include in the revenue requirement for the purpose of connecting future unknown load customers. The March 31st Evidence Update did not discuss that request and OEB staff Interrogatory #70 was not identified as being impacted by the update.

Interrogatory:

a) Please clarify if Hydro One has increased the amount being requested to connect unknown customers and, if so, the amount Hydro One is now requesting.

b) Please also identify the incremental load included in the updated load forecast associated with those unknown load customers (as part of the evidence update) and if that amount of load changed relative to the as filed application.

Response:

a) Capital expenditures for ISD T-SA-05 were updated in Exhibit O to reflect updated inflation assumptions. The updated total for the 2023-2027 period is $40.5M. Please see Exhibit O-01-02 Attachment 2.

b) As explained in Undertaking JT2.06 the capital expenditures are based on historical expenditures and not on a load forecast.

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O - STAFF INTERROGATORY - 374

Reference:

Exhibit O-2-1, Attachment 6, Appendix 2-JC, Transmission OM&A Programs Table
Exhibit I-24-E-VECC-063

Preamble:

At the first reference, in the updated Appendix 2-JC for transmission OM&A programs, Hydro One reports a 2021 actual of $40.1 million for 'Power Equipment', whereas the 2021 forecast was $45.0 million. Hydro One also reports a 2021 actual of $55.3 million for 'Protection, Control, Monitoring, Metering and Telecommunications (including cybersecurity)'. The 2021 forecast was $52.2 million.

At the second reference, Hydro One details incremental labour-related costs for the Joint Security Operations Centre in 2022 and 2023 (costs that are captured in the 'Protection, Control, Monitoring, Metering and Telecommunications (including cybersecurity)' line of Appendix 2-JC).

Interrogatory:

a) Please explain the driver(s) for the underspend in 'Power Equipment' and overspend in 'Protection, Control, Monitoring, Metering and Telecommunications (including cybersecurity)'.

b) If the underspend for 'Power Equipment' was related to equipment / material supply issues, what steps is Hydro One taking to ensure that it can fulfill its program commitments from 2022 to 2027?

c) How much of the overspend for 'Protection, Control, Monitoring, Metering and Telecommunications (including cybersecurity)' is attributed to higher equipment costs and insourcing of certain cybersecurity functions?

d) What impact will the 2021 underspend and overspend have on 'Power Equipment' and 'Protection, Control, Monitoring, Metering and Telecommunications (including cybersecurity)' expenditures, respectively, from 2022 to 2027?

e) For the incremental labour-related costs associated with the Joint Security Operations Centre, please confirm the incremental cost in 2022 is $2.38 million, and in 2023 is $3.58 million. If not confirmed, please update as necessary and providing reasoning.

Response:

a) The overspend in "Protection, Control, Monitoring, Metering and Telecommunications (including cybersecurity)" is due to the "Operation of Power System Telecom Services" and "Leased Telecommunication Circuits for Power System" drivers. The overspend is mostly attributed to the under forecasting of telecom services retained from Acronym Solutions Inc. (formerly Hydro One Telecom) as we continue to seek efficiency and ongoing optimization. The underspend on power equipment is mostly attributed to the lower than historical corrective work completed compared to the forecast.

b) The underspend in "Power Equipment' is not attributed to equipment / material supply issues.

c) The overspend in "Protection, Control, Monitoring, Metering, and Telecommunications (including cybersecurity)" is not attributed to higher equipment costs and insourcing of certain cybersecurity functions.

d) Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

e) The incremental costs are materially aligned with those presented in Interrogatory O-VECC-063.

O - STAFF INTERROGATORY - 375

Reference:

Exhibit O-2-1, Pages 6 and 7

Preamble:

Hydro One states that the increase in 2021 OM&A results for transmission "…was partially offset by lower Property Taxes and Rights Payments of $5.2M, due to a one-time successful re-negotiation with Hydro Ottawa on a stations occupation rights agreement and lower than anticipated payment to Metrolinx in 2021."

Interrogatory:

a) Please break down how much of the $5.2 million reduction in Property Taxes and Rights Payments is attributed to:

   i. The successful renegotiation with Hydro Ottawa on a stations occupation rights agreement
   ii. A lower than anticipated payment to Metrolinx

b) What is the duration of the above noted stations occupation rights agreement with Hydro Ottawa and how have the savings been carried forward from 2022 to 2027?

c) Please explain how Hydro One was able to have a successful renegotiation with Hydro Ottawa and describe why a similar outcome cannot be replicated in other future negotiations (for both transmission and distribution) as it is characterized as a "one-time successful" renegotiation.

d) Please explain why the above noted payment to Metrolinx in 2021 was lower than anticipated. In the response, please address if similar lower than anticipated payments are expected from 2022 to 2027 (and detail why / why not) for the transmission and distribution businesses.

e) How will the lower payment to Metrolinx in 2021 impact Property Taxes and Rights Payments for the transmission business from 2022 to 2027?

Response:

a) In addition to the variance contribution related to Hydro Ottawa and Metrolinx referenced in Exhibit O-02-01, a significant portion of the variance is related to property tax changes with a number of municipalities. These changes included successful tax appeals, payment adjustments, lower tax rates and postponed reassessments. These are included in the breakdown of the $5.2M variance provided below.

Variances ($M)	Description
3.4	Property Tax payments - savings attributable to two successful tax appeals, a payment adjustment, lower than anticipated tax rates from municipalities and the postponed reassessments of the property values by the Municipal Property Assessment Corporation (MPAC).
0.7	First Nations - savings attributable to pending and completed agreements
0.5	Hydro Ottawa Renegotiation - refer to b) and c)
0.6	Metrolinx Transmission crossings - refer to d) and e)

i. Please refer to Hydro Ottawa Renegotiation in above table.
ii. Please refer to Metrolinx Transmission Crossings in above table.

b) The agreement with Hydro Ottawa was originally signed in 1987. It was reviewed in 2019 and updated to reflect a more accurate occupation area, resulting in a reduction. This new area will be the basis to determine cost going forward and the costs will be adjusted based on the current fair market value of the lands.

c) Hydro One occupies physical space within Hydro Ottawa facilities specifically within the transmission station sites. Hydro One negotiated a one-time reduction of the rentable area. There are no other known opportunities at this time.

d) In 2020 Hydro One signed an agreement with Metrolinx for rights payments at crossings. As part of this agreement, Hydro One is required to identify all crossing points by 2023. As such, Hydro One will defer the forecasted $0.6M payment to Metrolinx for crossing rights until such a time that all crossings can be identified and validated. Payment is expected to be made in 2023.

e) Hydro One anticipates that the full payment for all Metrolinx crossings will be paid in the fiscal year of 2023 for existing crossings, in accordance with the recently negotiated Master Crossing Agreement with Metrolinx. Property Tax payments will not be impacted as these are only rights related payments.

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O - STAFF INTERROGATORY - 376

Reference:

Exhibit O-2-1, Attachment 10, Appendix 2-JC, Distribution OM&A Programs Table

Preamble:

The materiality threshold for Hydro One's distribution business is $1 million. In the updated Appendix 2-JC for distribution OM&A programs, the 2021 actuals for the following programs were materially higher than the planned amounts:

- Stations
- Lines
- Vegetation Management
- Distribution Generation Connections
- Operations
- Indigenous Relations, Communications and Stakeholder Relations, and Outsourcing Services
- General Counsel
- Regulatory Affairs
- Information Technology

Conversely, the 2021 actuals for the following programs were materially lower than the planned amounts:

- Meters, Telecom & Control
- Research, Development & Demonstration
- Operations Support

Interrogatory:

a) Please complete the table below with the requested information.

Program	Driver(s) for Underspend / Overspend in 2021	Description of How Underspend / Overspend will Impact Program Expenditures from 2022 to 2027
Stations		
Distribution Generation Connections		
Operations		
Indigenous Relations, Communications and Stakeholder Relations, and Outsourcing Services		
General Counsel		
Regulatory Affairs		
Information Technology		
Research, Development & Demonstration		
Operations Support		

Note: As there are specific questions relating to the 'Meters, Telecom & Control', 'Lines' and 'Vegetation Management' programs, they have not been included in this table to avoid duplication.

Response:

a) Please see table below with the requested information.

Program	Driver(s) for Underspend / Overspend in 2021	Description of How Underspend / Overspend will Impact Program Expenditures from 2022 to 2027
Stations	Actual spend was higher than forecast in stations OM&A programs primarily due to PCB contaminated 115kV bushing replacements that are more costly compared to typical bushing replacements at stations with lower primary voltages, land assessment and remediation projects that were more costly than expected, and an increase of mandated Environmental Compliance Approval (ECA) inspections for new stormwater drainage systems.	No material impact is expected as a result of these variances.
Distribution Generation Connections	This variance was due to an error in the 2021 forecast which inadvertently included connection impact assessment (CIA) fees.	No material impact is expected as a result of these variances.
Operations	Actual spend was higher than forecast due to Hydro One's COVID cohort schedule for operators.	No material impact is expected as a result of these variances.
Indigenous Relations, Communications and Stakeholder Relations, and Outsourcing Services	Actual spend was higher than forecast primarily due to the categorizing of costs to Communications and Stakeholder Relations which were forecasted under Customer OM&A in the filed evidence. When these actuals are removed and recategorized to Customer, the remaining variance is immaterial.	No material impact is expected as a result of these variances.
General Counsel	Actual spend was higher than forecast because regulatory litigation matters were not included in the original forecast, including the following two matters: (i) this Application; and (ii) the implementation of the Divisional Court decision regarding the deferred tax benefit (EB-2020-0194).	No material impact is expected as a result of these variances.

Program	Driver(s) for Underspend / Overspend in 2021	Description of How Underspend / Overspend will Impact Program Expenditures from 2022 to 2027
Regulatory Affairs	Actual spend was higher than forecast primarily due to higher than forecasted spending associated with Hydro One's joint rate application.	No material impact is expected as a result of these variances.
Information Technology	Actual spend was higher than forecast because, in 2021, Information Solutions repatriated ~160 staff from Inergi which resulted in higher than planned, one-time OM&A costs associated with the transition. This repatriation is expected to yield savings in future years.	No material impact is expected as a result of these variances. The 2023 Information Solutions OM&A costs already reflect the savings associated with the new support agreement with Capgemini and repatriation of Inergi resources (refer to Exhibit E-05-01, Sections 5.0 and 6.0 for further information).
Research, Development & Demonstration	Actual spend was lower than forecast due to the re-evaluation of certain expenditures in light of the significant upward demand pressures experienced in the Sustainment Lines program category.	No material impact is expected as a result of these variances.
Operations Support	Actual spend was lower than forecast primarily due a reduction in operating work and resourcing issues due to the COVID-19 pandemic.	No material impact is expected as a result of these variances.

O - STAFF INTERROGATORY - 377

Reference:

Exhibit O-2-1, Attachment 10, Appendix 2-JC, Distribution OM&A Programs Table

Preamble:

In the updated Appendix 2-JC for distribution OM&A programs, Hydro One reports a 2021 actual of $15.2 million for 'Meters, Telecom & Control'. The 2021 forecast was $17.5 million.

Interrogatory:

a) Please explain the driver(s) for the underspend for 'Meters, Telecom & Control' in 2021 and update the table below with 2021 actuals, and 2023 values reflecting the inflationary update.

	2018 Actual	2019 Actual	2020 Actual	2021 Planned	2021 Actual	2022 Planned	2023 Planned
Retail Revenue Meters	10.4	10.3	8.9	11.2		11.1	
Wholesale Revenue Meters	2.3	1.9	2.1	2.2		2.3	
Telecom, Monitoring and Control	5.0	3.3	3.9	4.1		4.1	
Total	17.7	15.5	14.9	17.5	15.2	17.5	20.8

b) What impact will the 2021 underspend have on 'Meters, Telecom & Control' expenditures from 2022 to 2027?

Response:

a) The primary driver for the underspend for 'Meters, Telecom & Control' in 2021 is in the Retail Revenue Meters category. The underspend in this driver of $2.2M is primarily due to an accounting reclassification in Q4-2021 from OM&A to Capital for the Meter Sampling Program ($0.8M) and a lower than planned volume of AMI investigations ($0.9M).

	2018 Actual	2019 Actual	2020 Actual	2021 Planned	2021 Actual	2022 Planned	2023 Planned
Retail Revenue Meters	10.4	10.3	8.9	11.2	9.0	11.1	12.8
Wholesale Revenue Meters	2.3	1.9	2.1	2.2	1.9	2.3	2.5
Telecom, Monitoring and Control	5.0	3.3	3.9	4.1	4.3	4.1	5.5
Total	17.7	15.5	14.9	17.5	15.2	17.5	20.8

b) Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

O - STAFF INTERROGATORY - 378

Reference:

Exhibit O-2-1, Attachment 10, Appendix 2-JC, Distribution OM&A Programs Table

Preamble:

In the updated Appendix 2-JC for distribution OM&A programs, Hydro One reports a 2021 actual of $159.2 million for 'Lines'. The 2021 forecast was $121.2 million.

Interrogatory:

a) Please explain the driver(s) for the increased cost for 'Lines' in 2021 and update the table below with 2021 actuals, and 2023 values reflecting the inflationary update.

	2018 Actual	2019 Actual	2020 Actual	2021 Planned	2021 Actual	2022 Planned	2023 Planned
Trouble Calls	64.4	75.4	76.4	59.3		60.4	
Underground Cable Locates	11.5	11.8	12.3	12.0		12.3	
Disconnects / Reconnects	13.8	17.6	18.7	14.6		14.8	
Line Maintenance	13.5	12.4	13.5	7.6		8.3	
PCB Equipment and Waste Storage	13.4	16.5	14.5	14.1		14.7	
Other Services	16.6	15.3	14.6	13.7		14.7	
Total	133.3	149.0	149.9	121.2	159.2	125.3	138.9

b) What impact will the 2021 overspend have on 'Lines' expenditures from 2022 to 2027?

Response:

a) The increased cost for 'Lines' in 2021 is primarily a result of increased Trouble Call volumes and increased Disconnect/Reconnect volumes.

	2018 Actual	2019 Actual	2020 Actual	2021 Planned	2021 Actual	2022 Planned	2023 Planned
Trouble Calls	64.4	75.4	76.4	59.3	80.2	60.4	67.2
Underground Cable Locates	11.5	11.8	12.3	12.0	13.4	12.3	14.1
Disconnects / Reconnects	13.8	17.6	18.7	14.6	24.7	14.8	17.2
Line Maintenance	13.5	12.4	13.5	7.6	9.6	8.3	14.0
PCB Equipment and Waste Storage	13.4	16.5	14.5	14.1	16.3	14.7	9.9
Other Services	16.6	15.3	14.6	13.7	15.0	14.7	16.4
Total	133.3	149.0	149.9	121.2	159.2	125.3	138.9

b) Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

O - STAFF INTERROGATORY - 379

Reference:

Exhibit O-2-1, Attachment 10, Appendix 2-JC, Distribution OM&A Programs Table
Exhibit I-24-E-VECC-083

Preamble:

At the first above noted reference, Hydro One provides an updated Appendix 2-JC for distribution OM&A programs.

At the second reference, Hydro One provides a breakdown of the incremental OM&A cost for the Acquired Utilities in each year from 2018 through 2022, and the fully integrated OM&A cost in 2023.

Interrogatory:

a) Please confirm that 2018 to 2022 values provided in the updated Appendix 2-JC for distribution OM&A programs do not include incremental OM&A costs for the Acquired Utilities (i.e., only 2023 and beyond include OM&A costs for the Acquired Utilities).

b) Please complete the table below by:
   i. Detailing what the actual incremental OM&A costs for the Acquired Utilities were in 2021
   ii. Reflecting any inflationary updates for the fully integrated cost in 2023 for the Acquired Utilities

   When providing 2021 actuals for the Acquired Utilities, please provide commentary for any variance(s) between planned and actual.

	Incremental OM&A						**Fully Integrated OM&A**
OM&A	**2018 Actual**	**2019 Actual**	**2020 Actual**	**2021 Planned**	**2021 Actual**	**2022 Planned**	**2023 Planned**
Norfolk	2.8	4.1	2.9	3.0		3.8	
Haldimand	3.0	2.8	3.1	5.3		6.0	
Woodstock	1.8	3.6	3.0	2.5		2.7	
Total ($M)	7.6	10.5	8.9	10.7		12.5	

Response:

a) Confirmed.

b)

	Incremental OM&A						Fully Integrated OM&A
OM&A	2018 Actual	2019 Actual	2020 Actual	2021 Planned	2021 Actual	2022 Planned	2023 Planned
Norfolk	2.8	4.1	2.9	3.0	2.3	3.8	4.0
Haldimand	3.0	2.8	3.1	5.3	3.0	6.0	6.2
Woodstock	1.8	3.6	3.0	2.5	1.8	2.7	2.7
Total ($M)	**7.6**	**10.5**	**8.9**	**10.7**	**7.0**	**12.5**	**12.8**

Overall, 2021 actuals were $3.7M lower than planned totals of $10.7M, primarily due to the completion of cycle one of the vegetation management program (Optimal Cycle Protocol) in Haldimand in early 2021.

O - STAFF INTERROGATORY - 380

Reference:

Exhibit O-2-1, Attachment 10, Appendix 2-JC, Distribution OM&A Programs Table
Exhibit I-1-E-Staff-225

Preamble:

At the first reference, Hydro One reports a 2021 actual of $147.7 million for 'Vegetation Management' in the updated Appendix 2-JC for distribution OM&A programs. The 2021 forecast was $139.6 million.

At the second reference, Hydro One provides performance actuals for the Defect Correction (OCP) program.
In the updated evidence, Hydro One has not provided any 2021 actuals for kilometres cleared and unit cost ($/km) for vegetation management.

Interrogatory:

a) Please explain the driver(s) for the increased cost for 'Vegetation Management' in 2021 and update the table below with 2021 actuals.

	2018 Actual	2019 Actual	2020 Actual	2021 Planned	2021 Actual
Defect Correction (OCP)	127.1	153.7	127.3	123.4	
Public Safety and Reliability Demand	10.9	7.2	9.2	15.2	
QA/QC	1.5	1.5	1.3	1.0	
Total	139.5	162.4	137.9	139.6	147.7

b) What impact will the 2021 overspend have on 'Vegetation Management' expenditures from 2022 to 2027?

c) Please update the table below with 2021 OCP performance actuals and the averages for the 2018 to 2021 period.

Please include a commentary on the number of kilometers that Hydro One was able to clear in 2021 as well as a discussion of the driver(s) for the unit cost ($/km) in 2021.

	2018	2019	2020	2021	Average
Kms cleared (km)	26,070	28,009	22,716		
Unit cost ($/km)	4,910	5,609	5,670		

Witness: FALTAOUS Peter

Response:

a) Please see the actuals for 2021 updated in the table below.

	2018 Actual	2019 Actual	2020 Actual	2021 Planned	2021 Actual
Defect Correction (OCP)	127.1	153.7	127.3	123.4	134.0
Public Safety and Reliability Demand & Planned	10.9	7.2	9.2	15.2	13.1
QA/QC	1.5	1.5	1.3	1.0	0.5
Total	139.5	162.4	137.9	139.6	147.7

In 2021, Hydro One completed more right of way kilometres to address areas which were effected by high defect densities and resource impacts due to pandemic response in 2020.

b) Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

c)

	2018	2019	2020	2021	Average
Kms cleared (km)	26,070	28,009	22,716	33,298	27,523
Unit cost ($/km)	4,910	5,609	5,670	4,020	5,052

A reduced unit cost in 2021 was primarily the result of reduced defect density encountered during the second cycle of OCP and improved planning and governance procedures implemented.

O - STAFF INTERROGATORY - 381

Reference:

Exhibit E-6-1, Attachment 5
Exhibit O-2-1, Attachment 11

Preamble:

At the first reference, Hydro One provides its Confidential Labour Relations Strategy Appendix which details: objectives of upcoming rounds of bargaining, specific points of focus (including compensation-related changes intended to be pursued), and views or assumptions in respect of certain negotiating approaches.

The second reference was updated to reflect 2021 actuals for Hydro One's compensation.

Interrogatory:

a) What impact(s) have recent events (e.g., cost increases for specialized labour) and inflation had on the approach and objectives outlined in Hydro One's Confidential Labour Relations Strategy?

b) If there has been an impact(s), how has this been reflected in Hydro One's compensation forecast from 2022 to 2027?

Response:

[redacted]

[redacted]

b) Hydro One's approach in its evidence update was to adjust costs due to inflation at the envelope level as further explained in Exhibit O-01-02 and Hydro One's response to Staff-357.

For 2022, there will be no inflationary impact to projected internal labour costs for represented employees given collective agreements for SUP and PWU do not expire until March 2023, and thus wage increases are already known. The increased cost pressures due to inflation will impact a range of supply categories to varying degrees (refer to section 2.2 in O-01-02) in 2022. For 2023 to 2027, Hydro One did not update its compensation table (Exhibit E-06-01-2A) in its evidence update, as the level of impact inflation will have on costs related to unionized labour are currently unknown for the test year.

[redacted]

O - STAFF INTERROGATORY - 382

Reference:

Exhibit O-2-1, Attachment 11
Exhibit I-1-E-Staff-253

Preamble:

At the first reference, Hydro One provides 2021 actuals for FTE levels and compensation.

At the second reference, Hydro One outlines the number of employees that are eligible for retirement, and the number of actual retirements for the period from 2018 to 2021. In the response, Hydro One only provided year-to-date values for 2021 based on the time it responded to the interrogatory.

In its update, Hydro One has not provided any commentary or 2021 actuals relating to retirements.

Interrogatory:

a) Please populate the table below with information on 2021 actuals for retirement eligibility and employee retirements. For purposes of this table, eligibility is defined as the ability to retire with an undiscounted pension.

	2018	2019	2020	2021
Number of Hydro One Employees Eligible for Retirement	1,011	954	899	
Number of Actual Hydro One Employee Retirements	206	167	161	

Response:

a) 2021 Retirement eligibility figures, and actual retirements are indicated in bolded text in the table below.

	2018	2019	2020	2021
Number of Hydro One Employees Eligible for Retirement	1,011	954	899	**743**
Number of Actual Hydro One Employee Retirements	206	167	161	**213**

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O - STAFF INTERROGATORY - 383

Reference:

Exhibit O-2-1, Attachment 11
Exhibit I-1-E-Staff-254

Preamble:

At the first reference, Hydro One provides 2021 actuals for total FTE levels.

At the second reference, Hydro One provides a breakdown of FTEs, based on representation.

In its update, Hydro One has not provided any commentary or 2021 actuals relating to the breakdown of FTEs based on representation.

Interrogatory:

a) Please explain why Hydro One has not reduced any of the planned FTE levels from 2022 to 2027 given that 2021 FTE actuals exceeded the 2021 planned FTE level. In the response, please address this considering Hydro One receiving direction from the OEB to reduce its compensation costs.

b) Please update the table below to include 2021 actuals, broken down by representation.

Type	**Representation**	**2019 Actual**	**2020 Actual**	**2021 Planned**	**2021 Actual**
Regular	MGT/Non-Represented	613	647	724	
	Society	1425	1449	1674	
	PWU	3534	3603	3704	
	Total Regular	5572	5699	6103	
Casual	PWU Hiring Hall	1373	1197	1329	
	CUSW	936	948	938	
	EPSCA	217	223	198	
	LIUNA	272	291	247	
	Total Casual	2798	2659	2712	
	Temporary	194	152	175	
Total		8564	8509	8990	9078

c) Please provide commentary for any variance(s) between the 2021 planned and actual FTEs for each representation.

d) In light of the update, please confirm that Hydro One has not made any revisions to its staffing composition for each representation, as detailed in Exhibit E / Tab 6 / Schedule 1 / p. 18 / Table 1, for the 2022 to 2027 period. If there are revisions, please update Table 1 accordingly and provide reasoning for the revisions.

Response:

a) As per the 2021 Actual figures reported in part b) below, overall Hydro One's FTEs were within 1% of the forecast. The actual regular and temporary FTEs were aligned with the forecast, while the casual FTEs exceeded planned levels by approximately 200. As per Hydro One's pre-filed evidence at Exhibit E-06-01, Section 2.2, casual employees are contingent workers hired to perform specific work for a set period of time and then are laid off. Any increase in the use of casual employees in 2021 does not impact the planned FTE levels or compensation costs for subsequent years, as the level of casual FTEs required is based on the work that Hydro One plans to execute each year, and the approach that Hydro One will use to execute its work.

b)

Type	**Representation**	**2019**	**2020**	**2021**	**2021**
		Actual	**Actual**	**Planned**	**Actual**
Regular	MGT/Non-Represented	613	647	724	**699**
	Society	1425	1449	1674	**1611**
	PWU	3534	3603	3704	**3694**
	Total Regular	5572	5699	6103	**6004**
Casual	PWU Hiring Hall	1373	1197	1329	**1267**
	CUSW	936	948	938	**1076**
	EPSCA	217	223	198	**237**
	LIUNA	272	291	247	**331**
	Total Casual	2798	2659	2712	**2911**
	Temporary	194	152	175	**163**
Total		8564	8509	8990	**9078**

c) For all Regular FTE categories, no material variances were observed. For Casual Trades FTEs, Hydro One's actual FTE levels were approximately 200 FTEs higher than planned levels. This variance reflects the additional Tx capital work performed in 2021. The majority of Hydro One's casual trades resources are used in the execution of transmission capital projects and

programs. Please refer to the response to O-SEC-263 Attachment 1 for the 2021 Transmission Capital Performance Report for transmission capital specific variances.

d) Hydro One did not provide FTE revisions for year 2022 in its update. Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-O1-02 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

For years 2023 to 2027 Hydro One's FTE plans have not been revised.

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O - STAFF INTERROGATORY - 384

Reference:

Exhibit O-1-1, Page 3
Exhibit O-1-4, Attachment 1 and Attachment 2

Preamble:

Hydro One stated in the updated evidence that:

> Hydro One recognizes that our customers and all Ontarians will also be experiencing once-in-a generation inflationary pressures. As a result, Hydro One is proposing to defer the Transmission and Distribution revenue requirement increases arising from the higher assumed inflation to the next rate period. The incremental revenue requirements associated with this inflation update will be recorded in deferral accounts for recovery commencing in 2028. As a result, there will be no material changes to the proposed transmission or distribution rates for the 2023 to 2027 rate period due to the proposed changes in inflation assumptions.

Hydro One provided the draft accounting orders for the newly requested Transmission Approved Revenue Requirement Deferral Account and Distribution Approved Revenue Requirement Deferral Account.

Interrogatory:

a) Please explain the consideration of the intergenerational inequity impacts of using this deferral approach.

b) Please provide any OEB precedent that Hydro One is aware of where a deferral account for a similar purpose was approved (please provide the EB# and the reference to the relevant decisions and orders).

Response:

a) Hydro One has proposed to commence recovery of the deferred amounts in 2028. In developing its proposal, Hydro One considered the impacts of the deferred recovery mechanism on intergenerational equity. Hydro One considered that, while the proposal would shift certain costs associated with the 2023-2027 rate period to customers starting in 2028, on balance given current economic conditions, the benefits of mitigating rates over the

test period outweigh the intergenerational equity concerns in relation to future ratepayers. In this respect, Hydro One shares the following considerations:

- As the proposed deferral of 2023-2027 revenue requirement is for a 5-year period, the customers that would bear the cost of the deferred amounts in future will largely be the same as today's customers. Those customers will benefit from these costs being deferred from a period during which they are faced with inflationary increases affecting many other costs that cannot be deferred; and
- As the amounts to be deferred will be specific and finite, the deferrals will not expose future generations of customers to the uncertainty of potentially escalating costs.

b) The proposed deferred recovery mechanism is not dissimilar to the approach and mechanics associated with OPG's Rate Smoothing Deferral Account (EB-2016-0152). Under that account, portions of OPG's approved revenue requirement associated with the costs of refurbishing the Darlington Nuclear Generating Station are deferred for rate smoothing purposes, with the deferred amounts recorded in the account for future recovery.

O - STAFF INTERROGATORY - 385

Reference:

Exhibit O-1-1, Page 3

Preamble:

Hydro One stated in the updated evidence that:

> Based on actual Ontario CPI of 3.5% for 2021 and forecast Ontario CPI of 4.5% and 3.3% for 2022 and 2023 provided by Scotiabank Capital (Scotia), Hydro One has increased its capital expenditures for transmission by $381.0M for a total of $7,639.4M and for distribution by $278.0M for a total of $5,574.5M over the 2023–2027 period. OM&A for 2023 has increased for 2023 by $22.1M for transmission and by $31.4M for distribution.

Interrogatory:

a) Please confirm that Hydro One did not specifically address the impact of the inflation increase on the pension and OPEB expense in the updated evidence.

b) Please confirm that the inflation increase may also impact the interest rate that is the main factor in determining the deferred benefit pension liability and OPEB liability for both transmission and distribution.

c) If a) and b) are confirmed, please clarify how Hydro One will address the impact of the interest rate on the pension and OPEB liabilities.

Response:

a) Confirmed. As described in Exhibit O-01-02 of the evidence update, Hydro One's initial 2.0% inflationary assumption was applied to all costs in the investment plans. Hydro One took a similar approach to update for the revised inflation rate assumptions based on the inflation update methodology described in section 2.3 of Exhibit O-01-02 and further detailed in response to O-Staff-357, part a). The Pension and OPEB expenses did not specifically reflect the inflation increase as part of the evidence update, as the inflation update was applied to the overall portfolio of capital and OM&A and was not specifically applied, or excluded from, specific costs or items.

b) The discount rate used for the purpose of the benefit cost projections for both pension and OPEB is developed based on long-term corporate AA bond yields with a duration similar to that of the plan liabilities. Many factors can affect corporate AA bond yield fluctuations over time, and it is possible that yields could trend upwards during a period of high short-term inflation. The impact of a higher discount rate would result in lower pension and OPEB plan liabilities.

c) Hydro One is currently working with Willis Towers Watson to complete a pension valuation as of December 31, 2021, which must be filed by September 30, 2022 with the Financial Services Regulatory Authority of Ontario (FSRA). At this point, Hydro One's application includes the most up-to-date Pension and OPEB forecasts available. With respect to Pension contributions, ratepayers are protected as a result of the established Pension Cost Differential Variance Account for pension contributions attributed to OM&A for both Transmission and Distribution.

Furthermore, Hydro One's proposed Custom IR Framework includes protection mechanisms for ratepayers such as the Earning Sharing Mechanism (ESM) and the Capital In-Service Variance Account (CISVA).

O - STAFF INTERROGATORY - 386

Reference:

Exhibit O-1-5, Page 2

Preamble:

Hydro One updated the balance in the External Station Maintenance, E&CS and Other External Revenues variance account by including a life-to-date adjustment of ($27.2) million. As part of this evidence update, Hydro One proposes to return $27.5M to customers as part of the 2023 Rates Revenue Requirement over a one-year period to be implemented at the time of the Draft Rate Order stage (DRO).

The total Transmission regulatory account balances requested for disposition in this Application have been updated from a debit balance of $5.6M to a credit balance of $21.9M and will be reflected in the updated Uniform Transmission Rates at the time of the DRO.

Hydro One states in Footnote 3 that the other regulatory accounts requested for disposition remain over a five-year period as originally proposed.

Interrogatory:

a) Please provide Hydro One's position on the notion of disposing all regulatory accounts over a one-year period.

Response:

a) Hydro One is not opposed to disposing of all Transmission regulatory accounts over a one-year period given the materiality of the balance. However, with respect to the disposition of Distribution regulatory accounts, Hydro One believes that the 5-year disposition period of these account balances over the rate term continues to remain appropriate as originally proposed based on the reasons provided in interrogatory response to G-VECC-094 part a).[1]

[1] Interrogatory response to G-VECC-094 filed on November 29, 2021

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O - STAFF INTERROGATORY - 387

Reference:

Exhibit O-1-1, Pages 5 and 6

Preamble:

The above reference documents Hydro One's proposal to record the deferred incremental revenue requirement associated with each of: 1) inflationary increases; and 2) load forecast changes due to increased CDM impacts per the IESO's December 2021 APO, in deferral accounts for recovery beginning in 2028. For each of Tx and Dx, Hydro One proposes separate sub-accounts for tracking the deferred incremental revenue requirement for each of inflationary impacts and load forecast impacts.

Interrogatory:

a) Please state whether or not the balances in these accounts (and sub-accounts) will attract carrying charges. If so, please explain what interest rate Hydro One proposes for the balances of these deferral accounts.

Response:

a) Please refer to the response to O-VECC-166.

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O - STAFF INTERROGATORY - 388

Reference:

Exhibit O-1-2, Pages 18 and 19
Exhibit E-9-4, Pages 1 to 8
Exhibit D-1-1, Attachments 1 to 10
Chapter 2 Filing Requirements for 2022 Rate Applications, June 24, 2021, Page 38

Preamble:

Hydro One included property taxes and rights payments as part of OM&A, and is adjusting the property taxes and rights payments in 2023 for the inflation update.

In Exhibit E, it states that for both Transmission and Distribution, the forecast property tax expenses and rights payments reflect higher tax rates, increases in the assessed value of Hydro One properties, and increasing land value. Regarding right payments, it states that Hydro One anticipates increased costs as negotiations with government bodies and railway companies and reviews within the individual agreements are triggered, mainly due to increases in land values.

Furthermore, the Chapter 2 Filing Requirements indicate that property taxes is not an OM&A account and should be excluded from OM&A totals.

Interrogatory:

a) Please explain why Hydro One has proposed to include property taxes and right payments in OM&A and not including it as a separate line item as seen in the Revenue Requirement Workform in Exhibit D.

b) Please provide a discussion on why both property taxes and right payments are proposed to be adjusted by inflation, in consideration of the factors that drive changes in property taxes and right payments as noted above. Please discuss if other methodologies of determining property and right payments from 2024 to 2027 were considered.

Response:

a) Hydro One has included property taxes as part of its OM&A amounts in prior applications and the approach has been approved by the OEB consistently. In the most recent Distribution Application (EB-2017-0049) and the most recent Transmission Application (EB-2019-0082), the OEB approved a Custom IR proposal where the OM&A (inclusive of property taxes) was

established in the first test year of each of the two applications and then escalated by Inflation less Productivity in years 2-5 for Distribution and years 2-3 for Transmission.

b) Municipalities review tax payments annually, and property tax rates are defined in line with inflation. As costs go up due to inflation, municipalities may require more money to fund their operations which will translate to property tax rate increases - which is one of the levers available to the municipalities. As for rights payments, it is adjusted based on the latest appraisal that determines the updated fair market value of the lands.

O - STAFF INTERROGATORY - 389

Reference:

Exhibit O-1-2, Attachment 8
Exhibit E-8-1, Attachment 2

Preamble:

For Transmission and Distribution depreciation expense for 2023 to 2027, capitalized depreciation did not change from the as-filed amounts while asset removal costs increased from the as-filed amounts.

Interrogatory:

a) Please explain why capitalized depreciation did not increase even though depreciation on fixed assets increased.

b) Please explain why asset removal costs increased and how the increase relates to the update in capital.

Response:

a) As outlined in Exhibit O-01-02, the Inflation Update was incorporated to reflect the updated inflationary pressures on OM&A and Capital expenditures. The change in capitalized depreciation was not material and therefore was not reflected as part of the Inflation Update.

b) Removal costs reflect costs for work associated with the removal of assets from service; these costs are not capitalized and are estimated based on the level of effort required to remove these assets. As the overall costs to remove the assets from service increase due to inflationary pressures, the associated removal costs also increased.

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O - STAFF INTERROGATORY - 390

Reference:

Exhibit O-1-4, Attachments 1 and 2
Exhibit A-4-2, Pages 2 to 4

Preamble:

In the draft accounting orders for the Transmission and Distribution Account 1508, Sub-account Approved Revenue Requirement Deferral Account, the sub-account for Inflation Updates is proposed to record the incremental approved revenue requirement equal to the difference between the as-filed base revenue requirement and approved base revenue requirement arising from the inflation update for the 2023-2027 rate application term. The sub-account for Load Shortfalls is proposed to record the portion of approved rates revenue requirement equal to the revenue deficiency attributed to the change in forecast billing determinants for the 2023-2027 rate application term.

For Transmission and Distribution, the offsetting entries to the sub-accounts for Approved Revenue Requirement and Load Shortfalls is to Transmission Services Revenues or Distribution Services Revenues. As indicated in the footnotes of the draft accounting orders, the offsetting accounts remain under review and if an update is required, Hydro One will update the draft accounting order at the draft rate order stage.

Interrogatory:

a) For the Load Shortfalls sub-accounts, please confirm that the change in forecast billing determinants referred to is the change between the as-filed billing determinants and the billing determinants as approved in the draft order process. If not confirmed, please explain. If confirmed, please revise the draft accounting order to reflect this during the draft rate order stage.

b) With regards to the offsetting accounts for the Approved Revenue Requirement and Load Shortfalls sub-accounts, please indicate which other accounts are being considered and provide supporting rationale on why the Transmission/Distribution Services Revenues account is currently proposed.

c) Per Exhibit A, the inflation factor will be updated annually over the 2024 to 2027 period. The X factor will not be updated annually. The C factor will be updated annually to reflect any changes in inflation.

i. Please confirm that after the revenue requirements are approved in the draft rate order stage, the amounts to be recorded in the Transmission and Distribution Inflation Updates and Load Shortfalls sub-accounts are known and will not change. If not confirmed, please explain.

ii. Please explain and provide an example to show the correlation between the as filed revenue requirement, approved revenue requirement in the draft rate order process, the annually updated revenue requirements in 2024 to 2027 and the amounts recorded in the Inflation Updates and Load Shortfalls sub-accounts.

Response:

a) Confirmed.

b) Hydro One continues to assess the correct offset, which may be within revenue or operating expenses, to ensure compliance with US GAAP accounting standards. While there is no requirement for financial accounting to be fully aligned with rate regulated accounting for rate applications purposes, there is a preference for alignment for regulatory efficiency. As indicated in the footnotes of the draft accounting orders, the offsetting accounts remain under review and if an update is required, Hydro One will update the draft accounting order at the draft rate order stage.

c)

i. Confirmed.

ii. The tables below show the correlation between the as-filed transmission and distribution revenue requirements and the amounts recorded in the Inflation Updates and Load Shortfalls sub-accounts.

The tables also provide an illustrative example, for 2024, to show how the change in the RCI factor (resulting from an updated inflation factor) will impact the rates revenue requirement at the annual update stage. The revenue offsets and the amounts to be recorded in the sub-accounts for Inflation Update and Load Shortfalls will be approved by the OEB during the 2023 Draft Rate Order process and will not change during the annual updates. As a result, any change in the RCI factor will flow through to the rates revenue requirement.

	Transmission	**As Filed (2024)**	**Evidence Update (2024)**	**Illustrative 2024 Annual Update (with 0.5% increase in RCI factor)****
(A)	**Total Revenue Requirement ($M)**	1,937.8	1,968.2	1,977.5
(B)	Offsets (*non-rate revenues, export revenues, disposition of regulatory accounts and low voltage switchgear credit)* ($M)	-54.7	-54.7	-54.7
(C = A + B)	**Rates Revenue Requirement Before Deferrals ($M)**	1,883.1	1,913.5	1,922.7
(D)	Proposed Revenue Requirement in Inflation Update Sub-Account (Exhibit O-01-04, Table 1) ($M)		30.4	30.4
(E = C - D)	**Rates Revenue Requirement less Inflation Update Sub-Account* ($M)**		1,883.1	1,892.3
(F)	Proposed Revenue Requirement in Load Shortfalls Sub-Account (Exhibit O-01-04, Table 3) ($M)		10.9	10.9
(G=E - F)	**Rates Revenue Requirement less both sub-accounts ($M)**		1,872.2	1,881.4

** The Rates Revenue Requirement in the March 31 evidence update less Inflation Update Sub-Account is equal to the as-filed Rates Revenue Requirement*

*** Illustrative annual update revenue requirement for 2024 is derived by applying an RCI factor of 6.93% (2024 distribution RCI factor of 6.43% as noted in Exhibit O-01-02, Table 27 is increased by 0.5%) to the 2023 total revenue requirement ($1,849.3 million).*

	Distribution	As Filed (2024)	Evidence Update (2024)	Illustrative 2024 Annual Update (with 0.5% increase in RCI factor)**
(A)	**Total Revenue Requirement ($M)**	1,711.3	1,753.3	1,761.7
(B)	Offsets (External Revenues) ($M)	-46.5	-46.5	-46.5
(C = A + B)	**Rates Revenue Requirement Before Deferrals ($M)**	1,664.8	1,706.9	1,715.2
(D)	Proposed Revenue Requirement in Inflation Update Sub-Account (Exhibit O-01-04, Table 2) ($M)		42.0	42.0
(E = C - D)	**Rates Revenue Requirement less Inflation Update Sub-Account* ($M)**		1,664.8	1,673.2
(F)	Proposed Revenue Requirement in Load Shortfalls Sub-Account (Exhibit O-01-04, Table 4) ($M)		7.3	7.3
(G=E - F)	**Rates Revenue Requirement less both sub-accounts ($M)**		1,657.5	1,665.9

**The Rates Revenue Requirement in the March 31 evidence update less Inflation Update Sub-Account is equal to the as-filed Rates Revenue Requirement*

*** Illustrative annual update revenue requirement for 2024 is derived by applying an RCI factor of 5.55% (2024 distribution RCI factor of 5.05% as noted in Exhibit O-01-02, Table 29 is increased by 0.5%) to the 2023 total revenue requirement ($1,669.1 million).*

O - STAFF INTERROGATORY - 391

Reference:

Exhibit O-1-1, Page 5
Exhibit A-1-3, Table 1
Exhibit A-1-4, Table 1

Preamble:

At the first reference, Hydro One states:

> The transmission revenue deficiency attributed to the change in transmission load forecast totals $122.8M over the 2023 to 2027 period. The distribution revenue deficiency attributed to the change in distribution load forecast totals $52.9M over the 2023 to 2027 period.

From the above estimates, OEB staff calculate that the average annual incremental revenue deficiency for the change in the Tx load forecast is $24.56M (= $122.8M/5 years). Similarly, the average annual incremental revenue deficiency for the change in the Dx load forecast is $10.58M (= $52.9M/5 years).

From Hydro One's proposed Tx and Dx Custom IR plans at the second and third references respectively, OEB staff calculates an average annual Tx revenue requirement of $2,029.6M and an average annual Dx revenue requirement of $1,795.0M.

Based on this, the average annual incremental Tx revenue deficiency is an increase of about 1.2% (= 24.56M/$2,029.6M) from the original proposed. Similarly, the average annual incremental Dx revenue requirement is 0.6% (=$10.58M/$1,795.0M).

Interrogatory:

a) Please confirm OEB staff's calculations above based on the original filed evidence and the updated evidence cited in the references, or provide any necessary corrections.

b) Please explain why Hydro One believes that the incremental revenue requirement updates should be deferred for collection, given the magnitude of the revenue requirement impacts, instead of being incorporated into the annual revenue requirement for each year of the 2023-2027 plan.

Response:

a) Hydro One confirms the calculations provided by OEB Staff.
With respect to references provided in the interrogatory, Hydro One would like to clarify that Exhibit A-01-03, Table 1 should state A-04-02, Table 3 and Exhibit A-01-04, Table 1 should state A-04-03, Table 3.

b) Recognizing that the evidentiary updates for both higher inflation and changing load forecasts result in incremental revenue requirements at a time when customers are facing unique economic uncertainties brought upon by global events, Hydro One believes that it is appropriate to defer collection of the incremental revenue requirement until 2028.

In light of the intergenerational inequity considerations discussed in response to O-Staff-384, this proposal was considered on an overall basis and reflects a customer-centric approach that preserves Hydro One's ability to deliver on its commitments to customers without impacting the proposed transmission and distribution rates over the 2023 to 2027 period in a material way. As previously stated in Exhibit O-01-01, Hydro One believes strongly in keeping its commitment to customers to complete the proposed investment plans against a backdrop of inflationary pressures. This proposed mechanism ensures that customers are not burdened by the inflationary pressures and changing load forecasts affecting the cost of investments that will benefit current and future generations.

O - STAFF INTERROGATORY - 392

Reference:

Exhibit O-1-3, Page 2 of 16
Exhibit L-6-1, Pages 3-5 of 20

Preamble:

Hydro One proposes to maintain as-filed customer rate impacts by deferring impacts of the deficiency associated with changes in the transmission and distribution load forecasts.

The as-filed rate impacts in 2023 reflect total bill reductions for all Hydro One Legacy customers except Seasonal customers transitioning into R2.

Interrogatory:

a) Please provide the 2023 transmission and distribution rates that would result calculating rates based on the updated forecasts. That is, without deferral of the associated deficiency impacts into a future period. In doing so, please consider the most appropriate way to apply any mitigation strategies Hydro One has already proposed in the initial evidence.

b) Please provide the bill impacts that would result from implementing the rates calculated in part (a) above in 2023.

c) Please explain the need for the additional rate mitigation measure.

d) Please provide references to any policy instruments which support Hydro One's proposal.

Response:

a) **Transmission:** Table 1 below shows the forecasted UTRs for 2023. The forecast UTRs are calculated using Hydro One's as-filed revenue requirement and the updated charge determinants. The proposed $27.5M credit for the External Revenues Variance Account, outlined in Exhibit O-01-05 is included. The values for other transmitters are as per the UTR Order under Proceeding EB-2022-0084, filed April 7, 2022.

Table 1: Forecast of Uniform Transmission Rates with Updated Load Forecast

Year	Network ($/kW)	Line Connection ($/kW)	Transformation Connection ($/kW)
2023	5.05	0.83	2.81

Distribution: Tables 2 and 3 below provide the 2023 distribution rates reflecting the updated load forecast and as-filed rates revenue requirement. A detailed rate design sheet is provided as Attachment 1 to this response.

Table 2: 2023 Distribution Rates with Updated Load Forecast (Excluding ST)

Rate Class	2023		
	Service Charge ($/month)	Volumetric Charge ($/kWh)	Volumetric Charge ($/kW)
UR	36.04		
R1	57.43	0.0053	
R2	116.98	0.0081	
GSe	30.71	0.0653	
UGe	23.91	0.0314	
GSd	98.70		18.3824
UGd	90.24		10.6086
St Lgt	2.94	0.1069	
Sen Lgt	2.65	0.1474	
USL	33.67	0.0213	
DGen	187.67		10.4816
AUR	29.76		
AUGe	25.71	0.0148	
AUGd	155.88		2.4025
AR	36.13		
AGSe	37.86	0.0173	
AGSd	182.64		4.1518

Table 3: 2023 Distribution Rates with Updated Load Forecast - ST Rate class

Charge Description	Unit	2023
Service Charge	$	770.88
Meter Charge	$	398.1
ST Common Line	$/kW	1.4624
HVDS-high	$/kW	2.8204
HVDS-low	$/kW	4.7211
LVDS-low	$/kW	1.9007
Specific ST lines	$/kM	599.6911

b) The response below provides the transmission and distribution bill impacts that result from reflecting the updated load forecast in rates. Note that Hydro One has updated the 2022 rates used in the starting point for the bill impact calculations to reflect final amounts approved by the OEB.

Transmission:

The average bill impacts for 2023 through 2027 are shown in response to Interrogatory O-VECC-163.

The total 2023 bill impact for a typical Hydro One medium density residential (R1) customer is provided in Table 4 below.

Table 4: Typical Medium Density (R1) Residential Customer Bill Impacts

	Typical R1 Residential Customer		
	400 kWh	**750 kWh**	**1,800 kWh**
Total Bill as of Jan 1, 2022[1]	$86.17	$130.55	$263.67
RTSR included in 2022 R1 Customer's Bill (Based on July 1, 2021 UTR)	$7.70	$14.45	$34.67
Estimated 2022 Monthly RTSR[2]	$8.14	$15.26	$36.63
2022 change in Monthly Bill	**$0.43**	**$0.82**	**$1.96**
2022 change as a % of total bill	*0.5%*	*0.6%*	*0.7%*
Estimated 2023 Monthly RTSR[3]	$7.88	$14.77	$35.44
2023 change in Monthly Bill	**($0.26)**	**($0.49)**	**($1.19)**
2023 change as a % of total bill	*-0.3%*	*-0.4%*	*-0.4%*

[1] Total bill including HST, based on time-of-use commodity prices effective May 1, 2021 and distribution rates effective January 1, 2022 approved per Distribution Rate Order EB-2021-0032, dated December 14, 2021(includes impacts of all components of the Fair Hydro Plan).

[2] The estimated 2022 Monthly RTSRs reflect Hydro One's 2022 TX Rates Revenue Requirement as included in 2022 Uniform Transmission Rate Schedules issued December 16, 2021 (EB-2021-0276).

[3] The impact on RTSR is assumed to be the net impact on average transmission rates, adjusted for Hydro One's total revenue disbursement allocator per 2022 UTR Order (EB-2022-0082 dated April 7, 2022)

The total 2023 bill impact for a typical Hydro One General Service Energy less than 50 kW (GSe) are provided in Table 5 below.

Table 5: Typical General Service Energy less than 50 kW (GSe < 50 kW) Customer Bill Impacts

	GSe Customer Monthly Bill		
	1,000 kWh	**2,000 kWh**	**15,000 kWh**
Total Bill as of Jan 1, 2022[1]	$225.11	$416.29	$2,901.63
RTSR included in 2022 GSe Customer's Bill (Based on July 1, 2021 UTR)	$15.34	$30.69	$230.16
Estimated 2022 Monthly RTSR[2]	$16.21	$32.42	$243.16
2022 change in Monthly Bill	**$0.87**	**$1.73**	**$13.00**
2022 change as a % of total bill	*0.4%*	*0.4%*	*0.4%*
Estimated 2023 Monthly RTSR[3]	$15.68	$31.37	$235.27
2023 change in Monthly Bill	**($0.53)**	**($1.05)**	**($7.88)**
2023 change as a % of total bill	*-0.2%*	*-0.3%*	*-0.3%*

[1]Total bill including HST, based on time-of-use commodity prices effective May 1, 2021 and distribution rates effective January 1, 2022 approved per Distribution Rate Order EB-2021-0032, dated December 14, 2021(includes impacts of all components of the Fair Hydro Plan).

[2]The estimated 2022 Monthly RTSRs reflect Hydro One's 2022 TX Rates Revenue Requirement as included in 2022 Uniform Transmission Rate Schedules issued December 16, 2021 (EB-2021-0276).

[3]The impact on RTSR is assumed to be the net impact on average transmission rates, adjusted for Hydro One's total revenue disbursement allocator per 2022 UTR Order (EB-2022-0082 dated April 7, 2022)

Distribution:

Table 6 below provides the 2023 bill impacts using distribution rates provided in response to part a). For any rate class where the total bill impacts at typical consumption level is over 10%, the same mitigation measures as described in Exhibit L, Tab 6, Schedule 1, page 17, will be applied.

Table 6: 2023 Bill Impacts with Rates Provided in Tables 2 and 3

Rate Class	Consumption Level	Monthly Consumption (kWh)	Monthly Peak (kW)	Change in DX Bill ($)*	Change in DX Bill (%)*	Change in Total Bill ($)*	Change in Total Bill (%)*
UR	Low	340		($2.24)	-5.8%	($2.24)	-2.8%
	Typical	750		($2.40)	-6.2%	($2.56)	-1.9%
	Average	690		($2.38)	-6.1%	($2.51)	-2.0%
	High	1,260		($2.60)	-6.7%	($2.95)	-1.5%
R1 (with DRP)	Low	370		($0.29)	-0.8%	($0.38)	-0.5%
	Typical	750		($0.44)	-1.2%	($0.64)	-0.5%
	Average	784		($0.45)	-1.2%	($0.66)	-0.5%
	High	1,650		($0.80)	-2.2%	($1.25)	-0.5%
R1 (without DRP)	Low	370		($0.78)	-1.3%	($0.84)	-0.8%
	Typical	750		($2.72)	-4.2%	($2.78)	-1.8%
	Average	784		($2.89)	-4.4%	($2.96)	-1.8%
	High	1,650		($7.31)	-9.9%	($7.38)	-2.6%
R2 (with DRP)	Low	440		($0.47)	-1.3%	($0.71)	-0.8%
	Typical	750		($0.59)	-1.6%	($1.02)	-0.8%
	Average	978		($0.68)	-1.8%	($1.25)	-0.8%
	High	2,110		($1.13)	-3.1%	($2.38)	-0.8%
R2 (without DRP)	Low	440		($15.91)	-20.0%	($15.25)	-11.5%
	Typical	750		($18.49)	-21.9%	($17.86)	-10.1%
	Average	978		($20.38)	-23.1%	($19.79)	-9.4%
	High	2,110		($29.77)	-28.0%	($29.33)	-7.9%
Seasonal-UR	Low	40		($24.72)	-40.2%	($23.30)	-36.6%
	Average	369		($35.08)	-48.9%	($33.39)	-29.0%
	High	1,040		($56.22)	-60.7%	($53.95)	-24.6%
Seasonal-R1	Low	40		($2.54)	-4.1%	($2.39)	-3.8%
	Average	369		($11.16)	-15.6%	($10.53)	-9.2%
	High	1,040		($28.74)	-31.0%	($27.12)	-12.4%
Seasonal-R2	Low	40		$59.53	96.9%	$56.10	88.1%
	Average	369		$51.84	72.3%	$49.47	43.0%
	High	1,040		$36.13	39.0%	$35.96	16.4%
GSe	Low	60		($3.62)	-9.2%	($3.41)	-7.5%
	Typical	2,000		($9.83)	-5.6%	($9.25)	-2.2%
	Average	1,887		($9.47)	-5.6%	($8.91)	-2.3%
	High	5,570		($21.25)	-5.0%	($20.00)	-1.8%
UGe	Low	180		($3.28)	-9.7%	($3.03)	-5.6%
	Typical	2,000		($5.83)	-6.2%	($4.88)	-1.5%
	Average	2,494		($6.52)	-5.9%	($5.39)	-1.3%
	High	6,930		($12.73)	-4.9%	($9.89)	-0.9%
GSd	Low	9,310	55	($73.10)	-6.0%	($71.76)	-2.4%
	Average	34,334	110	($142.32)	-6.1%	($139.14)	-1.7%
	High	75,790	250	($302.96)	-5.9%	($293.05)	-1.6%

Rate Class	Consumption Level	Monthly Consumption (kWh)	Monthly Peak (kW)	Change in DX Bill ($)*	Change in DX Bill (%)*	Change in Total Bill ($)*	Change in Total Bill (%)*
UGd	**Low**	13,900	55	($54.87)	-7.4%	($48.73)	-1.5%
	Average	42,592	111	($106.20)	-7.6%	($93.23)	-1.1%
	High	97,610	280	($239.02)	-7.1%	($202.54)	-1.0%
St Lgt	**Low**	30		($0.96)	-13.1%	($0.92)	-8.7%
	Average	1,274		($8.92)	-5.8%	($8.92)	-3.0%
	High	2,310		($15.55)	-5.7%	($15.59)	-2.8%
Sen Lgt	**Low**	20		($1.04)	-15.0%	($0.99)	-10.9%
	Average	49		($1.79)	-14.6%	($1.71)	-9.8%
	High	80		($2.59)	-14.5%	($2.48)	-9.4%
USL	**Low**	100		($6.73)	-15.5%	($6.33)	-12.0%
	Average	477		($8.92)	-16.6%	($8.39)	-7.9%
	High	550		($9.34)	-16.8%	($8.79)	-7.5%
DGen	**Low**	10	0.03	($11.68)	-5.8%	($13.19)	-5.8%
	Average	1,709	12	($19.01)	-5.7%	($18.62)	-2.8%
	High	8,490	45	($40.70)	-5.8%	($35.23)	-1.6%
ST	**Low**	88,780	500	($461.14)	-20.4%	($457.13)	-2.3%
	Average	1,373,443	2,808	($2,197.28)	-35.9%	($2,123.74)	-0.9%
	High	2,641,420	13,730	($7,045.18)	-28.9%	($6,204.77)	-1.2%
Former Woodstock Hydro Customers to Hydro One Rate Classes							
AUR	**Low**	310		$5.57	23.1%	$6.88	11.4%
	Typical	750		$5.35	22.0%	$9.00	8.0%
	Average	636		$5.40	22.3%	$8.45	8.5%
	High	1,160		$5.14	21.1%	$10.97	6.8%
AUGe	**Low**	190		($3.86)	-11.7%	($3.27)	-6.0%
	Typical	2,000		$5.91	10.6%	$9.46	3.3%
	Average	2,471		$8.45	13.7%	$12.78	3.6%
	High	7,240		$34.21	28.1%	$46.32	4.8%
AUGd	**Low**	9,370	50	$35.65	13.3%	$8.32	0.4%
	Average	47,636	134	$63.97	13.5%	($44.99)	-0.5%
	High	137,890	340	$135.93	13.9%	($167.83)	-0.7%
St Lgt	**Average**	37,079	104	$1,061.28	36.7%	$1,423.41	15.9%
USL	**Average**	1,349		$40.73	193.9%	$44.71	24.5%
ST	**Average**	895,853	3,301	($2,559.70)	-27.9%	$5,353.72	3.4%
Former Norfolk Power Customers to Hydro One Rate Classes							
AR	**Low**	290		($3.29)	-8.4%	($0.73)	-1.0%
	Typical	750		($4.03)	-10.1%	$2.33	1.8%
	Average	692		($3.94)	-9.8%	$1.94	1.6%
	High	1,230		($4.80)	-11.8%	$5.52	3.0%
AGSe	**Low**	110		($15.32)	-27.4%	($13.80)	-20.8%
	Typical	2,000		($16.45)	-15.8%	($4.39)	-1.3%
	Average	2,377		($16.68)	-14.7%	($2.51)	-0.7%

Rate Class	Consumption Level	Monthly Consumption (kWh)	Monthly Peak (kW)	Change in DX Bill ($)*	Change in DX Bill (%)*	Change in Total Bill ($)*	Change in Total Bill (%)*
	High	6,410		($19.10)	-8.8%	$17.58	1.8%
AGSd	**Low**	13,020	55	($107.01)	-20.4%	($73.95)	-2.7%
	Average	70,294	181	($191.97)	-17.0%	($37.20)	-0.3%
	High	129,420	300	($275.73)	-16.2%	($1.86)	0.0%
St Lgt	**Average**	11,389	39	$207.78	20.7%	$245.15	10.2%
Sen Lgt	**Average**	108	0.3	$4.51	32.3%	$4.74	18.7%
USL	**Average**	904		$26.42	102.8%	$30.25	23.6%
Former Haldimand County Hydro Customers to Hydro One Rate Classes							
AR	**Low**	250		($0.60)	-1.6%	$0.79	1.2%
	Typical	750		($1.10)	-3.0%	$3.04	2.4%
	Average	742		($1.09)	-2.9%	$3.01	2.4%
	High	1,410		($1.76)	-4.7%	$6.01	2.9%
AGSe	**Low**	90		$9.41	31.4%	$9.09	22.9%
	Typical	2,000		$3.87	5.7%	$8.91	2.9%
	Average	2,261		$3.11	4.3%	$8.89	2.6%
	High	5,430		($6.08)	-4.5%	$8.59	1.1%
AGSd	**Low**	10,880	55	$84.81	27.0%	$67.45	3.0%
	Average	57,529	175	$46.22	5.7%	($43.83)	-0.4%
	High	135,160	375	($18.02)	-1.1%	($229.16)	-1.0%
St Lgt	**Average**	31,001	85	($2,082.39)	-38.7%	($2,206.40)	-20.3%
Sen Lgt	**Average**	61	0.2	($10.74)	-48.0%	($9.99)	-35.5%
USL	**Average**	471		$22.06	102.8%	$21.95	29.6%

* In the pre-filed evidence, 2023 bill impacts were calculated using estimated 2022 distribution rates and RTSRs. In this update 2022 distribution rates and RTSRs have been updated to reflect the OEB's Decisions in EB-2021-0032 and EB-2021-0033.

c) While rates will decrease in 2023, customers will see an average increase in their bills over the entirety of the test period. As noted on page 1 of Exhibit O-01-04, the proposed revenue deferral will ensure that customers are not impacted by the inflation update and load forecast update over the test period.

d) Please see response to Interrogatory O-Staff-384, part b).

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2023 Rate Design Including 7th Year of Residential Phase-in to All-Fixed Rates for R1 and R2 Rate Classes

Total 2023 Revenue Requirement per Inflation Update (RR1) **$ 1,669,057,975**
Total 2023 Revenue Requirement as filed on August 5, 2021 (RR2) **$ 1,632,376,473**

Rate Class	Number of Customers	GWh	kWs	Revenue	Alloc Cost		Misc Rev	Revenue from Rates	2022 R/C Ratio	R/C Ratio from the CAM	Target 2023 R/C Ratio	Total rev to be collected	Shifted Rev	% Change in revenue from rates	% Revenue Share	Revised Revenue to be collected	Difference in Revenue Requirement	Base Fixed Charge ($/month)	Revenue from Fixed Charge	Fixed Rev %	Revenue from Volumetric Charge	Base Volumetric Charge ($/kWh)	Base Volumetric Charge ($/kW)	CSTA Rate Adders ($/kW)	Hopper Foundry Rate Adder ($/kW)	Total Volumetric Charge ($/kW)
				(A)	(B)	(%)	(C)	(D=A-C)	(E)	(F=A/B)	(G)	(H=BxG)	(I=H-A)	(J=I/D)	(K=H/RR1)	(L=K*RR2)	(M=H-L)		(N= (L - C) x O)	(O)	(P=L-C-N)					
UR	246,399	2,008	-	$ 113,690,459	$ 108,771,613	6.52%	$ 4,630,445	$ 109,060,014	1.12	1.05	1.05	$ 113,690,459	$ -	0.0%	6.8%	$ 111,191,842	$ 2,498,617	$ 36.04	$ 106,561,397	100%	$ -	$ -				
R1	544,981	5,041	-	$ 424,174,152	$ 371,064,414	22.23%	$ 12,768,943	$ 411,405,209	1.12	1.14	1.14	$ 424,174,152	$ -	0.0%	25.4%	$ 414,851,921	$ 9,322,232	$ 57.43	$ 375,577,550	93%	$ 26,505,427	$ 0.0053				
R2	414,577	4,788	-	$ 650,982,533	$ 681,201,661	40.81%	$ 15,915,358	$ 635,067,176	0.97	0.96	0.96	$ 650,982,533	$ -	0.0%	39.0%	$ 636,675,650	$ 14,306,883	$ 116.98	$ 581,971,525	94%	$ 38,788,768	$ 0.0081				
GSe	88,795	1,978	-	$ 169,497,778	$ 167,055,381	10.01%	$ 3,851,401	$ 165,646,377	0.94	1.01	1.01	$ 169,497,778	$ -	0.0%	10.2%	$ 165,772,663	$ 3,725,115	$ 30.71	$ 32,726,241	20%	$ 129,195,021	$ 0.0653				
GSd	5,343	2,164	6,937,130	$ 139,193,690	$ 151,610,594	9.08%	$ 2,285,784	$ 136,907,906	0.88	0.92	0.92	$ 139,193,690	$ -	0.0%	8.3%	$ 136,134,579	$ 3,059,111	$ 98.70	$ 6,327,968	5%	$ 127,520,827		$ 18.3824	$ 0.1293	$ 0.0125	$ 18.5242
UGe	18,432	543	-	$ 23,450,547	$ 24,415,782	1.46%	$ 627,686	$ 22,822,862	0.99	0.96	0.96	$ 23,450,547	$ -	0.0%	1.4%	$ 22,935,166	$ 515,381	$ 23.91	$ 5,289,310	24%	$ 17,018,170	$ 0.0314				
UGd	1,743	876	2,284,824	$ 27,195,347	$ 28,281,435	1.69%	$ 471,352	$ 26,723,996	0.87	0.96	0.96	$ 27,195,347	$ -	0.0%	1.6%	$ 26,597,665	$ 597,682	$ 90.24	$ 1,887,487	7%	$ 24,238,826		$ 10.6086	$ 0.1293		$ 10.7379
St Lgt	5,494	83	-	$ 9,512,077	$ 9,812,382	0.59%	$ 265,796	$ 9,246,281	0.93	0.97	0.97	$ 9,512,077	$ -	0.0%	0.6%	$ 9,303,026	$ 209,050	$ 2.94	$ 194,069	2%	$ 8,843,162	$ 0.1069				
Sen Lgt	19,409	11	-	$ 5,344,077	$ 4,834,512	0.29%	$ 2,746,062	$ 2,598,015	0.94	1.11	1.06	$ 5,141,280	$ (202,797)	-7.8%	0.3%	$ 5,028,288	$ 112,992	$ 2.65	$ 618,002	27%	$ 1,664,224	$ 0.1474				
USL	5,752	32	-	$ 3,539,795	$ 2,988,814	0.18%	$ 93,336	$ 3,446,458	1.11	1.18	1.06	$ 3,178,465	$ (361,329)	-10.5%	0.2%	$ 3,108,611	$ 69,854	$ 33.67	$ 2,324,115	77%	$ 691,160	$ 0.0213				
DGen	1,489	30	208,699	$ 5,749,979	$ 6,919,278	0.41%	$ 82,158	$ 5,667,821	0.86	0.83	0.83	$ 5,749,979	$ -	0.0%	0.3%	$ 5,623,609	$ 126,369	$ 187.67	$ 3,353,958	61%	$ 2,187,493		$ 10.4816	$ 0.1293		$ 10.6109
ST	910	14,983	30,627,361	$ 63,250,241	$ 72,723,633	4.36%	$ 1,345,059	$ 61,905,182	0.99	0.87	0.87	$ 63,250,241	$ -	0.0%	3.8%	$ 61,860,167	$ 1,390,074	N/A*	$ 11,322,513	19%	$ 49,192,596		N/A*			N/A*
AUR	15,476	118	-	$ 5,932,827	$ 6,351,258	0.38%	$ 276,408	$ 5,656,419	-	0.93	0.93	$ 5,932,827	$ -	0.0%	0.4%	$ 5,802,439	$ 130,388	$ 29.76	$ 5,526,031	100%	$ -	$ -				
AUGe	1,380	41	-	$ 1,061,654	$ 1,364,713	0.08%	$ 35,458	$ 1,026,196	-	0.78	0.80	$ 1,091,770	$ 30,117	2.9%	0.1%	$ 1,067,776	$ 23,994	$ 25.71	$ 425,707	41%	$ 606,611	$ 0.0148				
AUGd	207	118	334,039	$ 1,127,253	$ 1,576,363	0.09%	$ 43,091	$ 1,084,161	-	0.72	0.80	$ 1,261,091	$ 133,838	12.3%	0.1%	$ 1,233,375	$ 27,715	$ 155.88	$ 387,771	33%	$ 802,512		$ 2.4025	$ 0.1293		$ 2.5318
AR	38,991	336	-	$ 18,066,593	$ 21,166,734	1.27%	$ 763,278	$ 17,303,315	-	0.85	0.85	$ 18,066,593	$ -	0.0%	1.1%	$ 17,669,536	$ 397,056	$ 36.13	$ 16,906,259	100%	$ -	$ -				
AGSe	4,223	117	-	$ 4,166,211	$ 4,515,738	0.27%	$ 121,460	$ 4,044,752	-	0.92	0.92	$ 4,166,211	$ -	0.0%	0.2%	$ 4,074,649	$ 91,562	$ 37.86	$ 1,918,486	49%	$ 2,034,703	$ 0.0173				
AGSd	303	231	646,691	$ 3,122,764	$ 4,403,669	0.26%	$ 96,110	$ 3,026,654	-	0.71	0.80	$ 3,522,935	$ 400,172	13.2%	0.2%	$ 3,445,511	$ 77,425	$ 182.64	$ 664,452	20%	$ 2,684,949		$ 4.1518	$ 0.1293		$ 4.2811
	1,413,905	**33,500**	**41,038,745**	**1,669,057,975**	**1,669,057,975**	**100%**	**46,419,183**	**1,622,638,792**				**1,669,057,975**	**0**			**1,632,376,473**	**36,681,502**		**1,153,982,841**		**431,974,449**					

*** Final ST rates are calculated outside the rate design sheet.**

Total Rev (K+L) **$ 1,585,957,290**
Misc Rev (C) **$ 46,419,183**
Total Rev Req **$ 1,632,376,473**

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Reference:

Exhibit O-1-1, Page 4
Exhibit O-1-2, Pages 11-15

Preamble:

At the bottom of the first reference, Hydro One states:

> In December 2021, the IESO issued its 2021 APO. The 2021 APO contains materially higher forecasts for CDM in Ontario, averaging a 19% increase in CDM compared to the forecast used in the pre-filed evidence over the test period (2023-2027). As a result of the change in the IESO's CDM forecast, from its 2020 APO to its 2021 APO, the CDM assumptions used to establish Hydro One's load forecasts for both transmission and distribution have become outdated. Updating the CDM assumptions in Hydro One's load forecasts has a material impact on the load forecasts for both distribution and transmission, which must be taken into account to ensure that the billing determinants underpinning rates appropriately allow for recovery of Hydro One's approved rates revenue requirements.

At the second reference, Hydro One provides its explanation for maintaining its proposed transmission (Tx) and distribution (Dx) capital and operating programs and projects in light of inflationary pressures. However, OEB staff note that the impacts of reduced load forecasts due to increased CDM impacts per the IESO's December 2021 APO are not addressed.

Interrogatory:

a) Please state whether or not Hydro One has made any changes to its Tx and Dx plans and capital and operating budgets for the 2023-2027 plan period as a result of the IESO's December 2021 APO.

b) If Hydro One has made changes to the Tx and Dx capital and operating budgets as a result of higher forecasted CDM impacts, and hence lower electricity demand and consumption in Ontario and also for Hydro One's customers, please provide information on the nature of changes, whether these are deferment or reductions of programs and projects, the dollar reductions, and where these are shown in this exhibit.

c) If Hydro One has not made any changes in terms of delay or reductions of Tx and Dx capital and operating programs and projects as a result of the IESO's updated CDM forecasts that materially impact Hydro One's load forecast over the 2023-2027 period, please provide an explanation of why a material reduction in demand does not result in a reduction in costs to meet that demand, on its own or in order to help mitigate inflationary pressures.

d) Please identify the specific CDM data points that have changed between the 2020 APO and 2021 APO that have directly impacted Hydro One's load forecast, preferably through a direct comparison of the relevant tables in the Demand Forecast modules produced by the IESO for the 2020 APO (https://www.ieso.ca/-/media/Files/IESO/Document-Library/planning-forecasts/apo/APO-Demand-Forecast-Module-Data.ashx) and 2021 APO (https://www.ieso.ca/-/media/Files/IESO/Document-Library/planning-forecasts/apo/Dec2021/Demand-Forecast-Module-Data.ashx).

Response:

a) No, Hydro One has not updated its plans as part of this Application as a result of the IESO's December 2021 APO.

b) Not applicable, see part a) above.

c) A reduction in energy demand does not necessarily reduce the capital investment and maintenance necessary to sustain the electricity grid to continue delivering secure and reliable electricity. Notwithstanding a reduction to the load forecast overall, Hydro One's transmission and distribution investment plans include non-discretionary System Access and System Service investments that respond to customer load growth being experienced in certain regions of Ontario, making necessary System Renewal investments to preserve the performance of critical asset groups that are in poor condition, and complete OM&A work required to meet public and employee safety objectives, maintain transmission system reliability at targeted performance levels, and comply with legislative and regulatory requirements.

d) The CDM energy savings in the 2020 APO and 2021 APO are not comparable since the historical EE savings for future years are not included in the 2020 APO. In the as-filed evidence, Hydro One used the CDM savings provided by the IESO in Feb 2021 but not the 2020 APO information. For the updated load forecast, Hydro One used the CDM savings in 2021 APO.

The following tables provide the summary of the CDM energy savings in APO 2020 and APO 2021.

Table 1 - Energy savings in APO2020

Tables from APO2020	Categories	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Table 19	Conservation - Energy Efficiency - Programs	9.75	9.86	10.96	12.27	12.11								
Table 19	Conservation - Codes and Standards - Regulations	4.22	5.17	6.28	7.07	7.37								
Table 20	current framwork								2.42	2.51	2.47	2.41	2.36	2.33
Sum of table 21	EE-nera term framework								1.33	2.35	3.37	3.98	4.08	3.95
Table 22 (scenario 2)	long term framwork								0	0	0	0.09	0.65	1.37
Sum of table 24	C&S								8.07	8.72	9.18	9.63	9.93	10.4
	Total	13.97	15.03	17.24	19.34	19.48			11.82	13.58	15.02	16.11	17.02	18.05

Table 2 - Energy savings in APO2021

Figures in APO2021	Categories	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Figure 15	Programs (Energy Efficiency Programs)	9.86	10.96	12.27	13.03	13.53							
Figure 15	Regulations (Codes & Standards)	5.17	6.28	7.07	7.37	7.37							
Figure 16	EE historical program								12.94	11.97	11.17	10.62	9.79
Figure 17	EE curent framework								2.41	3.42	4.05	4.25	4.2
Figure 18	EE long term framework								0	0	0.14	0.7	1.48
Figure 19	Incremental Conservation Potential								2.14	2.75	3.63	4.48	5.29
Figure 20	C&S								8.89	9.4	9.89	10.23	10.73
	Total	15.03	17.24	19.34	20.40	20.90			26.38	27.54	28.88	30.28	31.49

The table below summarizes the differences in the categories of CDM savings that are included in the 2021 and 2020 APO. In addition to minor differences in the savings for the existing categories, the 2021 APO includes two additional categories of energy savings which were not included in the 2020 APO.

		APO2021	APO2020
1	Historical result EE &CS 2005-2020	YES	YES
2	Historical EE program savings for future years	YES	NO
3	Current framework EE savings (2021-2024)	YES	YES
4	Long term framework EE savings (2025 after)	YES	YES
5	Incremental conservation potential	YES	NO
6	Future C&S	YES	YES

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O - STAFF INTERROGATORY - 394

Reference:

Exhibit O-1-3, Pages 3-4 of 16 (including Table 2)
Exhibit I-24-D-VECC-038

Preamble:

Hydro One provides an updated estimate of the cumulative CDM impact on 12-month average peak demand, based on the updated information in the 2021 APO.

Interrogatory:

a) Please provide Hydro One's supporting calculations used to develop Table 2 and convert the APO's estimated energy savings from CDM (in TWh) into estimates of monthly peak demand savings (in MW); e.g., in the form of an updated version of the information provided in Exhibit I, Tab 24, Schedule D-VECC-038 part (b) and the accompanying spreadsheet provided in response to part (d).

b) Was any additional new information from the IESO (beyond the data in the 2021 APO) used to make the updates to Table 2? If so, please describe.

Response:

a) Please see response to O-VECC-154, parts a) and f).
APO 2021 did not provide updated peak savings.

b) No.

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O - STAFF INTERROGATORY - 395

Reference:

Exhibit O-1-3, Pages 7-8 of 16

Preamble:

Hydro One notes that it derives its distribution energy savings from the transmission energy savings provided by the IESO, and provides an updated estimate of the updated CDM impact in GWh (Table 7)

Interrogatory:

a) Please provide the multiplier used to convert from the CDM savings in the APO to the savings for Hydro One's distribution service territory.

b) Please confirm that Hydro One's estimate of CDM impact on distribution load (Table 7) is based solely on the province-wide CDM data provided by IESO, and does not make use of more granular data on the impact of CDM within Hydro One's distribution territory (e.g. the persisting impacts of CDM programs delivered by Hydro One under previous CDM frameworks).

c) If confirmed, please provide Hydro One's rationale for this approach.

d) Do Hydro One's CDM results from previous CDM frameworks differ substantially from the provincial results (if weighted by the multiplier used in part (a))? Please describe.

Response:

a) Hydro One's distribution CDM energy saving is based on the 2021 APO and assumption of Hydro One share of the Ontario energy savings. The graph provided in the response to VECC-TCQ-13 demonstrates the steps for deriving Hydro One distribution's CDM savings based on the total savings for Ontario.

b) Confirmed.

c) The CDM savings from the IESO includes all savings from historical and future energy efficiency programs, Code and Standards which is the same definition used by Hydro One for load forecasting. We applied the share of Hydro One to the Ontario savings to derive the energy savings.

d) The differences of the CDM assumptions between the information updated in Feb 2022 and Oct 2021 are due to the updated CDM energy savings for 2019-2027 in the 2021 APO.

O - STAFF INTERROGATORY - 396

Reference:

Exhibit O-1-4, Page 9 of 10

Preamble:

Hydro One proposes to record the deferred revenue requirement associated with revenue deficiencies associated with its load forecast, with the final deferred revenue to be approved at the time of the Draft Rate Order in this proceeding, with recovery commencing in 2028.

Interrogatory:

a) Please confirm that Hydro One is requesting that these amounts be approved on a final basis, and would not be subject to any adjustment based on updated information on CDM impacts in 2023 to 2027 that becomes available prior to the commencement of the recovery period in 2028.

b) If confirmed, please provide Hydro One's rationale for this approach.

Response:

a) Confirmed.

b) Hydro One anticipates that, as part of its decision, the OEB would approve 2023-2027 billing/charge determinants for Hydro One's transmission and distribution businesses which are based on Hydro One's load forecasts. These parameters will not change once approved over the test period that is the subject of this application and, therefore, the deferred revenue associated with revenue deficiencies attributed to revised load forecasts amounts will also not change.

Hydro One notes that a further adjustment based on additional updated information on CDM impacts could be viewed as analogous either to updating Hydro One's load forecast each year or to a Lost Revenue Adjustment Mechanism (LRAM). Neither of those mechanisms would be consistent with the OEB's existing policies.

As noted on page 26 of the OEB's *Handbook for Utility Rate Applications*, after rates are set as part of a Custom IR application, such as Hydro One's current Application, the OEB does not expect to address annual applications for updates to sales volumes (i.e. load forecasts).

Hydro One further notes that the OEB did not approve LRAM mechanisms in its prior decisions for Hydro One's distribution and transmission businesses. The policy context surrounding such mechanisms has also changed. In the OEB's *Conservation and Demand Management Guidelines for Electricity Distributors* (EB-2021-0106) the OEB states that LRAM mechanisms are

> *"no longer the default approach for CDM activities…. distributors are expected to determine how to incorporate the historical and forecast impacts of CDM activities into their load forecast, for the purpose of making the load forecast as accurate as possible, thereby reducing the likelihood of significant revenue impacts due to deviations from forecast. The equivalent of an LRAMVA does not exist for many other external factors used in load forecasting that affect electricity consumption and expose distributors to revenue risk."*

O - STAFF INTERROGATORY - 397

Reference:

Exhibit F-1-3
Exhibit O-1-2, Attachment 7

Preamble:

In the original filed application, filed on August 30, 2021, Exhibit F / Tab 1 / Schedule 3 provides tables summarizing Hydro One's debt and equity financing for each of Transmission and Distribution, and for historical (2017-2020), bridge (2021 and 2022) and test (2023-2027) years.

In the Inflation Update filed on March 31, 2022, Exhibit O / Tab 1 /Schedule 2 / Attachment 7 appears to be an update of Exhibit F / Tab 1 / Schedule 3.

Interrogatory:

a) Please confirm that only pages 3 and 4 of Exhibit O / Tab 1 / Schedule 2 / Attachment 7 are updated from Exhibit F / Tab 1 / Schedule 3. In other words, there are no changes on pages 1, 2, 4 and 5. In the alternative, please explain.

b) Please provide a complete update of Attachment 7 for 2021 actuals, or an explanation as to why this is not possible.

Response:

a) Hydro One confirms that only pages 3 and 4 of Exhibit O-01-02 of Attachment 7 were updated for 2023 to reflect rate base impact as a result of the inflationary update. There were no changes on pages 1, 2, 5 and 6.

b) Attachment 7 from Exhibit O-01-02 has been updated for 2021 actuals in Attachment 1 to this response.

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HYDRO ONE NETWORKS INC.
DISTRIBUTION
Debt and Equity Summary
Historical Years (2018, 2019, 2020, 2021) and Bridge Year (2022)
As at December 31
($M)

Updated Line No.	Particulars	Amount Outstanding 2018 Actual	Amount Outstanding 2019 Actual	Amount Outstanding 2020 Actual	Amount Outstanding 2021 Actual	Amount Outstanding 2022 Bridge
		(a)	(b)	(c)	(d)	(e)
1	Long-term debt *	3,600.7	4,215.7	4,610.6	4,810.6	4,636.9
2	Short-term debt	712.3	332.3	44.4	221.4	352.5
3	Preference shares	-	-	-	-	-
4	Common equity	2,716.0	2,635.0	2,770.0	2,893.0	3,525.1

* Includes debt payable within one year; excludes the 2.25 year debt issue used as short term debt, variable rate debt, unamortized debt premiums/discount, hedging gains/losses and marks to market

HYDRO ONE NETWORKS INC.
TRANSMISSION
Debt and Equity Summary
Historical Years (2018, 2019, 2020, 2021) and Bridge Year (2022)
As at December 31
($M)

Updated Line No.	Particulars	Amount Outstanding 2018 Actual	Amount Outstanding 2019 Actual	Amount Outstanding 2020 Actual	Amount Outstanding 2021 Actual	Amount Outstanding 2022 Bridge
		(a)	(b)	(c)	(d)	(e)
1	Long-term debt *	5,358.3	6,243.3	7,101.3	7,301.3	7,635.9
2	Short-term debt	1,634.7	1,149.7	681.7	869.7	545.6
3	Preference shares	-	-	-	-	-
4	Common equity	4,729.0	4,866.0	5,170.0	5,383.0	5,456.4

* Includes debt payable within one year; excludes the 2.25 year debt issue used as short term debt, variable rate debt, unamortized debt premiums/discount, hedging gains/losses and marks to market

HYDRO ONE NETWORKS INC.
DISTRIBUTION
Summary of Cost of Capital
Test Year 2023
Utility Capital Structure
Year Ending December 31
($M)

		2023			
Line No.	**Particulars**	**($M)**	**%**	**Cost Rate (%)**	**Return ($M)**
		(a)	(b)	(c)	(d)
I	Long-term debt	4,880.7	52.0%	4.07%	198.6
2	Short-term debt	375.8	4.0%	1.56%	5.9
3	Deemed long-term debt	380.3	4.0%	4.07%	15.5
4	Total debt	5,636.8	60.0%	3.90%	220.0
5	Common equity	3,757.9	40.0%	8.34%	313.4
6	Total rate base	9,394.7	100.0%	5.68%	533.4

HYDRO ONE NETWORKS INC.
TRANSMISSION
Summary of Cost of Capital
Test Year 2023
Utility Capital Structure
Year Ending December 31
($M)

		2023			
Line No.	**Particulars**	**($M)**	**%**	**Cost Rate (%)**	**Return ($M)**
		(a)	(b)	(c)	(d)
I	Long-term debt	7,873.7	53.9%	4.04%	318.3
2	Short-term debt	584.5	4.0%	1.56%	9.1
3	Deemed long-term debt	308.7	2.1%	4.04%	12.5
4	Total debt	8,766.9	60.0%	3.87%	340.0
5	Common equity	5,844.6	40.0%	8.34%	487.4
6	Total rate base	14,611.5	100.0%	5.66%	827.4

HYDRO ONE NETWORKS INC.
DISTRIBUTION
Summary of Cost of Capital
Last OEB-approved year (2018)
Utility Capital Structure
Year Ending December 31
($M)

		2018			
Line No.	**Particulars**	**($M)**	**%**	**Cost Rate (%)**	**Return ($M)**
		(a)	(b)	(c)	(d)
I	Long-term debt	3768.1	49.34%	4.47%	168.5
2	Short-term debt	305.5	4.00%	2.29%	7.0
3	Deemed long-term debt	508.5	6.66%	4.47%	22.7
4	Total debt	4582.1	60.00%	4.33%	198.3
5	Common equity	3054.8	40.00%	9.00%	274.9
6	Total rate base	7,636.9	100.00%	6.20%	473.2

HYDRO ONE NETWORKS INC.
TRANSMISSION
Summary of Cost of Capital
Last OEB-approved year (2020)
Utility Capital Structure
Year Ending December 31
($M)

		2020			
Line No.	**Particulars**	**($M)**	**%**	**Cost Rate (%)**	**Return ($M)**
		(a)	(b)	(c)	(d)
I	Long-term debt	6409.4	51.86%	4.42%	283.6
2	Short-term debt	494.4	4.00%	2.75%	13.6
3	Deemed long-term debt	512.0	4.14%	4.42%	22.7
4	Total debt	7415.8	60.00%	4.31%	319.8
5	Common equity	4943.8	40.00%	8.52%	421.2
6	Total rate base	12,359.6	100.00%	6.00%	741.0

O - ANWAATIN INTERROGATORY - 007

Reference:

Exhibit O-1-1, Section 1.2
Exhibit O-1-2, Section 2.5.2

Preamble:

Hydro One indicates that approach to address current inflation projections in relation to costs included in the Investment Plan for 2023-2027 is "customer centric".

Interrogatory:

a) Please discuss the specific impacts of Hydro One's approach to inflation projections on its Indigenous customers (on- and off-reserve) and any measures undertaken to ensure that Indigenous customers were considered in the development of Hydro One's "customer centric" approach.

b) Please discuss the customer engagement activities Hydro One undertook to inform the development of its approach to inflation projections and file all related documents and reports.

c) Please discuss the extent to which Hydro One undertook Indigenous-specific customer engagement to inform the development of its approach to inflation projections and file all related documents and reports.

d) Hydro One indicates that "[i]f the cumulative inflation for 2022 and 2023 exceeds 10%, Hydro One will aim to manage its work program to the capped amount through investment reprioritization and redirection and will adjust the outcomes outlined in TSP Section 2.5 and DSP Section 3.5 accordingly."
   i. Please discuss whether Hydro One considered or consulted Indigenous communities in setting the 10% threshold and file all related documents and reports.
   ii. Please discuss whether the proposed investment reprioritization and redirection mechanism is anticipated to impact or otherwise affect electricity reliability in remote and near-remote Indigenous communities.

Response:

a) Hydro One developed its approach to update the inflation assumptions in the current application with all customers' interests in mind, including Indigenous customers. The proposed approach allows Hydro One to deliver on our commitments to our customers, including Indigenous customers, without impacting the proposed transmission and distribution rates during the 2023-2027 period in a material way. As discussed in O-01-01,

> *With evolving circumstances continuing to impact forecast inflation levels (and the trend) for 2022 and 2023, Hydro One has developed an approach to help protect its customers from the impacts of this uncertainty on their electricity transmission and distribution rates and to deliver on our public commitments by deferring the recovery of approved revenue requirements that reflect the updated inflation assumptions impacting capital and OM&A forecasts.*[1]

This approach is consistent with, and took into account, the results of the customer engagement activities performed as part of this application. This approach allows Hydro One to continue to meet customer needs and preferences, and deliver associated outcomes, expressed in its customer engagement survey results (see Exhibit B-01-01, SPF Section 1.6). This includes the Overview Report (Customer Engagement – Understanding Customer Needs and Preferences)[2] and the First Nations Chiefs Engagement Report (Phase II),[3] which reflect the needs and preferences of Indigenous communities.

By deferring the incremental costs due to inflation to the future rate period, Hydro One is also considering customers' interests by recognizing that they too will experience the impact of the once-in-a-generation inflationary pressures that all Ontarians are experiencing. The proposed approach helps shield customers from the immediate impacts of increased inflation, while still enabling Hydro One to achieve the outcomes valued by its customers.

b) Please refer to part a).

c) Please refer to part a).

[1] Exhibit O-01-01, page 2, lines 23-28
[2] Exhibit B-01-01, SPF Section 1.6, Attachment 1
[3] Exhibit B-01-01, SPF Section 1.6, Attachment 2

d)

i. Hydro One considers the 10% to be reasonable and in the interest of all customers, including Indigenous communities. Please refer to Interrogatory O-VECC-149 for additional details.

ii. Please refer to Interrogatory O-PP-026, part e).

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O - ANWAATIN INTERROGATORY - 008

Reference:

Exhibit O-1-1, Section 1.2
Exhibit O-1-2, Attachment 1
Letter, February 7, 2022, Hydro One to Board re Postponement of Settlement Conference
Letter, February 11, 2022, Hydro One to Board re Evidence Update and Schedule

Preamble:

Hydro One's February 7, 2022 correspondence requesting postponement of the settlement conference and February 11, 2022 correspondence outlining the scope of evidentiary updates each refer to the "Consensus Forecast for Canadian CPI" as a justification for the need to update Hydro One's application.

Interrogatory:

a) Please explain why the Inflation Update is based on the Scotiabank Capital Inflation Report and not the Consensus Forecast for Canadian CPI, which was referred to in the Hydro One correspondence giving rise to the application update.

b) Please explain Hydro One's rationale for using the Scotiabank Capital Inflation Report and provide all related documents and reports.

c) Did Hydro One undertake any analysis to compare and contrast the Scotiabank Capital Inflation Report and other inflation reports or forecasts? If so, please file the analysis and all related documents and reports. If not, please explain why not.

Response:

a) Please see Hydro One's response to O-LPMA-029.

b) Please see Hydro One's response to O-LPMA-029.

c) No, Hydro One did not compare or contrast the Scotiabank Capital Inflation Report (which was provided in Exhibit O-01-02 Attachment 1) with other inflation reports or forecasts. Hydro One relied on the Scotiabank Capital Inflation Report on its own merits.

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 111

Reference:

Exhibit O-2-1, Page 2

Interrogatory:

With respect to 2022, Hydro One plans to manage its in-service additions in 2022 within the total envelopes set out in its pre-filed evidence for both transmission and distribution. If necessary, Hydro One will leverage its internal redirection and reprioritization processes to manage within its planned total envelopes reflected in its pre-filed evidence for both transmission and distribution.

Please provide any internal documents that describe Hydro One's internal redirection and reprioritization processes including governance.

Response:

Please refer to Exhibit B-01-01, SPF Section 1.7, Subsection 1.7.4.6.

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 112

Reference:

Exhibit O-2-1, Page 2

Interrogatory:

The 2021 transmission capital expenditures were $117.8M above the OEB-approved amount of $1,169.2M. Hydro One continues to make every effort to manage the capital expenditures at the envelope level by making reductions or deferrals to discretionary investments to mitigate the impact to the total capital envelope.

With reference to Hydro One's internal redirection and reprioritization processes, please explain why Hydro One was unable to adequately leverage its internal redirection and reprioritization processes in order to manage project variances and stay within the OEB-approved total transmission capital envelope of $1169.2 million.

Response:

Hydro One disagrees with the assertion that it was unable to adequately leverage its internal redirection and reprioritization processes.

In 2021, Hydro One invested approximately $129M above the OEB approved amounts for System Access and System Service in response to load customer connections and upgrades, and third party driven secondary land use and relocation requests, as well as investments to address system needs identified through bulk system and regional planning processes. As these investments are mandatory, Hydro One has limited ability to manage positive variances through offsetting reductions in the System Access and System Service cost category.

Hydro One did leverage it internal redirection and reprioritization processes, which resulted in System Renewal investments which were $112.0M below the OEB-approved amount of $982.8M to accommodate emerging, mandatory system growth investments and required system connections and upgrades. With a significant population of poor condition assets, further deferral would present undue risk to critical network facilities and supply points.

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 113

Reference:

Exhibit O-2-1, Page 7

Interrogatory:

The 2021 distribution capital expenditures were $135.2M (21.5%) above the OEB-approved amount of $627.6M. Hydro One continues to make every effort to manage the distribution capital expenditures at the envelope level by making reductions or deferrals to discretionary investments to mitigate the impact to the total capital envelope.

With reference to Hydro One's internal redirection and reprioritization processes, please explain further why Hydro One was unable to adequately leverage its internal redirection and reprioritization processes in order to manage project variances and stay within the OEB-approved distribution capital expenditures at $627.6 million.

Response:

In 2021, Hydro One invested approximately $78M above the OEB approved amounts for System Access due to higher than forecast system access requests, including joint use and relocation requests and new customer load connections and upgrades. As these System Access investments are mandatory, Hydro One has limited discretion to manage these pressures within the System Access cost category.

Hydro One did leverage it internal redirection and reprioritization processes, which resulted in System Service expenditures which were $33.3M lower than the OEB-approved category amount to accommodate increases in non-discretionary System Access expenditures. Further, planned System Renewal work was reprioritized and redirected, however in mid-December, a severe storm moved across Ontario with high sustained winds and gusts of up to 120 km/hour; this windstorm impacted a total of ~761,100 (~52%) customers, requiring significant response and equipment replacements – as a result of the scale and timing of this major event, trouble call and storm damage response expenditures exceeded forecasts by $32.4M, offsetting the impacts of planned work redirection.

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 114

Reference:

Exhibit O-2-1, Page 6

Interrogatory:

The 2021 OM&A results for transmission were $401.8M or $12.8M higher than forecasted amount for 2021 of $389.0M. This increase was primarily due to Common and Other OM&A costs exceeding forecast by $20.4M, which was mostly driven by project write-offs and COVID-19 related expenditures that were not previously forecasted.

a) Please provide a detailed breakdown of the $20.4 million.
Please provide the nature of the specific project write-offs and costs by project.

b) For each project write-off, please provide the corresponding CWIP amount.

Response:

a) The breakdown of actual 2021 Common and Other OM&A costs allocated to Transmission which exceeded the as-filed forecast is as follows:

Common and Other OM&A Allocated to Transmission ($M)	Historical	
	2021	
	As-Filed Forecast	Actual
Common Corporate Functions & Services (CCF&S)	90.7	93.2
Planning	25.2	26.6
Information Solutions	51.4	54.1
Cost of Sales - External Work	6.4	5.6
Other OM&A	-122.1	-107.5
Total	**51.6**	**71.9**
Variance to As-Filed Forecast		**20.4**

Of the $20.4M variance to the as-filed forecast, $14.1M is related to project write-offs and the remaining balance is attributable to COVID-19 expenditures. The table below provides a

breakdown of the $14.1M, including the nature of the work and the corresponding construction work in progress (CWIP) balance that was written off:

Investment Category	CWIP Balance Written Off ($M)	Description
Amounts Greater than $3M		
Integrated Stations Renewal	7.0	Shortly after energization, Gage TS T12 transformer failed, and was not repairable.
Amounts Less than $3M		
Protection, Control and Telecom	2.9	Replacement of existing special protection system to a higher requirement to address load growth in Leamington area, and investments to telecom facilities that were not pursued
Stations Component Replacements and Local Area Supply	1.8	Equipment purchased and development undertaken for component replacement where technology has lapsed, and transmission facility upgrades in Toronto that were ultimately not pursued
Information Solutions and Other	2.4	The balance is attributable to several smaller transmission projects, inventory write-offs and discovery work for information solutions projects ranging between $50K to $300K each.
Total	**14.1**	

b) Please refer to part a).

O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 115

Reference:

Exhibit O-2-1, Attachment 2 – Transmission Capital Projects, OEB Appendix 2-AA

Interrogatory:

Please explain the specific drivers for the 2021 variances in the following investments:

a) System Access: Overhead Lines Refurbishment Projects, Component Replacement Programs and Secondary Land Use Projects

b) System Renewal: Integrated Station Investment

c) General Plant: Information Solutions

Response:

a) Please see Interrogatory O-SEC-263 Attachment 1 for the Transmission Capital Program Performance Report - 2021.

b) Please see response to part a).

c) Please see Interrogatory O-Staff-362 Attachment 1 for the General Plant 2021 Capital Program Performance Report.

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 116

Reference:

Exhibit O-2-1, Page 3

Interrogatory:

In 2021, System Renewal investments were $112.0M below the OEB-approved amount of $982.8M. The variance was primarily driven by redirections across OEB categories to accommodate emerging, mandatory system growth investments and required system upgrades, as well as General Plant investments. This variance reflects lower than planned investments in transmission line refurbishments including underground cable replacement, partially offset by higher than planned expenditures for air blast circuit breakers and station reinvestments.

a) Please complete the attached tables.

Unit Accomplishments

ISD	Investment Title	2018 A	2019 A	2020 A	2021 F	2021 A	2022 F	2022 Update	2023	2024	2025	2026	2027
T-SR-01	Transmission Station Renewal - Network Stations												
	# Transformers												
	# Breakers												
	# Protection Systems												
T-SR-02	Transmission Station Renewal - Air Blast Circuit Breakers												
	# Transformers												
	# Breakers												
	# Protection Systems												
T-SR-03	Transmission Station Renewal - Connection Stations												
	# Transformers												
	# Breakers												
	# Protection Systems												

Response:

a) This information is not readily available, but the overall number of major station assets replaced may be found in Interrogatory O-AMPCO-120 part t) and O-SEC-265 Attachment 5.

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 117

Reference:

Exhibit O-2-1, Page 4

Interrogatory:

In 2021, System Service investments were $70.5M above the OEB-approved amount of $148.2M, largely driven by investments in response to system needs identified through bulk system and regional planning processes. The variance is primarily due to the increased scope, complexity and cost associated with the Lakeshore TS project as well as schedule extensions and increased costs associated with delays to NextBridge's East-West Tie line construction, which were beyond Hydro One's control.

a) Please provide details on the change in scope, complexity and cost associated with the Lakeshore TS project.

b) Please provide the forecast completion date for the Lakeshore TS project.

c) Please provide updates to all impacted System Service Investment Summary Documents related to the Lakeshore TS project.

Response:

a) Please see Interrogatory B2-Staff-094, part h).

b) Lakeshore TS will be completed by Q4 2022.

c) No Investment Summary Documents in this application are impacted by Lakeshore TS.

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 118

Reference:

Exhibit O-2-1, Attachment 2 "Transmission Capital Projects, OEB Appendix 2-AA"

Interrogatory:

Please provide Attachment 2 OEB Appendix 2-AA on the basis of In-Service Additions.

Response:

Please refer to Attachment 1.

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Appendix 2-AA
Transmission Capital Projects Table ($M) - In-Service Additions

						As-Filed						Updated Inflation*				
Projects	**2018 Actual**	**2019 Actual**	**2020 Actual**	**2021 Forecast**	**2021 Actual**	**2022 Forecast**	**2023 Test**	**2024 Test**	**2025 Test**	**2026 Test**	**2027 Test**	**2023 Test**	**2024 Test**	**2025 Test**	**2026 Test**	**2027 Test**
Reporting Basis	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP
System Access																
Generator Customer Connection	-0.8	0.3	0.4	1.9	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Load Customer Connection	8.6	65.6	4.6	14.4	4.5	43.1	30.7	46.2	57.9	61.8	38.1	31.9	48.6	60.9	65.1	40.1
Component Replacement Programs and	3.7	7.0	0.5	-1.6	12.1	0.5	42.3	2.7	2.8	1.3	0.8	43.8	2.8	3.0	1.4	0.9
P&C Enablement for Generation Connections	0.5	-0.3	1.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sub-Total	12.0	72.6	7.3	15.1	17.7	43.6	73.0	48.9	60.7	63.2	38.9	75.7	51.4	63.9	66.5	41.0
System Renewal																
Ancillary Systems	5.3	0.3	-15.7	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Circuit Breakers	0.0	2.5	1.1	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Integrated Station Investment	519.3	392.2	496.1	290.1	362.1	484.1	773.4	705.6	753.7	504.6	814.6	792.0	738.7	790.8	531.1	857.4
IT Security	8.8	27.7	18.5	48.6	51.7	39.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Power Equipment	0.2	0.1	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Component Replacement Programs	192.1	222.2	205.2	227.0	212.6	306.2	238.4	330.9	405.8	434.0	499.5	245.0	346.6	425.8	456.7	525.7
Power Transformers	1.7	0.2	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Protection and Automation	42.6	22.9	9.1	24.5	16.7	18.0	65.2	82.1	97.4	100.6	34.4	67.4	86.0	102.2	105.8	36.2
Site Facilities and Infrastructure	0.2	0.1	1.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tx Transformers Demand and Spares	79.7	74.5	67.9	58.0	45.0	45.1	49.2	51.2	51.9	52.8	53.8	50.6	53.7	54.4	55.6	56.7
Underground Lines Cable Refurbishment & Replac	2.4	2.1	41.3	1.1	1.4	2.4	2.5	2.6	109.9	0.6	0.5	2.6	2.7	115.3	0.6	0.6
Sub-Total	852.3	744.8	824.5	653.7	689.8	895.3	1,128.7	1,172.3	1,418.6	1,092.6	1,402.9	1,157.6	1,227.7	1,488.5	1,149.9	1,476.5
System Service																
Inter Area Network Transfer Capability	205.3	18.9	4.7	140.9	122.5	299.8	46.5	1.0	35.9	0.0	76.8	47.7	1.1	37.8	0.0	80.8
Local Area Supply Adequacy	10.1	15.9	16.4	34.8	26.2	85.8	7.9	17.6	123.4	69.9	20.4	8.1	18.5	129.8	73.6	21.5
Performance Enhancement	0.0	0.0	3.9	0.0	0.0	0.0	3.0	0.0	2.4	0.0	0.0	3.2	0.0	2.5	0.0	0.0
Power Quality	1.8	2.2	3.1	1.3	0.9	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Risk Mitigation	0.7	8.5	4.5	3.7	0.5	0.6	1.5	2.0	2.0	2.0	2.0	1.6	2.1	2.1	2.1	2.1
Smart Grid	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sub-Total	218.0	45.5	32.6	180.7	150.0	386.6	58.9	20.6	163.7	71.9	99.2	60.6	21.7	172.3	75.7	104.4
General Plant																
Fleet	9.3	15.0	13.5	14.4	9.0	14.9	25.8	26.4	26.7	27.0	27.9	26.6	27.2	28.1	28.5	29.4
Facilities & Real Estate	22.6	18.3	17.4	15.4	15.1	14.4	13.4	39.0	14.0	21.8	16.3	13.8	40.3	14.7	23.0	17.2
Information Solutions	35.1	57.8	36.9	26.8	21.0	35.7	64.2	40.1	67.3	45.8	41.1	66.1	41.2	70.9	48.2	43.3
System Operations	7.0	2.3	6.3	85.3	80.3	2.0	47.3	3.0	4.2	2.4	7.6	48.7	3.1	4.4	2.5	8.0
Operating Infrastructure	3.9	5.4	3.7	14.3	14.3	13.1	11.2	43.1	16.3	16.7	26.9	11.6	44.7	17.1	17.5	28.3
Other	0.0	-2.1	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sub-Total	77.9	96.6	79.9	156.3	139.7	80.1	162.1	151.6	128.4	113.7	119.8	166.8	156.6	135.1	119.6	126.1
Progressive Productivity						-24.1	-54.6	-61.0	-61.0	-61.0	-61.0	-56.2	-64.2	-64.2	-64.2	-64.2
Total	**1,160.3**	**959.6**	**944.4**	**1,005.9**	**997.2**	**1,381.6**	**1,368.1**	**1,332.4**	**1,710.3**	**1,280.3**	**1,599.8**	**1,404.5**	**1,393.2**	**1,795.6**	**1,347.5**	**1,683.8**
Less Renewable Generation Facility Assets																
Total	**1,160.3**	**959.6**	**944.4**	**1,005.9**	**997.2**	**1,381.6**	**1,368.1**	**1,332.4**	**1,710.3**	**1,280.3**	**1,599.8**	**1,404.5**	**1,393.2**	**1,795.6**	**1,347.5**	**1,683.8**

* The 2023-2027 forecast reflects updated inflation assumptions calculated using the methodology described in Section 2.3 of Exhibit O-1-2

Notes:

1 Please provide a breakdown of the major components of each capital project undertaken in each year. Please ensure that all projects below the materiality threshold are included in the miscellaneous line. Add more projects as required.

2 The applicant should group projects appropriately and avoid presentations that result in classification of significant components of the capital budget in the miscellaneous category.

O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 119

Reference:

Exhibit O-2-1

Interrogatory:

Please update the following interrogatories and undertaking responses to include 2021 year-end actuals.

a) B2-AMPCO-020 (a)

b) B2-AMPCO-022A (a)

c) B2-AMPCO-022B (a

d) B2-AMPCO-036 (b)

e) B2-AMPCO-049 (a)

f) JT-1.08

g) JT1.09

Response:

Hydro One is providing the requested information as it is readily available notwithstanding that it not directly related to the direction provided in Procedural Order 5 and the 2021 financial information included in Hydro One's updated evidence.

a) B2-AMPCO-020 (a):

The table below provides the number of transmission unplanned outage hours due to equipment failure system-wide.

Year	Hours
2019	343,712
2020	362,559
2021	347,700

b) B2-AMPCO-022A (a)

The completed table is provided below however it only addresses the subset of equipment failures that resulted in transmission delivery point interruptions.

Interruptions by Equipment Type	Avg 2008 to 2012 (%)	Avg 2013 to 2017 (%)	2018 (%)	2019 (%)	2020 (%)	2021 (%)
Lines	38%	51%	54%	61%	66%	19%
Protection Equipment	16%	18%	24%	11%	9%	23%
Transformers	15%	10%	11%	10%	6%	12%
Breakers	18%	9%	4%	8%	4%	26%
Bus	8%	5%	6%	8%	9%	13%
Other (switches, capacitors,	5%	6%	2%	2%	7%	8%

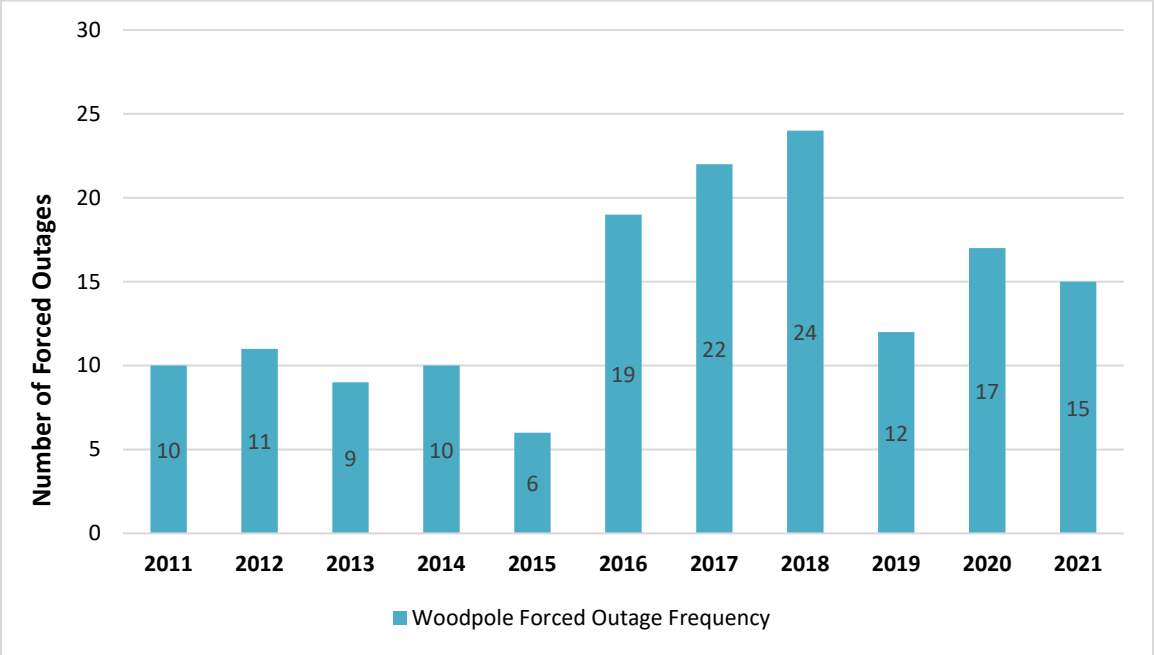
c) B2-AMPCO-022B (a)

The table below provides the direct defective equipment caused interruption duration data for Transmission Lines, Transformers, Breakers and Other for each of the years 2016 to 2021.

Interruption Duration by Equipment Type	2016 (%)	2017 (%)	2018 (%)	2019 (%)	2020 (%)	2021 (%)
Lines	28%	71%	73%	77%	94%	59%
Transformers	68%	9%	10%	9%	2%	14%
Breakers	1%	5%	1%	1%	0%	10%
Other	3%	15%	16%	12%	4%	17%

d) B2-AMPCO-036 (b)

The graph below provides the number of forced outages as a result of wood poles.



e) B2-AMPCO-049 (a)

The table below provides a sampling of trouble tickets for a vendor.

Outage Statistics PSTS Circuit Type
(Circuits Carrying Critical Tele-protection Applications)

Item	2016	2017	2018	2019	2020	2021	Comment
Number of Tickets logged by ITMC	98	105	104	118	101	134	ITMC: Integrated Telecom Management Centre
Total Outage time (Hours)	5,400	6,623	5,511	9,496	7,404	12,492	
Average Outage time per instance (Hours)	54	66	59	87	73	93	

f) JT-1.08

The percentages presented in B2-AMPCO-022A (part b) above) are based on the total number of interruptions in the transmission system provided below:

Year	2008 - 2012	2013 - 2017	2018	2019	2020	2021
Delivery point interruptions	881	892	197	183	138	78

g) JT1.09

The percentages presented in B2-AMPCO-022B (part c) above) are based on the total hours of interruptions in the transmission system provided below:

Year	2016	2017	2018	2019	2020	2021
Delivery Point Interruption Hours	956.2	323.1	421.1	402.1	403.8	124.3

O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 120

Reference:

Exhibit O-2-1

Interrogatory:

Please update the following interrogatories and undertaking responses to include 2021 year-end actuals and any changes to the 2022 forecast.

a) B2-AMPCO-024

b) B2-AMPCO-028

c) B2-AMPCO-030

d) B2-AMPCO-032 (d)

e) B2-AMPCO-033 (b) & (d)

f) B2-AMPCO-034 (b)

g) B2-AMPCO-036 (d)

h) B2-AMPCO-037 (c)

i) B2-AMPCO-38 (d)

j) B2-AMPCO-39 (c)

k) B2-AMPCO-40 (b) & (c)

l) B2-AMPCO-041 (b) & (c)

m) B2-AMPCO-042 (b) & (c)

n) B2-AMPCO-043 (a)

o) B2-AMPCO-044 (a) & (b)

p) B2-AMPCO-047

q) B2-AMPCO-050 (a) & (b)

r) B2-SEC-095

s) B2-SEC-109

t) JT-2.01

Response:

Hydro One is providing the requested information (units and reliability type information) as it is readily available notwithstanding that it is not directly related to the direction provided in Procedural Order 5 and the 2021 financial information included in Hydro One's updated evidence.

Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

a) B2-AMPCO-024
Please see Attachment 1.

b) B2-AMPCO-028
Please see part t) below

c) B2-AMPCO-030
Please see Attachment 2.

d) B2-AMPCO-032 (d):
T-SR-01 Table 3 for the 2018-2022 period has been provided below. The table only includes historical costs associated with the network station investments planned over the 2023-2027 period.

($ Millions)	2018 Actuals	2019 Actuals	2020 Actuals	2021 Actuals	2022 Bridge	Total
Capital and Minor Fixed Assets	1.4	3.3	8.5	35.5	126.6	175.3
Less Removals	0.0	0.0	0.0	0.1	3.5	3.6
Gross Investment Cost	**1.4**	**3.3**	**8.5**	**35.4**	**123.1**	**171.7**
Less Capital Contributions	0.0	0.0	0.0	0.3	1.2	1.5
Net Investment Cost	**1.4**	**3.3**	**8.5**	**35.1**	**121.9**	**170.2**

e) B2-AMPCO-033 (b) & (d)

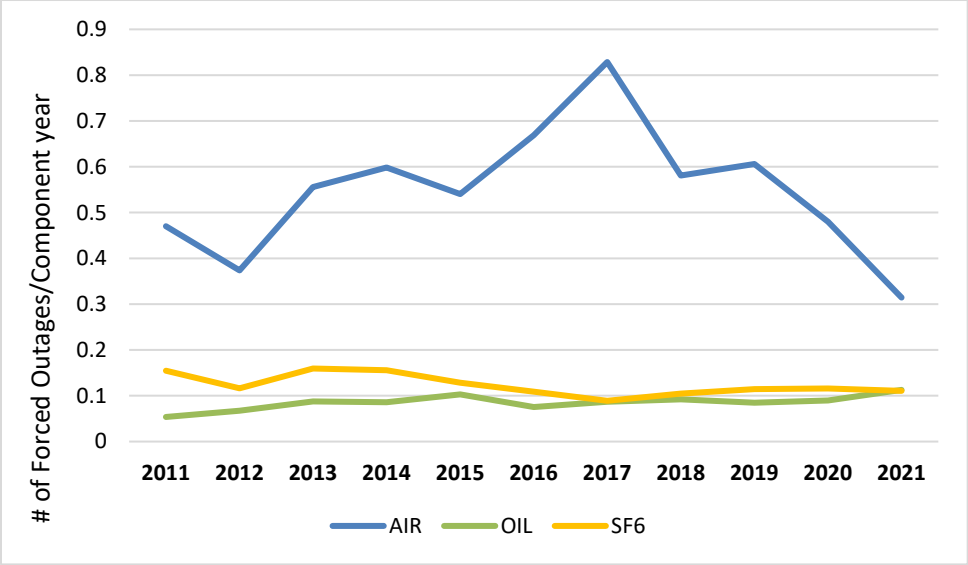
(b) T-SR-02 Table 3 for the period 2018 to 2022 has been provided below. The table only includes historical costs associated with the network station investments planned over the 2023-2027 period.

($ Millions)	2018 Actuals	2019 Actuals	2020 Actuals	2021 Actuals	2022 Forecast
Capital and Minor Fixed Assets	53.0	100.6	164.5	179.9	140.5
Less Removals	1.6	2.3	2.1	2.7	6.1
Gross Investment Cost	**51.5**	**98.3**	**162.4**	**177.1**	**134.4**
Less Capital Contributions	0.1	0.0	-0.1	0.3	0.0
Net Investment Cost	**51.6**	**98.3**	**162.3**	**176.8**	**134.4**

(d) This information is not readily available but the overall number of replaced units may be found in part t) below and Interrogatory O-SEC-265 Attachment 5.

f) B2-AMPCO-034 (b)

See updated T-SR-02 Figure 1 showing the Circuit Breaker forced outages by breaker type.



g) B2-AMPCO-036 (d)

T-SR-04 Table 3 for 2018-2022 period has been provided below.

($ Millions)	2018	2019	2020	2021	2022 (Forecast)
Gross Investment Cost	38.4	43.3	51.1	61.2	57.3
Less Removals	3.1	3.5	4.1	5.0	4.6
Capital and Minor Fixed Assets	**35.3**	**39.8**	**47.0**	**56.2**	**52.7**
Less Capital Contributions	0.0	0.0	0.0	0.0	0.0
Net Investment Cost	**35.3**	**39.8**	**47.0**	**56.2**	**52.7**

h) B2-AMPCO-037(c)

Please see below for number of wood poles replaced in 2010-2022:

2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021 A	2022 F
442	412	584	635	897	845	761	966	735	827	796	1003	1024

i) B2-AMPCO-38 (d)

T-SR-05 Table 4 - Investment Cost ($ Millions) for the period 2018 to 2022 is shown below.

($ Millions)	Actual				Forecast
	2018	2019	2020	2021	2022
Gross Investment Cost	37.7	11.1	8.1	16.2	22.6
Less Removals	0.0	0.0	0.0	0.0	0.0
Capital and Minor Fixed Assets	**37.7**	**11.1**	**8.1**	**16.2**	**22.6**
Less Capital Contributions	0.0	0.0	0.0	0.0	0.0
Net Investment Cost	**37.7**	**11.1**	**8.1**	**16.2**	**22.6**

j) B2-AMPCO-39 (c)

T-SR-06 Table 3 for the period 2018 to 2022 is shown below.

($ Millions)	2018 A	2019 A	2020 A	2021 A	2022 F
Gross Investment Cost	5.8	13.8	10.6	12.7	18.5
Less Removals	0.0	0.3	0.2	0.3	0.6
Capital and Minor Fixed Assets	**5.8**	**13.5**	**10.4**	**12.4**	**17.9**
Less Capital Contributions	0.0	0.0	0.0	0.0	0.0
Net Investment Cost	**5.8**	**13.5**	**10.4**	**12.4**	**17.9**

k) B2-AMPCO-40 (b) & (c)

(b) T-SR-07 Table 1 Shieldwire replacements for the 2018 to 2022 period are shown below.

Shieldwire	2018 Actual	2019 Actual	2020 Actual	2021 Actual	2022 Forecast
Units (Km)	209	119	42	352	333
% of Fleet	0.60%	0.34%	0.12%	1.01%	0.96%

(c) T-SR-07 Table 3 for the period 2018 to 2022 is shown below.

($M)	2018	2019	2020	2021 A	2022 F	Total
Gross Investment Cost	10.5	9.2	4.8	14.7	14.0	54.3
Less Removals	1.2	0.8	0.3	1.2	1.1	4.6
Capital and Minor Fixed Assets	**9.3**	**8.4**	**4.5**	**13.4**	**13.0**	**49.7**
Less Capital Contributions	0.0	0.0	0.0	0.0	0.0	0.0
Net Investment Cost	**9.3**	**8.4**	**4.5**	**13.4**	**13.0**	**49.7**

l) B2-AMPCO-041 (b) and (c)

(b) The table below shows the T-SR-08 insulator replacements for the 2018-2022 period

Insulators	**2018**	**2019**	**2020**	**2021**	**2022 (Forecast)**
Units	3900	4290	2794	3690	3544
% Of Fleet	3.3 %	3.6 %	2.3 %	3.1%	3.0 %

(c) The table below shows the T-SR-08 investment costs for the 2018-2022 period.

($ Millions)	**2018 Actual**	**2019 Actual**	**2020 Actual**	**2021 Actual**	**2022 Forecast**
Gross Investment Cost	71.1	85.3	62.1	61.0	74.6
Less Removals	5.7	6.8	5.0	5.1	6.0
Capital and Minor Fixed Assets	**65.4**	**78.5**	**57.1**	**55.9**	**68.6**
Less Capital Contributions	0.0	0.0	0.0	0.0	0.0
Net Investment Cost	**65.4**	**78.5**	**57.1**	**55.9**	**68.6**

m) B2-AMPCO-042 (b) & (c)

(b) Please see Interrogatory O-AMPCO-126 for T-SR-09 Figure 8 showing the frequency of COB/CP Insulator Failures

(c) The table below shows the insulators replacements for the 2010 to 2022 period.

2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022F**
638	878	210	433	233	155	2100	3422	3900	4290	2794	3690	3544

n) B2-AMPCO-043 (a)

The investment cost for T-SR-09 for the 2018-2022 period is shown below.

($ Millions)	**2018 Actual**	**2019 Actual**	**2020 Actual**	**2021 Actual**	**2022 Forecast**
Net Investment Cost	49.6	66.6	60.8	33.6	41.0

o) B2-AMPCO-044 (a) & (b)

(a) Three protection relays were replaced and put into service in 2021. The released project under this program for 2021 will be in-serviced by mid-2022.

(b) The table below shows the T-SR-10 investment costs for the 2021-2022 period.

($M)	2021 (Actual)	2022 (Forecast)
Gross Investment Cost	2.4	4.7
Less Removals	0.0	0.0
Capital and Minor Fixed Assets	**2.4**	**4.7**
Less Capital Contributions	0.0	0.0
Net Investment Cost	**2.4**	**4.7**

p) B2-AMPCO-047

The table below shows the T-SR-15 investment costs for the 2018-2022 period

($M)	2018	2019	2020	2021	2022 (Forecast)	Total
Gross Investment Cost	10.9	10.7	13.1	12.1	10.8	57.6
Less Removals	1.2	0.8	1.1	0.9	0.9	4.9
Capital and Minor Fixed Assets	**9.7**	**9.9**	**12.0**	**11.2**	**9.9**	**52.7**
Less Capital Contributions	0.0	0.0	0.0	0.0	0.0	0.0
Net Investment Cost	**9.7**	**9.9**	**12.0**	**11.2**	**9.9**	**52.7**

q) B2-AMPCO-050 (a) & (b)

(a) From 2018 to 2022 approximately 4.7 circuit km of underground cables is forecasted to be replaced.

(b) T-SR-18 Table 2 Investment Cost has been provided for the 2018-2022 period.

($ Millions)	2018	2019	2020	2021	2022	2018-2022 Total
Gross Investment Cost	0.4	1.0	2.8	2.35	25.1	41.1
Less Removals	0.0	0.0	0.0	0.0	0.0	0.0
Capital and Minor Fixed Assets	**0.4**	**1.0**	**2.8**	**2.5**	**25.1**	**41.1**
Less Capital Contributions	0.0	0.0	0.0	0.0	0.0	0.0
Net Investment Cost	**0.4**	**1.0**	**2.8**	**2.5**	**25.1**	**41.1**

r) B2-SEC-095

Please see O-AMPCO-118 Attachment 1.

s) B2-SEC-109

(a) T-SR-06 Tables 1 and 2 are shown below.

Table 1 - Tower Foundation Assess/Clean/Coat Program Revised

	Actuals				Forecast					
	2018	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Units	628	959	827	928	896	819	819	819	819	819
% of Fleet	1.3%	1.9%	1.7%	1.9%	1.8%	1.7%	1.7%	1.7%	1.7%	1.7%

Table 2 -Tower Member Refurbishment Program Revised

	Actuals				Forecast					
	2018*	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Units	N/A	413	233	542	533	533	533	533	533	533
% of Fleet	N/A	0.8%	0.5%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%

**The program began in 2019.*

(b) The breakdown of the annual costs of the T-SR-06 program is shown below.

$ Millions	Actuals				Forecast					
	2018	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Tower Foundation ACC Budget	4.7	10.8	8.4	9.2	11.3	11.1	11.3	11.5	11.7	11.9
Tower Member Refurbishment*	0.0	1.6	1.1	2.0	2.8	3.0	3.0	3.1	3.2	3.2
Tower Foundation Life Extension	1.1	1.1	0.9	1.2	3.8	4.1	4.2	4.3	4.4	4.4
Net Investment Cost	**5.8**	**13.5**	**10.4**	**12.4**	**17.9**	**18.2**	**18.5**	**18.9**	**19.2**	**19.6**

**The program began in 2019.*

t) JT-2.01

Please see Attachment 3.

B2-AMPCO-24-Attachment #1 This interrogatory has been updated to include the requested information for 2021.

Replacement History by ESL & Condition

TRANSMISSION ASSETS	Population	Expected Service Life (ESL) (Years)	total # replaced 2018 to 2020 (actual)	total # repaired 2018 to 2020 (actual)[1]	# replaced 2021 to 2022 (forecast)	2018 # replaced beyond ESL	2019 # replaced beyond ESL	2020 # replaced beyond ESL	2021 # replaced beyond ESL	2018 # replaced in poor condition	2019 # replaced in poor condition	2020 # replaced in poor condition	2021 # replaced in poor condition	2018 # replaced beyond ESL & in poor condition	2019 # replaced beyond ESL & in poor condition	2020 # replaced beyond ESL & in poor condition	2021 # replaced beyond ESL & in poor condition
Transformer	721	50	62	-[2]	40	28	16	14	10	28	24	14	10	28	16	14	10
Circuit Breakers	4,756	OCB - 55 Others - 40	358	-[2]	298	54	67	66	87	63	63	60	95	54	58	59	87
Protection Systems[3]																	
Electromechanical	1,784	45	347	-[2]	228	55	103	56	37				-				-
Solid State	3,077	25	294	-[2]	124	103	93	89	59				-				-
Microprocessor	7,633	20	248	-[2]	169	5	41	18	38				-				-
Conductors (circuit km)	28,552	ACSR - 90 Copper - 70 Aluminum - 100	214	-[2]	533	51	7	22	2	51	82	81	31	51	7	22	2
Poles - Wood	40,041	50	2,358	-[2]	2,046	735	827	796	1,003	735	827	796	1,003	735	827	796	1,003
Insulators	119,459	90	10,984	-[2]	7,311	-	-	-	-	3,900	4,290	2,794	3,690	-	-	-	-
Underground Cable (circuit km)	273	LPLF/HPLF - 70 XLPE - 50	4.7	-[2]	-	-	-	-	-	-	-	4.7	-	-	-	-	-

Notes

[1] Major repairs

[2] Not applicable as these assets are not repaired (i.e. they are replaced) or any repair work is relatively minor

[3] Please see Interrogatory B2-Staff-039 for further information regarding protection equipment replacements.

List of Material Capital Investments (EB-2019-0082 Exhibit B-1-1 TSP Section 3.3.6.1)

Table 5 - System Access - Material Capital Investments Proposed

		EB-2019-0082 (As Filed)					EB-2021-0110				
		Plan	Plan	Plan	Plan	Plan	Actual	Actual	Forecast	Forecast	Forecast
ISD	Investment Name	2020	2021	2022	2023	2024	2020	2021	2022	2023*	2024*
SA-01	Connect New IAMGOLD Mine	24.9	0.0	0.0	0.0	0.0	4.0	35.1	19.4	24.5	0.0
SA-02	Horner TS: Build a Second 230/27.6kV Station	29.9	0.0	0.0	0.0	0.0	31.3	17.5	0.5	0.0	0.0
SA-03	Halton TS: Build a Second 230/27.6kV Station	8.0	17.7	6.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7
SA-04	Connect Metrolinx Traction Substations	6.5	7.9	7.1	1.0	0.0	0.4	0.1	0.3	10.5	12.9
SA-05	Future Transmission Load Connection Plans	0.0	5.0	24.9	24.9	0.0	0.0	0.0	0.0	5.5	25.2
SA-06	Protection and Control Modifications for Distributed Generation	3.8	3.1	2.7	2.8	2.8	7.7	6.5	5.0	4.2	4.2
SA-07	Secondary Land Use Transmission Asset Modifications	55.1	15.0	13.9	15.6	3.9	15.6	16.0	19.1	10.3	5.2
System Access Projects & Programs Less Than $3M		**27.6**	**9.4**	**8.5**	**7.8**	**9.2**	**31.2**	**49.4**	**34.0**	**110.9**	**109.3**
Total Gross System Access Capital ($M)		**155.7**	**58.1**	**63.0**	**52.0**	**15.8**	**90.2**	**124.7**	**78.3**	**165.9**	**162.4**
Less Capital Contributions ($M)		*-130.9*	*-46.7*	*-51.3*	*-39.3*	*-11.7*	*-70.6*	*-54.8*	*-46.9*	*-82.3*	*-87.8*
Total Net System Access Capital ($M)		**24.8**	**11.3**	**11.7**	**12.7**	**4.1**	**19.5**	**69.6**	**31.5**	**83.6**	**74.6**

Table 6 - System Renewal - Material Capital Investments Proposed

ISD	Investment Name	2020	2021	2022	2023	2024	2020	2021	2022	2023*	2024*
SR-01	Air Blast Circuit Breaker Replacement Projects	107.5	128.4	133.5	129.2	98.7	177.8	186.0	130.4	158.2	131.1
SR-02	Station Reinvestment Projects	107.0	125.4	120.6	87.9	53.9	121.7	120.7	110.6	106.1	80.6
SR-03	Bulk Station Transformer Replacement Projects	33.2	51.8	72.5	131.5	113.8	15.1	22.1	63.1	112.9	102.1
SR-04	Bulk Station Switchgear and Ancillary Equipment Replacement Projects	17.5	32.4	41.4	34.6	49.3	12.2	24.9	47.2	76.9	60.2
SR-05	Load Station Transformer Replacement Projects	91.2	132.3	129.4	178.5	200.0	83.9	120.6	140.7	164.6	171.4
SR-06	Load Station Switchgear and Ancillary Equipment Replacement Projects	19.2	30.8	47.5	58.4	77.0	17.8	9.4	22.6	41.1	50.6
SR-07	Protection and Automation Replacement Projects	6.7	8.6	12.7	12.2	21.7	7.1	11.8	8.9	2.3	1.6
SR-08	John Transformer Station Reinvestment Project	3.5	17.9	25.6	24.0	20.9	0.0	0.0	0.0	0.3	0.4
SR-09	Transmission Station Demand and Spares and Targeted Assets	44.2	36.4	37.0	37.7	38.3	61.3	33.7	41.0	46.2	47.0
SR-10	Transformer Protection Replacement	3.8	0.0	0.0	0.0	0.0	0.3	0.1	0.6	0.0	0.0
SR-11	Legacy SONET System Replacement	4.1	26.0	27.6	28.1	28.1	0.4	0.6	4.6	20.5	30.9
SR-12	Telecom Performance Improvements	0.0	0.9	5.5	3.7	0.0	0.0	0.0	0.0	1.0	6.1
SR-13	ADSS Fibre Optic Cable Replacements	7.0	7.1	1.0	0.0	0.0	0.5	3.4	3.3	3.4	0.0
SR-14	Mobile Radio System Replacement	2.9	6.2	6.1	4.0	0.0	0.0	0.0	3.0	5.5	7.0
SR-15	Telecom Fibre IRU Agreement Renewals	0.0	2.8	8.5	2.6	1.5	0.0	0.0	8.5	2.8	1.5
SR-16	NERC CIP-014 Physical Security Implementation	18.0	18.0	18.0	0.0	0.0	24.2	24.2	15.1	0.0	0.0
SR-17	NERC CIP Transient Cyber Asset Project	3.5	0.0	0.0	0.0	0.0	1.1	0.6	7.6	0.0	0.0
SR-18	PSIT Cyber Equipment Replacement	1.0	5.0	7.7	7.0	3.4	2.9	2.3	8.3	0.0	0.0
SR-19	Transmission Line Refurbishment - End of Life ACSR, Copper Conductors & Structures	81.8	122.1	94.5	51.0	75.9	43.5	44.2	96.0	48.9	49.9
SR-20	Transmission Line Refurbishment - Near End of Life ACSR Conductor	62.2	63.4	111.7	117.8	137.7	0.1	0.0	0.0	6.7	64.9
SR-21	Wood Pole Structure Replacements	51.0	52.0	53.0	54.1	55.2	47.0	56.2	52.7	59.5	60.7
SR-22	Steel Structure Coating Program	11.4	21.8	22.3	22.7	23.2	8.1	16.2	22.6	24.9	25.3
SR-23	Tower Foundation Assess/Clean/Coat Program	11.8	22.3	22.8	23.3	23.7	8.4	9.2	11.3	11.1	11.3
SR-24	Transmission Line Shieldwire Replacement	12.3	12.6	12.8	13.1	13.4	4.5	13.4	12.9	12.7	12.9
SR-25	Transmission Line Insulator Replacement	68.3	69.7	66.3	67.6	68.9	57.1	55.9	68.6	82.6	82.1
SR-26	Transmission Line Emergency Restoration	9.6	9.8	10.0	10.2	10.4	12.0	11.2	9.9	10.7	10.9
SR-27	C5E/C7E Underground Cable Replacement	2.1	29.8	30.9	32.2	29.2	2.8	2.5	25.1	40.3	24.9
SR-28	OPGW Infrastructure Projects	5.3	7.5	2.2	6.2	9.7	0.1	0.0	11.2	17.0	11.3
SR-29	Physical Security ISL Application Replacement	5.0	1.1	0.0	0.0	0.0	4.3	3.4	0.0	0.0	0.0
System Renewal Projects & Programs Less Than $3M		**77.8**	**67.3**	**60.1**	**44.1**	**41.1**	**98.3**	**114.1**	**59.2**	**190.2**	**249.9**
Total Gross System Renewal Capital ($M)		**869.1**	**1109.2**	**1181.1**	**1181.5**	**1194.9**	**812.4**	**887.0**	**984.9**	**1246.1**	**1294.9**
Less Capital Contributions ($M)		*-3.8*	*-6.1*	*-8.3*	*-4.1*	*-1.1*	*-8.4*	*-16.3*	*-13.4*	*-6.3*	*-2.1*
Total Net System Renewal Capital ($M)		**865.2**	**1103.1**	**1172.8**	**1177.4**	**1193.8**	**804.0**	**870.7**	**971.5**	**1239.8**	**1292.8**

List of Material Capital Investments (EB-2019-0082 Exhibit B-1-1 TSP Section 3.3.6.1)

Table 7 - System Service - Material Capital Investments Proposed

ISD	Investment Name	2020	2021	2022	2023	2024	2020	2021	2022	2023*	2024*
SS-01	Lennox TS: Install 500kV Shunt Reactors	32.3	0.0	0.0	0.0	0.0	21.8	16.0	0.0	0.0	0.0
SS-02	Wataynikaneyap Line to Pickle Lake Connection	24.9	1.5	0.0	0.0	0.0	5.1	7.6	4.0	0.0	0.0
SS-03	Nanticoke TS: Connect HVDC Lake Erie Circuits	3.0	10.0	4.0	0.0	0.0	0.0	0.0	3.1	10.7	4.3
SS-04	East-West Tie Connection	46.3	38.8	22.6	0.0	0.0	68.1	36.4	20.0	1.1	0.0
SS-05	St. Lawrence TS: Phase Shifter Upgrade	9.0	18.0	9.0	0.0	0.0	0.9	39.2	37.8	12.6	0.0
SS-06	Merivale TS to Hawthorne TS: 230kV Conductor Upgrade	5.0	10.0	8.4	0.0	0.0	0.3	2.7	9.0	9.5	0.0
SS-07	Milton SS: Station Expansion and Connect 230kV Circuits	0.0	2.0	3.0	69.4	119.1	0.0	0.0	0.0	0.0	0.0
SS-08	Northwest Bulk Transmission Line	8.0	12.9	8.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SS-09	Barrie Area Transmission Upgrade	38.1	28.2	8.5	0.0	0.0	13.2	19.8	34.6	0.0	0.0
SS-10	Kapuskasing Area Transmission Reinforcement	6.7	3.8	0.0	0.0	0.0	16.6	4.9	2.3	0.0	0.0
SS-11	South Nepean Transmission Reinforcement	27.5	10.5	0.0	0.0	0.0	29.4	14.0	3.3	0.0	0.0
SS-12	Alymer-Tillsonburg Area Transmission Reinforcement	10.0	13.1	6.1	0.0	0.0	0.7	3.3	0.7	0.0	0.0
SS-13	Leamington Area Transmission Reinforcement	4.9	9.7	59.1	63.8	63.8	44.4	92.4	27.3	0.2	0.0
SS-14	Southwest GTA Transmission Reinforcement	10.3	7.8	6.9	3.9	2.0	0.6	0.2	4.1	6.8	7.9
SS-15	Future Transmission Regional Plans	0.0	0.0	10.5	19.6	0.0	0.0	0.0	0.0	11.3	21.1
SS-16	Customer Power Quality Program	3.3	3.4	3.4	3.4	3.5	1.2	0.1	0.0	0.0	0.0
System Service Projects & Programs Less Than $3M		**9.1**	**8.2**	**9.9**	**14.0**	**15.9**	**19.6**	**11.3**	**16.4**	**60.4**	**78.1**
Total Gross System Service Capital ($M)		**238.3**	**177.9**	**160.3**	**174.3**	**204.2**	**221.9**	**250.1**	**162.5**	**112.7**	**111.4**
Less Capital Contributions ($M)		*-34.2*	*-29.7*	*-8.5*	*0.0*	*0.0*	*-25.8*	*-31.4*	*-40.5*	*-17.1*	*-4.4*
Total Net System Service Capital ($M)		**204.1**	**148.2**	**151.8**	**174.3**	**204.2**	**196.1**	**218.6**	**122.0**	**95.6**	**107.0**

Table 8 - General Plant - Material Capital Investments Proposed

ISD	Investment Name	2020	2021	2022	2023	2024	2020	2021	2022	2023*	2024*
GP-01	Integrated System Operations Centre - New Facility Development	32.4	12.7	0.0	0.0	0.0	28.1	43.7	0.0	0.0	0.0
GP-02	Grid Control Network Sustainment	8.0	6.1	6.3	6.5	6.6	3.6	4.2	4.4	6.8	7.0
GP-03	Network Management System Capital Sustainment	0.0	7.8	22.4	8.2	0.0	5.0	9.6	16.6	8.0	0.0
GP-04	Integrated Voice Communications and Telephony System Refresh	0.0	1.9	3.2	1.1	0.0	0.0	0.1	3.2	1.0	0.0
GP-05	Transmission Non-Operational Data Management System	5.2	5.3	5.4	5.5	1.1	0.0	0.0	5.4	5.8	1.2
GP-06	Operating Common IT Infrastructure	0.8	2.0	3.7	3.3	2.2	0.0	1.9	2.0	3.6	3.1
GP-07	Hardware/Software Refresh and Maintenance	2.0	2.0	1.9	1.9	5.8	4.0	1.3	1.7	1.3	2.5
GP-08	Corporate Services Transformation - HR / Payroll	5.0	1.5	0.0	0.0	0.0	4.3	8.9	6.2	0.0	0.0
GP-09	Corporate Services Transformation - Finance	1.0	3.0	5.0	6.5	5.0	0.1	0.0	0.5	10.6	14.1
GP-10	Facility Accommodation & Improvements Service Centres & Admin	8.1	4.9	8.2	16.4	4.3	5.3	4.6	5.2	12.3	12.5
GP-11	Transmission Facilities & Site Improvements	9.4	9.5	9.6	9.7	9.9	11.4	11.2	9.6	10.2	10.4
GP-12	Transport & Work Equipment	13.2	13.2	13.3	13.3	13.3	8.8	6.4	9.7	21.9	22.4
General Plant Projects & Programs Less Than $3M		**30.2**	**24.3**	**15.8**	**11.1**	**10.7**	**54.2**	**35.8**	**38.2**	**73.0**	**57.3**
Total Gross System Service Capital ($M)		**115.4**	**94.4**	**94.7**	**83.6**	**58.9**	**124.7**	**127.7**	**102.8**	**154.5**	**130.5**
Total Net General Plant Capital ($M)		**115.4**	**94.4**	**94.7**	**83.6**	**58.9**	**124.7**	**127.7**	**102.8**	**154.5**	**130.5**

** The 2023-2027 forecast reflects updated inflation assumptions calculated using the methodology described in Section 2.3 of Exhibit O-01-02.*

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UNDERTAKING JT-2.01

Reference:

I-03-B2-AMPCO-28

Undertaking:

To update the table that was shown in IR B2-AMPCO-28 for those assets which may not be included in this as replacements related to system access and system service.

Response:

This interrogatory has been updated to include the requested information for 2021.

Replacements associated with System Access and System Service investments have been included in the table below. These investments materialize in much shorter timeframes and are typically driven by customer needs or system needs.

Projects	2018 Actual	2019 Actual	2020 Actual	2021 Actual	2022 F/Cast	2023 Test	2024 Test	2025 Test	2026 Test	2027 Test
System Renewal										
Circuit Breakers										
Circuit Breakers	-	3	1	2	-	-	-	-	-	-
Integrated Station Investment										
Transformers	28	24	10	10	19	30	18	27	21	24
Circuit Breakers	155	69	66	96	130	88	107	98	146	154
Protections	325	322	242	134	391	401	236	324	414	512
Overhead Lines Refurbishment Projects, Component Replacement Programs										
Wood Poles	735	827	796	1003	1024	1076	1076	1078	1082	1084
Conductors (circuit-km)	51	82	81*	31	515	19	300	338	235	679
Insulators	3900	4290	2794	3690	3544	3980	3980	3980	3980	3980
Protection and Automation										
Protections	-	-	-	3	21	42	42	42	42	42
Tx Transformers Demand and Spares										
Transformers	8	5	3	2	4	5	5	5	5	5
Circuit Breakers	1	0	1	4	2	2	2	2	2	2
Underground Lines Cable Refurbishment & Replacement										
Underground Cables (circuit-km)	-	-	4.7	-	-	-	-	7.2	-	-
System Access										
Load Customer Connection										
Breakers	-	-	-	-	-	-	-	6	-	-
Conductors (circuit-km)	-	-	8	-	-	-	-	-	-	17

*Hydro One is correcting this 2020 figure

Projects	2018 Actual	2019 Actual	2020 Actual	2021 Actual	2022 F/Cast	2023 Test	2024 Test	2025 Test	2026 Test	2027 Test
System Service										
Inter Area Network Transfer Capability										
Transformers	-	-	-	-	-	2	-	-	-	-
Conductors (circuit-km)	-	-	-	-	24	-	-	-	-	-
Local Area Supply Adequacy										
Transformers	-	-	-	1	2	-	-	-	-	-
Circuit Breakers	-	-	-	-	11	-	-	-	-	-
Protections	-	-	-	-	21	-	-	-	-	-
Conductors (circuit-km)	4	-	-	-	72	-	-	-	71	-

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 121

Reference:

Exhibit B2-AMPCO-034, part c)

Interrogatory:

a) Please provide the number of ABCBs replaced in 2021.

b) Please provide the number of ABCBs forecast to be replaced in 2022.

Response:

a) Nine ABCBs were replaced in 2021.

b) The requested information is related to Hydro One's original evidence, and thus is outside the scope of interrogatories permitted by Procedural Order 5. Hydro One is nevertheless providing it because it is readily available. None of the forecast 2022 breakers in B2-Staff-059 are ABCBs.

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 122

Reference:

Exhibit O-2-1
Exhibit B2-AMPCO-035

Interrogatory:

a) Part (c): Please provide the response to part (c) on the basis of total work completed under SR-03 for the period 2018-2022 (not only the sub-set of historical costs associated with the connection station investments planned over the 2023-2027 period).

b) Part (e): Please provide the number of transformers, breakers and protection systems replaced in 2021.

c) Part (e): Please provide the number of transformers, breakers and protection systems forecast to be replaced in 2022.

d) Part (f): Please provide total Detailed Investment Costs for all work over the 2018 - 2022 period (not only historical costs associated with the connection station investments planned over the 2023-2027 period).

Response:

a) Please see the table below from T-SR-03 Table 3 updated with 2021 actuals. As discussed in Interrogatory B2-Staff-078 Hydro One adjusted its ISD framework in this Application by combining investments that address common station types or objectives i.e. network stations, connection stations and ABCBs. Investments presented in the previous Application that were not planned for the 2023-2027 period were not mapped to this Application's ISD framework and this information is not readily available. Therefore, the table only includes historical costs associated with the connection station investments planned over the 2023-2027 period. Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

($ Millions)	2018 Actuals	2019 Actuals	2020 Actuals	2021 Actuals	2022 Bridge	Total
Capital and Minor Fixed Assets	8.5	13.7	34.3	112.5	223.3	392.3
Less Removals	0.0	1.0	0.5	0.7	6.6	8.8
Gross Investment Cost	**8.5**	**12.6**	**33.9**	**111.8**	**216.7**	**383.5**
Less Capital Contributions	0.0	0.7	0.9	2.0	10.3	13.9
Net Investment Cost	**8.5**	**12.0**	**32.9**	**109.8**	**206.5**	**369.7**

b) As discussed in Interrogatory B2-AMPCO-035, this information is not readily available for connection station investments, but the overall number of major station assets replaced may be found in Interrogatory O-AMPCO-120, part t) and O-SEC-265, Attachment 5.

c) Please see part b) above.

d) Please see the table below from T-SR-03 Appendix B updated with 2021 actuals. Please see part a) above for an explanation regarding the historical expenditures and 2022 forecast.

ISD Ref.	Station Name	EB-2019-0082	Type	Net Capital Investment ($ Millions)						In Service Year
				2018 Actuals	2019 Actuals	2020 Actuals	2021 Actuals	2022 Bridge	23-27 Total	
T-SR-03.01	Parry Sound TS	SR-05	E	0.1	0.4	0.9	7.4	8.3	8.6	2022
T-SR-03.02	Port Colborne TS	SR-02	E	0.0	1.0	3.0	16.0	7.3	9.7	2022
T-SR-03.03	Main TS	SR-05	E	3.3	1.4	4.1	6.8	10.5	4.2	2023
T-SR-03.04	Wilson TS	SR-05	P	0.1	0.4	0.8	4.6	21.3	15.0	2023
T-SR-03.05	Wonderland TS	SR-02	P	0.0	0.9	1.8	1.1	10.7	7.4	2023
T-SR-03.06	Moose Lake TS	SR-05	P	0.3	0.5	0.1	0.3	0.6	6.9	2023
T-SR-03.07	Orangeville TS	SR-05	E	0.2	0.5	3.5	12.7	10.1	15.8	2023
T-SR-03.08	Lambton TS	SR-02	P	0.0	0.4	1.9	6.3	24.4	17.9	2023
T-SR-03.09	Crowland TS	SR-05	P	0.0	0.1	0.3	1.3	14.1	20.5	2023
T-SR-03.10	Slater TS	SR-02	E	0.1	0.5	0.4	1.3	7.9	16.7	2023
T-SR-03.11	Lincoln Heights TS	-	P	0.0	0.0	0.4	0.7	2.9	17.8	2023
T-SR-03.12	Arnprior TS	SR-02	E	0.6	1.2	0.8	4.6	9.1	14.2	2023
T-SR-03.13	John TS	-	P	0.0	0.0	0.2	0.9	2.3	19.0	2024
T-SR-03.14	Rexdale TS	SR-06	E	0.6	0.6	0.2	2.9	10.0	15.6	2024
T-SR-03.15	Kirkland Lake TS	SR-06	P	0.5	0.7	1.3	1.1	6.8	14.8	2024
T-SR-03.16	Fairbank TS	SR-02	E	1.3	-0.2	8.8	25.5	13.0	33.8	2024
T-SR-03.17	Bridgman TS	SR-05	E	0.6	0.7	1.8	11.5	18.9	32.1	2024
T-SR-03.18	Murray TS	SR-05	P	0.0	0.2	0.2	0.0	2.6	37.9	2024

ISD Ref.	Station Name	EB-2019-0082	Type	Net Capital Investment ($ Millions)						In Service Year
				2018 Actuals	2019 Actuals	2020 Actuals	2021 Actuals	2022 Bridge	23-27 Total	
T-SR-03.19	Lauzon TS	SR-05	P	0.0	0.1	0.3	1.2	3.8	38.5	2024
T-SR-03.20	Longueuil TS	SR-05	P	0.0	0.0	0.1	0.5	1.6	15.6	2024
T-SR-03.21	Bridgman TS	-	P	0.0	0.0	-0.3	0.6	-3.0	6.9	2024
T-SR-03.22	Riverdale TS	-	P	0.0	0.0	0.0	0.0	0.3	6.9	2024
T-SR-03.23	Port Arthur TS #1	SR-06	P	0.0	0.0	0.0	0.2	1.1	24.1	2025
T-SR-03.24	Port Hope TS	SR-05	P	0.0	0.0	0.0	0.0	0.1	24.9	2025
T-SR-03.25	Manby TS	-	P	0.0	0.0	0.0	0.0	0.8	16.5	2025
T-SR-03.26	Elliot Lake TS	SR-05	P	0.0	0.0	0.3	0.2	2.1	21.8	2025
T-SR-03.27	Preston TS	SR-05	P	0.0	0.0	0.0	0.0	0.6	23.3	2025
T-SR-03.28	Wallace TS	SR-05	P	0.0	0.0	0.0	0.0	0.5	20.7	2025
T-SR-03.29	Bermondsey TS	SR-05	P	0.0	0.0	0.0	0.0	0.5	20.8	2025
T-SR-03.30	Scarboro TS	-	P	0.0	0.0	0.0	0.1	0.5	9.6	2025
T-SR-03.31	Newton TS	-	P	0.0	0.0	0.1	0.1	1.2	11.6	2025
T-SR-03.32	St. Andrews TS	SR-02	P	0.0	0.0	0.0	0.4	0.3	45.6	2025
T-SR-03.33	Picton TS	-	P	0.0	0.0	0.0	0.0	0.6	14.2	2025
T-SR-03.34	Midhurst TS	-	P	0.0	0.0	0.0	0.0	0.4	9.1	2025
T-SR-03.35	Orillia TS	-	P	0.0	0.0	0.0	0.0	0.3	7.9	2025
T-SR-03.36	Bracebridge TS	-	P	0.0	0.0	0.0	0.0	0.3	8.0	2026

ISD Ref.	Station Name	EB-2019-0082	Type	Net Capital Investment ($ Millions)						In Service Year
				2018 Actuals	2019 Actuals	2020 Actuals	2021 Actuals	2022 Bridge	23-27 Total	
T-SR-03.37	Charles TS	SR-05	P	0.0	0.0	0.0	0.0	0.6	30.9	2026
T-SR-03.38	Manby TS	-	P	0.0	0.0	0.0	0.0	0.2	21.7	2026
T-SR-03.39	Russell TS	SR-05	P	0.0	0.0	0.0	0.0	0.2	25.4	2026
T-SR-03.40	Duplex TS	SR-05	P	0.0	0.0	0.0	0.0	0.5	23.0	2026
T-SR-03.41	Lake TS	SR-06	P	0.0	0.0	0.0	0.5	2.6	32.5	2026
T-SR-03.42	Bunting TS	SR-06	P	0.0	0.6	0.6	0.7	1.9	37.9	2026
T-SR-03.43	Nebo TS	-	P	0.0	0.0	0.0	0.0	0.0	20.0	2026
T-SR-03.44	Palermo TS	SR-05	P	0.0	0.0	0.0	0.0	0.2	20.4	2026
T-SR-03.45	Carlton TS	SR-02	P	0.6	1.4	0.1	0.1	0.3	35.0	2026
T-SR-03.46	Birmingham TS	SR-05	P	0.0	0.0	0.0	0.0	0.2	26.8	2026
T-SR-03.47	Carling TS	-	P	0.0	0.0	0.0	0.0	0.0	9.4	2026
T-SR-03.48	Cherrywood TS	SR-06	P	0.0	0.0	0.0	0.0	0.3	16.1	2026
T-SR-03.49	Gage TS	SR-05	P	0.0	0.0	0.0	0.0	0.2	26.2	2026
T-SR-03.50	Woodbridge TS	SR-05	P	0.0	0.0	0.0	0.0	0.2	13.1	2027
T-SR-03.51	Fairchild TS	SR-05	P	0.0	0.0	0.0	0.0	0.2	42.3	2027
T-SR-03.52	Cedar TS	SR-05	P	0.0	0.0	0.0	0.0	0.7	24.2	2027
T-SR-03.53	Halton TS	SR-07	P	0.0	0.0	0.0	0.0	0.1	10.6	2027
T-SR-03.54	Waubaushene TS	-	P	0.0	0.0	0.0	0.0	0.1	18.6	2027

ISD Ref.	Station Name	EB-2019-0082	Type	Net Capital Investment ($ Millions)						In Service Year
				2018 Actuals	2019 Actuals	2020 Actuals	2021 Actuals	2022 Bridge	23-27 Total	
T-SR-03.55	Kent TS	SR-02	P	0.0	0.0	0.0	0.0	0.1	29.5	2027
T-SR-03.56	Muskoka TS	SR-06	P	0.0	0.0	0.0	0.0	0.0	8.0	2027
T-SR-03.57	Timmins TS	-	P	0.0	0.0	0.0	0.0	0.0	9.0	2027
T-SR-03.58	Glendale TS	SR-02	P	0.1	0.6	0.9	0.1	5.0	49.9	2027
T-SR-03.59	Vansickle TS	SR-06	P	0.0	0.0	0.0	0.0	0.0	12.0	2027
T-SR-03.60	Dundas TS	SR-06	P	0.0	0.0	0.0	0.0	0.0	12.1	2027
T-SR-03.61	Mohawk TS	SR-06	P	0.0	0.0	0.0	0.0	0.0	10.3	2027
T-SR-03.62	Bathurst TS	SR-05	P	0.0	0.0	0.0	0.0	0.0	18.4	2027
T-SR-03.63	Leslie TS	SR-05	P	0.0	0.0	0.0	0.0	0.0	35.7	2027
T-SR-03.64	Burlington TS	SR-06	P	0.0	0.0	0.0	0.0	0.0	11.9	2027
T-SR-03.65	Alliston TS	-	P	0.0	0.0	0.0	0.0	0.0	17.6	2028
T-SR-03.66	Dobbin TS	-	P	0.0	0.0	0.0	0.0	0.2	98.4	2028
T-SR-03.67	Strachan TS	SR-05	P	0.0	0.0	0.0	0.0	0.0	39.4	2028
T-SR-03.68a	Clarke TS	-	P	0.0	0.0	0.0	0.0	0.0	21.5	2028
T-SR-03.68b	Clarke TS	SR-05	P	0.0	0.0	0.0	0.0	0.0	24.3	2028
T-SR-03.69	Albion TS	-	P	0.0	0.0	0.0	0.0	0.0	40.3	2028
T-SR-03.70	Bilberry Creek TS	SR-05	P	0.0	0.0	0.0	0.0	0.0	22.6	2028
T-SR-03.71	Talbot TS	-	P	0.0	0.0	0.0	0.0	0.0	25.8	2028

ISD Ref.	Station Name	EB-2019-0082	Type	Net Capital Investment ($ Millions)						In Service Year
				2018 Actuals	2019 Actuals	2020 Actuals	2021 Actuals	2022 Bridge	23-27 Total	
T-SR-03.72	Havelock TS	-	P	0.0	0.0	0.0	0.0	0.0	17.3	2028
T-SR-03.73	Lisgar TS	-	P	0.0	0.0	0.0	0.0	0.0	11.1	2028
T-SR-03.74	Duplex TS	-	P	0.0	0.0	0.0	0.0	0.0	19.5	2028
T-SR-03.75	Crystal Falls TS	-	P	0.0	0.0	0.0	0.0	0.0	22.8	2028
T-SR-03.76	Douglas Point TS	-	P	0.0	0.0	0.0	0.0	0.0	22.1	2028
T-SR-03.77	Trout Lake TS	-	P	0.0	0.0	0.0	0.0	0.0	15.8	2028
T-SR-03.78	Lauzon TS	-	P	0.0	0.0	0.0	0.0	0.0	26.0	2028
T-SR-03.79	Galt TS	-	P	0.0	0.0	0.0	0.0	0.0	10.1	2028
T-SR-03.80	Martindale TS	-	P	0.0	0.0	0.0	0.0	0.0	20.8	2028
T-SR-03.81	Bruce B HWP TS	-	P	0.0	0.0	0.3	0.0	0.0	20.6	2028
T-SR-03.82	Campbell TS	SR-06	P	0.0	0.0	0.0	0.0	0.0	16.4	2028
T-SR-03.83	Bramalea TS	-	P	0.0	0.0	0.0	0.0	0.0	14.0	2028
T-SR-03.84	Erindale TS	SR-07	P	0.0	0.0	0.0	0.0	0.0	15.9	2028
T-SR-03.85	Gardiner TS	-	P	0.0	0.0	0.0	0.0	0.0	18.1	2028
T-SR-03.86	Morrisburg TS	-	P	0.0	0.0	0.0	0.0	0.0	4.7	2028
T-SR-03.87	Nepean TS	-	P	0.0	0.0	0.0	0.0	0.0	11.6	2028
T-SR-03.88	Beach TS	-	P	0.0	0.0	0.0	0.0	0.0	25.4	2028
T-SR-03.89	Port Arthur TS #1	-	P	0.0	0.0	0.0	0.0	0.0	8.8	2028

ISD Ref.	Station Name	EB-2019-0082	Type	Net Capital Investment ($ Millions)						In Service Year
				2018 Actuals	2019 Actuals	2020 Actuals	2021 Actuals	2022 Bridge	23-27 Total	
T-SR-03.90	South March TS	-	P	0.0	0.0	0.0	0.0	0.0	14.0	2028
T-SR-03.91	Clarabelle TS	-	P	0.0	0.0	0.0	0.0	0.0	12.6	2028
T-SR-03.92	Tomken TS	-	P	0.0	0.0	0.0	0.0	0.0	14.8	2029
T-SR-03.93	Malvern TS	-	P	0.0	0.0	0.0	0.0	0.0	9.8	2029
T-SR-03.94	Allanburg TS	-	P	0.0	0.0	0.0	0.0	0.0	6.4	2029
T-SR-03.95	Caledonia TS	-	P	0.0	0.1	0.2	0.0	0.0	6.2	2029
T-SR-03.96	Finch TS	SR-06	P	0.0	0.0	0.0	0.0	0.0	8.3	2029
T-SR-03.97	Tomken TS	-	P	0.0	0.0	0.0	0.0	0.0	9.1	2029
T-SR-03.98	Murray TS	-	P	0.0	0.0	0.0	0.0	0.0	7.5	2029
T-SR-03.99	Lake TS	-	P	0.0	0.0	0.0	0.0	0.0	14.1	2029
T-SR-03.100	Stratford TS	-	P	0.0	0.1	0.5	0.0	0.0	9.6	2029
T-SR-03.101	Bramalea TS	SR-07	P	0.0	0.0	0.3	0.0	0.0	5.4	2030
T-SR-03.102	Fergus TS	-	P	0.0	0.0	0.1	0.0	0.0	2.2	2030
Net Investment Cost				**8.5**	**12.0**	**33.1**	**109.8**	**206.5**	**1975.8**	

O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 123

Reference:

Exhibit O-2-1

Exhibit I-03-B2-AMPCO-032, part f)

Interrogatory:

a) Please provide Appendix B Detailed Investment Costs for the period 2018 to 2022 for total costs including 2021 actuals and 2022 forecast (not only historical costs associated with the network station investments planned over the 2023-2027 period).

b) Please identify the investments in part (a) not undertaken and explain why.

Response:

a) Please see the table below from T-SR-01 Appendix B updated with 2021 actuals. As discussed in Interrogatory B2-Staff-078 Hydro One adjusted its ISD framework in this Application by combining investments that address common station types or objectives i.e. network stations, connection stations and ABCBs. Investments presented in the previous Application that were not planned for the 2023-2027 period were not mapped to this Application's ISD framework and this information is not readily available. Therefore, the table only includes historical costs associated with the network station investments planned over the 2023-2027 period. Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

ISD Ref.	Station Name	EB-2019-0082	Type	Net Capital Investment ($ Millions)						In Service Year
				2018 Actuals	2019 Actuals	2020 Actuals	2021 Actuals	2022 Bridge	23-27 Total	
T-SR-01.01	Claireville TS	SR-04	E	0.5	0.7	0.8	8.5	7.9	9.0	2023
T-SR-01.02	Seaforth TS	SR-03	P	0.1	0.2	0.5	2.6	28.5	21.2	2023
T-SR-01.03	Fort Frances TS	SR-03	P	0.0	0.2	0.3	0.3	7.2	12.6	2023

ISD Ref.	Station Name	EB-2019-0082	Type	Net Capital Investment ($ Millions)						In Service Year
				2018 Actuals	2019 Actuals	2020 Actuals	2021 Actuals	2022 Bridge	23-27 Total	
T-SR-01.04	Keith TS	SR-03	E	0.4	0.4	1.8	12.1	15.0	11.6	2023
T-SR-01.05	Whitedog Falls SS	-	P	0.0	0.1	0.4	0.2	3.6	3.9	2023
T-SR-01.06	Milton SS	SR-04	P	0.0	0.0	0.5	0.6	4.8	13.3	2023
T-SR-01.07	Rabbit Lake SS	SR-04	P	0.2	0.3	0.8	3.6	10.4	11.5	2023
T-SR-01.08	Lakehead TS	SR-04	P	0.1	0.0	0.4	0.2	12.5	22.8	2024
T-SR-01.09	Sarnia Scott TS	SR-03	P	0.0	0.2	0.8	0.2	2.7	22.5	2024
T-SR-01.10	Kenora TS	SR-04	P	0.0	0.0	0.0	0.2	1.9	14.4	2025
T-SR-01.11	Marathon TS	SR-04	P	0.1	0.0	0.3	0.5	2.0	12.3	2025
T-SR-01.12	Wawa TS	SR-02	P	0.1	0.1	0.5	0.9	6.9	38.5	2025
T-SR-01.13	Lakehead TS	-	P	0.0	0.0	0.0	0.0	4.4	25.5	2025
T-SR-01.14	Middleport TS	SR-03	P	0.0	0.0	0.0	0.2	0.5	30.7	2025
T-SR-01.15	Porcupine TS	SR-03	P	0.0	0.0	0.5	0.7	5.1	75.3	2025
T-SR-01.16	Essa TS	-	P	0.0	0.0	0.0	0.0	0.5	37.7	2025
T-SR-01.17	Mackenzie TS	SR-04	P	0.0	0.8	0.4	3.2	3.3	49.0	2025
T-SR-01.18	Algoma TS	SR-03	P	0.0	0.0	0.2	0.1	0.8	30.1	2026
T-SR-01.19	Des Joachims TS	-	P	0.0	0.0	0.0	0.0	0.0	7.1	2026
T-SR-01.20	Otto Holden TS	SR-03	P	0.0	0.2	0.4	0.0	2.2	64.6	2026
T-SR-01.21	Ansonville TS	-	P	0.0	0.0	0.0	0.0	0.0	9.1	2027

ISD Ref.	Station Name	EB-2019-0082	Type	Net Capital Investment ($ Millions)						In Service Year
				2018 Actuals	2019 Actuals	2020 Actuals	2021 Actuals	2022 Bridge	23-27 Total	
T-SR-01.22	Manby TS	SR-03	P	0.0	0.0	0.0	0.3	0.7	54.4	2027
T-SR-01.23	Fort Frances TS	-	P	0.0	0.0	0.0	0.0	0.0	21.6	2027
T-SR-01.24	Merivale TS	SR-04	P	0.0	0.0	0.0	0.5	0.4	176.6	2027
T-SR-01.25	Beach TS	SR-03	P	0.0	0.0	0.0	0.3	0.4	46.7	2028
T-SR-01.26	Lennox TS	-	P	0.0	0.0	0.0	0.0	0.0	33.1	2028
T-SR-01.27	Buchanan TS	SR-03	P	0.0	0.0	0.0	0.0	0.0	34.6	2028
T-SR-01.28	Owen Sound TS	SR-06	P	0.0	0.0	0.0	0.0	0.0	22.7	2028
T-SR-01.29	Kenora TS	-	P	0.0	0.0	0.0	0.0	0.0	11.4	2028
T-SR-01.30	Mississagi TS	SR-04	P	0.0	0.0	0.0	0.0	0.0	23.3	2028
T-SR-01.31	Hawthorne TS	-	P	0.0	0.0	0.0	0.0	0.0	28.6	2028
T-SR-01.32	Cataraqui TS	-	P	0.0	0.0	0.0	0.0	0.0	26.3	2028
T-SR-01.33	Claireville TS	-	P	0.0	0.0	0.0	0.0	0.0	23.2	2029
T-SR-01.34	Beck 2 TS	-	P	0.0	0.0	0.0	0.0	0.0	9.9	2029
T-SR-01.35	Claireville TS	-	P	0.0	0.0	0.0	0.0	0.0	11.5	2029
	Net Investment Cost			**1.4**	**3.4**	**8.5**	**35.1**	**121.9**	**1046.3**	

b) All investments included in part a) above are planned to be undertaken.

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 124

Reference:

Exhibit O-2-1
Exhibit B2-AMPCO-033, part e)

Interrogatory:

a) Please provide Appendix B Detailed Investment Costs for the period 2018 to 2022 for total costs including 2021 actuals and 2022 forecast (not only historical costs associated with the network station investments planned over the 2023-2027 period).

b) Please identify the investments in part (a) not undertaken and explain why.

Response:

a) Please see the table below from T-SR-02 Appendix B updated with 2021 actuals. As discussed in Interrogatory B2-Staff-078 Hydro One adjusted its ISD framework in this Application by combining investments that address common station types or objectives i.e. network stations, connection stations and ABCBs. Investments presented in the previous Application that were not planned for the 2023-2027 period were not mapped to this Application's ISD framework and this information is not readily available. Therefore, the table only includes historical costs associated with the ABCB investments planned over the 2023-2027 period. Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

ISD Ref.	Station Name	EB-2019-0082	Type	Net Capital Investment ($ Millions)						In Service Year
				2018 A	2019 A	2020 A	2021 A	2022 F	23-27 Total	
T-SR-02.01	Cherrywood TS	SR-01	E	16.2	26.2	26.7	7.1	14.0	16.2	2023
T-SR-02.02	Beck 2 TS	SR-01	E	13.7	12.0	11.4	11.4	17.6	12.1	2023
T-SR-02.03	Bruce B SS	SR-01	E	0.9	1.5	46.3	84.9	24.5	47.6	2024
T-SR-02.04	Cherrywood TS	SR-01	E	0.0	0.7	4.4	22.2	16.9	40.4	2025

ISD Ref.	Station Name	EB-2019-0082	Type	Net Capital Investment ($ Millions)						In Service Year
				2018 A	2019 A	2020 A	2021 A	2022 F	23-27 Total	
T-SR-02.05	Middleport TS	SR-01	E	3.9	29.3	35.3	21.1	9.9	31.1	2025
T-SR-02.06	Nanticoke TS	SR-01	E	0.6	4.9	16.7	13.6	9.3	24.5	2025
T-SR-02.07	Lennox TS	SR-01	E	15.5	18.0	12.5	10.8	9.5	37.9	2026
T-SR-02.08	Beck 1 SS	SR-01	E	0.7	5.9	7.8	3.3	4.9	4.8	2026
T-SR-02.09	Bruce A TS	SR-01	P	0.0	0.0	0.8	2.1	23.6	224.7	2027
T-SR-02.10	Essa TS	-	P	0.0	0.0	0.3	0.3	3.3	76.9	2027
T-SR-02.11	Cherrywood TS	-	P	0.0	0.0	0.0	0.0	0.8	89.5	2028
	Total			**51.6**	**98.5**	**162.3**	**176.8**	**134.4**	**605.8**	

b) All investments included in part a) above are planned to be undertaken.

O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 125

Reference:

Exhibit JT-1.24

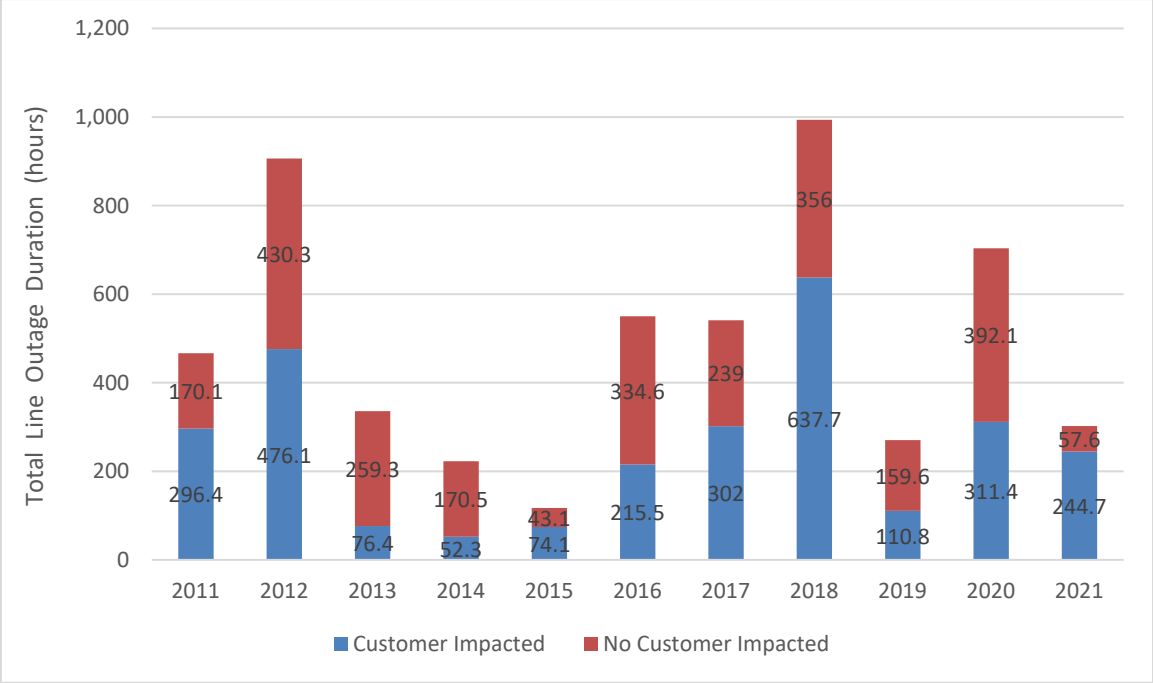
Interrogatory:

Please add 2021 data to the response.

Response:

Hydro One is providing the requested information as it is readily available notwithstanding that it not directly related to the direction provided in Procedural Order 5 and the 2021 financial information included in Hydro One's updated evidence.

T-SR-03 Figure 3 (forced outage duration due to wood pole failures) is split into two parts: "Customer Impacted" and "No Customer Impacted".



Witness: JABLONSKY Donna

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 126

Reference:

Exhibit JT-1.25

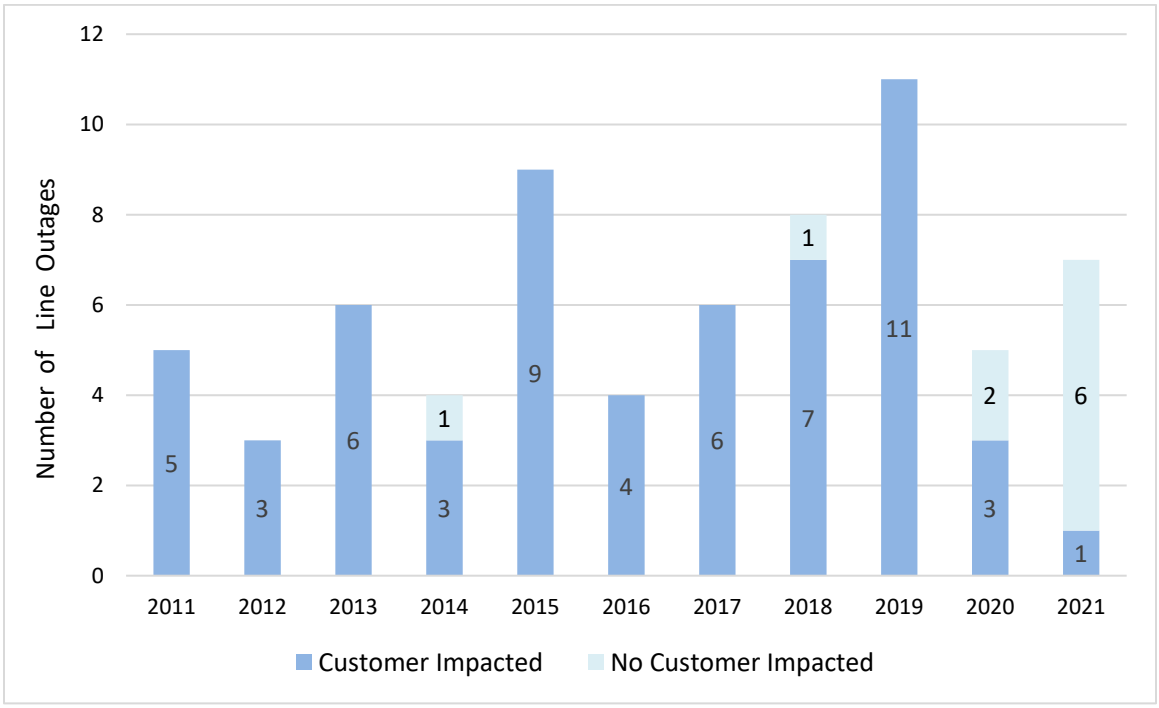
Interrogatory:

Please add 2021 data to the response.

Response:

Hydro One is providing the requested information as it is readily available notwithstanding that it not directly related to the direction provided in Procedural Order 5 and the 2021 financial information included in Hydro One's updated evidence.

T-SR-09 Figure 8 (number of COB and CP insulator failures) is split into two parts: "Customer Impacted" and "No Customer Impacted".



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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 127

Reference:

Exhibit O-2-1, Page 8

Interrogatory:

System Renewal capital expenditures were $14.7M higher than the OEB-approved amount of $237.3M. This increase was primarily due to trouble call and storm damage response expenditures exceeding forecasts by $32.4M, which were partially offset by the reduction of other planned work.

Please provide the specific reductions to planned work and explain how this was achieved.

Response:

Please see the Capital Performance Report update in I-22-O-SEC-264.

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 128

Reference:

Exhibit O-2-1, Page 8

Interrogatory:

2021 actuals for System Service expenditures were $33.3M lower than the OEB-approved amount of $144.1M. These reductions were primarily to accommodate increases in non-discretionary System Access expenditures. Reductions were achieved through deferrals of load growth projects.

a) Please provide the list of load growth projects deferred and the revised timeframe.

b) Please discuss any forecast changes to the 2022 plan and beyond for D-SS-01: System Upgrades Driven by Load Growth.

Response:

a) Load growth projects deferred for 2021 are as follows:

Load Growth Project	Project Start Year
City of Owen Sound Tie-Line Reinforcement	2023
Bradford North DS	2024
Lively DS F2 Upgrade - Black Lake Rd	2025
Elk Lake Voltage Conversion	2027
Mar DS	2023
Beaverton M29 extension	2027
Dundas TS #2 New Feeders	Beyond 2027
Dresden Area Load Relief	2023
Ancaster Area Load Relief	2026
Elora Area Load Relief	2026
Alma Area Load Relief	2027
Hawthorne TS M1 Load Growth	2023
Almonte TS M28 Load Growth	2025
Elginburg DS F2 and Station Load Growth	2022
Taylor Kidd DS F1 Load Growth	2022
Stewartville TS Load Growth	2026
Kemptville 8kV Load Growth	2022

Chesterville TS Load Growth	2025
Grand Bend Express Feeder - Load Growth	2022
Saugeen Shores DS and Port Elgin Load Growth	2022
Industrial Road DS - F2 - Upgrade Moxam Landing	2023
Millbrook Area Load Growth	2022
Margach DS F3 Offload SD 3201 (SW485)	2027
Elmhurst Beach DS	2025
Kleinburg TS M26 Extension	2026
Brown Hill TS M4 Extension	Beyond 2027
Chesterville M1 Load Growth	Beyond 2027
Morrisburg TS M25 Load Growth	Beyond 2027
Park Road DS- F1 Load Relief	Beyond 2027
Mar DS Red Bay Line Upgrade	2023
Pelham Load Relief	Beyond 2027.

b) Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 129

Reference:

Exhibit O-2-1, Page 8

Interrogatory:

In 2021, General Plant expenditures were $75.8M higher than the OEB-approved amount of $95.3M. This variance was primarily due to the timing of the ISOC and Information Solutions business enablement projects to modernize processes.

Please provide specific details on the reasons for the variance in General Plant.

Response:

For specific details on the variance in General Plant, please refer to Section 3.0 in the General Plant 2021 Capital Program Performance Report, provided in O-Staff-362, Attachment 1.

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 130

Reference:

Exhibit O-2-1

Interrogatory:

Please update the following interrogatories to include 2021 year-end actuals.

a) B3-AMPCO-055
b) B3-AMPCO-056
c) B3-AMPCO-058
d) B3-AMPCO-80
e) B3-AMPCO-088
f) B3-AMPCO-090
g) B3-AMPCO-091

Response:

a) See Attachment 1
b) See Attachment 2
c) See Attachment 3
d) See Attachment 4
e) See Attachment 5. For B3-AMPCO-088 part d), please refer to I-22-O-SEC-266 part d)
f) See Attachment 6
g) See Attachment 7

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B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 055

Reference:

Exhibit B-3-1, DSP Section 3.2

Interrogatory:

Please provide a table that sets out the percentage contribution to SAIDI for each of the years 2010 to 2021 for the following assets excluding Force Majeure:

- Transformer
- Pole
- Cross arm
- Overhead conductor
- Underground cable
- Submarine cable
- Overhead transformer
- Underground transformer
- Vegetation outages (tree caused)

Response:

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Cross Arm	1.78%	1.13%	0.81%	1.25%	2.57%	0.69%	1.17%	1.41%	1.14%	0.62%	1.25%
Station Transformer	0.10%	0.04%	0.89%	0.22%	0.08%	0.20%	0.62%	0.29%	0.14%	0.26%	0.09%
Overhead Conductor	3.43%	3.31%	3.73%	6.91%	3.38%	2.47%	2.73%	4.44%	4.63%	3.40%	3.29%
Overhead Transformer	0.34%	0.21%	0.27%	0.24%	0.36%	0.14%	0.15%	0.17%	0.15%	0.15%	0.18%
Pole	2.53%	3.42%	2.19%	3.00%	4.93%	2.79%	2.14%	3.05%	2.64%	3.80%	4.17%
Submarine Conductor	2.00%	0.39%	0.50%	0.50%	0.49%	0.51%	0.39%	0.52%	0.24%	0.52%	0.39%
Underground Conductor	0.17%	0.19%	0.08%	0.33%	0.08%	0.08%	0.16%	0.20%	0.30%	0.08%	0.11%
Underground Transformer	0.05%	0.02%	0.08%	0.03%	0.04%	0.02%	0.02%	0.03%	0.03%	0.03%	0.05%
Vegetation	27.20%	31.02%	28.61%	27.30%	29.41%	38.01%	44.70%	40.51%	33.56%	42.37%	41.65%

Witness: FALTAOUS Peter

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B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 056

Reference:

Exhibit B-3-1, DSP Section 3.2

Interrogatory:

Please provide a table that sets out the percentage contribution to SAIFI for each of the years 2010 to 2021 for the following assets excluding Force Majeure:

- Transformer
- Pole
- Cross arm
- Overhead conductor
- Underground cable
- Submarine cable
- Overhead transformer
- Underground transformer
- Vegetation outages (tree contact)

Response:

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Cross Arm	0.94%	0.75%	0.63%	0.78%	1.88%	0.82%	0.98%	1.23%	0.88%	0.69%	1.13%
Station Transformer	0.08%	0.04%	0.30%	0.11%	0.01%	0.21%	0.28%	0.22%	0.06%	0.27%	0.28%
Overhead Conductor	2.68%	2.15%	2.90%	3.89%	2.81%	2.06%	2.61%	4.42%	3.35%	2.65%	2.45%
Overhead Transformer	0.15%	0.12%	0.12%	0.13%	0.17%	0.09%	0.09%	0.10%	0.08%	0.09%	0.09%
Pole	1.25%	1.99%	1.37%	1.24%	2.30%	1.42%	1.66%	2.27%	1.69%	1.78%	2.26%
Submarine Conductor	0.14%	0.08%	0.13%	0.14%	0.11%	0.10%	0.09%	0.12%	0.08%	0.09%	0.09%
Underground Conductor	0.12%	0.22%	0.02%	0.24%	0.05%	0.04%	0.31%	0.12%	0.17%	0.12%	0.07%
Underground Transformer	0.03%	0.01%	0.06%	0.02%	0.04%	0.02%	0.02%	0.02%	0.03%	0.02%	0.04%
Vegetation	17.90%	20.89%	17.84%	18.13%	19.12%	24.11%	25.40%	23.07%	21.26%	23.31%	23.35%

Witness: FALTAOUS Peter

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B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 058

Reference:

Exhibit B-3-1, DSP Section 3.5

Interrogatory:

a) Please provide the total number of interruptions on the system for the each of years 2016 to 2021.

b) Please provide the total number of interruptions on the system for the each of years 2016 to 2021 excluding Force Majeure, Loss of Supply and Planned Outages.

c) Please provide the number of Force Majeure events per year for the years 2016 to 2021.

d) Please provide the number of storm events per year for the years 2016 to 2021.

Response:

a)

Year	Total Number of Interruptions
2016	35762
2017	35720
2018	42712
2019	35413
2020	40943
2021	41420

b)

Year	Number of Interruptions excluding Loss of Supply, FM & Planned Outages
2016	24092
2017	24602
2018	25262
2019	26948
2020	29212
2021	27869

c)

Year	Number of FM events
2016	3
2017	6
2018	5
2019	2
2020	2
2021	2

d)

Year	Number of storm events	Number of storm days
2016	23	30
2017	27	34
2018	23	31
2019	27	34
2020	25	41
2021	25	42

B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 080

Reference:

DSP Section 3.11, D-SA-01

Interrogatory:

a) Please complete the following table:

D-SA-01	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
# Joint Use Requests										
# Line Relocation Requests										
# Poles Replaced										

b) Please provide the capital contribution amounts for each of the years 2018 to 2022.

Response:

a) Hydro One understood the question to provide its count of the number of joint use and line relocation project requests, as well as the number of poles replaced under both programs. On this basis, Hydro One has provided actual figures. Given the unique and complex multi-year nature of some joint use and relocation projects, expenditure forecasts are not representative of future volumes; forecasts are based on historic expenditure levels, with adjustments for work volumes provided by Joint Use partners. However, many partners do not provide such information due to commercial sensitivities.

D-SA-01	**2018***	**2019***	**2020***	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
# Joint Use Requests	1,008	1,610	1,194	1,408	N/A					
# Line Relocation Requests	732	1,012	1,050	1,164						
# Poles Replaced	N/A	N/A	930	1,355						

**Note: Volumes for 2018-2020 have been updated due to a clerical error.*

Historically, Hydro One did not track the number of pole replacements as part of this work; Hydro One only began tracking this measure midway through 2020.

b) Refer to interrogatory response D-Staff-185 part (d).

B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 088

Reference:

DSP Section 3.11, D-SR-05

Interrogatory:

a) Page 4: Please provide the number of storms plus Force Majeure events for the years 2016 to 2021.

b) Page 4 Figure 2: Please add the numerical values to the chart for each year.

c) Page 5: Please provide the number of Trouble Calls by year for the years 2016 to 2021.

d) Page 5: Please provide the number of assets replaced over the period 2018 to 2021 under D-SR-05.

D-SR-05 Asset Replacement	2018	2019	2020	2021
Wood poles				
Transformers				
Insulators				
Conductors				
Cross Arms				
Reclosers				
Switches				
Submarine Cables (km)				
Regulators				
Other (specify)				
Total				

e) Please explain how transformer costs are allocated between ISD SR-04 and ISD SR-05.

Response:

a)

	2016	2017	2018	2019	2020	2021
Number of FM Events	3	6	5	2	2	2
Number of FM Days	9	16	23	5	9	12
Number of Storm Days	30	34	31	34	41	42
Number of FM+Storm Days	39	50	54	39	50	54

b)

($ in millions)	2016	2017	2018	2019	2020	2021
D-SR-05	$77.8	$87.0	$132.9	$97.6	$119.2	$120.91

c)

	2016	2017	2018	2019	2020	2021
Trouble Calls	43,939	40,205	39,788	40,505	43,242	41,814

d) Please see interrogatory response B3-SEC-150 (d)

e) ISD SR-04 involves the planned replacement of station transformers and ISD SR-05 involves the emergency replacement of distribution lines assets.

B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 090

Reference:

DSP Section 3.11, D-SR-07, Page 3

Interrogatory:

Poor condition poles include a subset of 17,000 red pine poles.

a) Please provide the quantity of red pine poles.

b) Please provide the number of red pine poles replaced over the 2018 to 2022 period.

c) Please provide the forecast number of red pine poles to be replaced over the 2023 to 2027 period.

Response:

a) There are currently 17,000 red pine poles that were not treated to CSA standards.

b)

	2018	2019	2020	2021
Red Pine Poles Replaced	1,166	1,437	1,720	1,819

For 2022, the design and scheduling of the pole replacement program is still in progress.

c) There are approximately 11,000 poles of this type planned for replacement in the 2023- 2027 period.

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B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 091

Reference:

DSP Section 3.11, D-SR-07, Page 3

Interrogatory:

With respect to the Test and Treat program that commenced in 2020:

a) Please provide the number of poles tested in 2020 and 2021 to date.

b) Please provide the number and percentage of poles in 2020 and 2021 that did not result in a poor condition rating.

Response:

a)

	2020	2021
Poles Test and Treated	10,884	60,280

b)

	2020	2021
Number of Poles in Good Condition	9,369	53,788
% of Poles Tested in good condition	86%	89%

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 131

Reference:

Exhibit I-03-B3-AMPCO-085

Interrogatory:

Please provide 2021 year end actuals.

Response:

In 2021, there were three Class 1 transformer failures and fifteen Class 2 transformer failures.

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 132

Reference:

Exhibit I-03-B3-AMPCO-087, part b)

Interrogatory:

Please update the table in the response to reflect 2021 year end actuals and any changes to the 2022 forecast.

Response:

Please refer to Attachment 1 for the updates for 2021 year-end actuals.

Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

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B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 087

Reference:

DSP Section 3.11, D-SR-04, Appendix A

Interrogatory:

a) Please add the following columns to Appendix A: Number of Transformers to be Replaced and Transformer Condition Rating.

b) Please provide Appendix A Planned for the years 2018 to 2022 and include the additional columns in part (a).

c) Please provide Appendix A Actual for the years 2018 to 2022 and include the additional columns in part (a).

d) Please identify the projects in part (b) that were not completed as planned and why.

e) Please provide the number of pad-mounted distribution station (PDS) forecasted over the 2023 to 2027 period.

f) Please provide the number of pad-mounted distribution station (PDS) completed over the 2018 to 2022 period.

Response:

a)

Project Name	Project ID	Project Description	Number of Transformers to be Addressed	Transformer Condition Rating	Net Capital Investment ($ Millions)				
					2023	2024	2025	2026	2027
Brookside DS	SR-04.1	Convert 44:8.32kV 5MVA station to PDS with 2x3MVA units	1	Poor	3.1	0.0	0.0	0.0	0.0
Chesterville Bran DS	SR-04.2	Convert 44:4.16kV 2MVA station to PDS with 2x3MVA units	1	Poor	0.1	0.0	0.0	0.0	0.0
Chesterville DS #2	SR-04.3	Convert 44:4.16kV 3MVA station to PDS with 3MVA unit	1	Poor	0.1	0.0	0.0	0.0	0.0
Cobalt DS	SR-04.4	Refurbish 44:12.5kV 3MVA station to 7.5MVA unit on new site with electronic reclosers	1	Poor	2.5	0.0	0.0	0.0	0.0
Craighurst DS	SR-04.5	Replace 44:8.32kV 5MVA transformer with 7.5MVA unit	1	Poor	0.9	0.0	0.0	0.0	0.0
Disputed Road RS	SR-04.6	Replace 27.6:27.6kV 25MVA transformer with 25MVA unit	1	Poor	2.9	0.0	0.0	0.0	0.0
Goodwood DS	SR-04.7	Refurbish 44:8.32kV 5MVA station to 7.5MVA unit	1	Poor	3.1	0.0	0.0	0.0	0.0
Kenora DS	SR-04.8	Replace 115:12.5kV 7.5MVA transformer with 7.5MVA unit	2	Poor / Poor	1.0	0.0	0.0	0.0	0.0
Killaloe DS	SR-04.9	Replace 44:12.5kV 6MVA transformer with 5MVA unit, electronic reclosers and SCADA	1	Poor	0.9	0.0	0.0	0.0	0.0
Millington DS	SR-04.10	Replace 44:8.32kV 5MVA transformer with 5MVA unit	1	Poor	1.0	0.0	0.0	0.0	0.0
Pointe Au Baril DS	SR-04.11	Replace 44:12.5kV 3MVA with 5MVA unit	1	Poor	1.4	0.0	0.0	0.0	0.0

Project Name	Project ID	Project Description	Number of Transformers to be Addressed	Transformer Condition Rating	Net Capital Investment ($ Millions)				
					2023	2024	2025	2026	2027
Snow Road DS	SR-04.12	Replace 44:12.5kV 3MVA transformer with 5MVA unit	1	Poor	0.9	0.0	0.0	0.0	0.0
Stratford DS	SR-04.13	Replace 27.6:8.32kV 3MVA transformer with 5MVA unit	1	Poor	0.4	0.0	0.0	0.0	0.0
Stratford Easthope DS	SR-04.14	Refurbish 27.6:8.32kV 3MVA station to 10MVA unit with SCADA	2	Poor / Poor	3.1	0.0	0.0	0.0	0.0
Wolsey Lake DS	SR-04.15	Replace 44:12.5kV 6MVA transformer to 7.5MVA unit with electronic reclosers	1	Poor	1.0	0.0	0.0	0.0	0.0
Alex Kenyon West DS	SR-04.16	Replace 44:4.16kV 2MVA transformer with 5MVA unit	1	Poor	0.1	0.9	0.0	0.0	0.0
Belmont DS	SR-04.17	Refurbish 27.6:8.32kV 3.6MVA station with 5MVA unit	1	Poor	1.8	1.3	0.0	0.0	0.0
Berwick DS	SR-04.18	Convert 44:8.32kV 3MVA station to PDS with 2x3MVA	1	Poor	0.6	0.3	0.0	0.0	0.0
Brighton Pinnacle DS	SR-04.19	Refurbish 44:4.16kV 5MVA with 5MVA unit, electronic reclosers and SCADA	1	Poor	0.5	2.6	0.0	0.0	0.0
Brockville Park DS	SR-04.20	Convert 44:4.16kV 5MVA station with breakers to PDS with 2x3MVA	2	Poor / Poor	0.0	1.1	0.0	0.0	0.0
Crozier DS	SR-04.21	Convert 44:25kV 2x6MVA station to PDS with 2x3MVA	2	Poor / Poor	0.0	1.0	0.0	0.0	0.0
Deseronto DS	SR-04.22	Replace 44:4.16kV 3MVA transformer with 5MVA unit, electronic reclosers and SCADA	1	Poor	0.1	1.0	0.0	0.0	0.0
Jellicoe DS #3	SR-04.23	Refurbish 115:12.5kV 1.5MVA station with 7.5MVA unit	1	Poor	0.0	3.2	0.0	0.0	0.0

Project Name	Project ID	Project Description	Number of Transformers to be Addressed	Transformer Condition Rating	Net Capital Investment ($ Millions)				
					2023	2024	2025	2026	2027
Lily Lake DS	SR-04.24	Refurbish 44:8.32kV 2MVA station with 7.5MVA unit on new site	1	Poor	0.2	1.6	0.0	0.0	0.0
Owen Sound DS #2	SR-04.25	Convert 44:8.32kV 2MVA station to PDS 3MVA unit on new site with electronic reclosers	1	Poor	0.2	2.3	0.0	0.0	0.0
Richardson RS	SR-04.26	Replace 44:44kV 25MVA station with 25MVA unit with SCADA	1	Poor	2.8	0.3	0.0	0.0	0.0
Ringwood DS	SR-04.27	Replace 44:8.32kV 5MVA transformer with 7.5MVA unit	1	Poor	0.0	1.0	0.0	0.0	0.0
Schreiber Winnipeg DS*	SR-04.28	Refurbish 115:12.5kV 6MVA station with 7.5MVA unit	2	Good / Good	0.0	3.2	0.0	0.0	0.0
Shelburn Andrew DS	SR-04.29	Convert 44:4.16kV 5MVA station to PDS 3MVA unit	1	Poor	0.0	3.2	0.0	0.0	0.0
Simcoe Ireland DS	SR-04.30	Refurbish 27.6:8.32kV 5MVA station with 5MVA unit	1	Poor	2.8	0.3	0.0	0.0	0.0
St.Thomas Union DS	SR-04.31	Replace 27.6:8.32kV 5MVA transformer with 5MVA unit	1	Poor	0.0	1.5	0.0	0.0	0.0
Stouffvil 10 Line DS	SR-04.32	Replace 44:8.32kV 5MVA transformer with 5MVA unit	1	Poor	0.1	1.0	0.0	0.0	0.0
Thamesville North DS	SR-04.33	Refurbish 27.6:8.32kV 5MVA station with 7.5MVA unit	1	Poor	0.0	3.2	0.0	0.0	0.0
Thorold Allanport DS	SR-04.34	Replace 27.6:4.16kV 5.4MVA transformer with 5MVA unit, electronic reclosers and SCADA	1	Poor	0.0	1.5	0.0	0.0	0.0

Project Name	Project ID	Project Description	Number of Transformers to be Addressed	Transformer Condition Rating	Net Capital Investment ($ Millions)				
					2023	2024	2025	2026	2027
Thorold Ormond DS	SR-04.35	Refurbish 27.6:4.16kV 5.4MVA transformer with 5MVA unit, electronic reclosers and SCADA	1	Poor	2.3	0.8	0.0	0.0	0.0
Thorold Turner DS	SR-04.36	Refurbish 27.6:8.32kV 3.6MVA station with 5MVA unit, electronic reclosers and SCADA	1	Poor	2.8	0.3	0.0	0.0	0.0
Uxbridge DS #2	SR-04.37	Refurbish 44:8.32kV 5MVA transformer with 7.5MVA unit	1	Poor	2.6	0.5	0.0	0.0	0.0
Williamstown RS	SR-04.38	Replace 44:44kV 25MVA transformer with 25MVA unit	1	Poor	2.6	0.5	0.0	0.0	0.0
Woodland Beach DS	SR-04.39	Refurbish 44:8.32kV 5MVA station with 7.5MVA unit	1	Poor	1.5	1.6	0.0	0.0	0.0
Young JCT RS	SR-04.40	Replace 27.6:27.6kV 15MVA with 15MVA unit	1	Poor	0.1	0.6	0.0	0.0	0.0
Black Corners DS	SR-04.41	Replace 44:8.32kV 5MVA transformer with 7.5MVA unit, electronic reclosers with SCADA	1	Poor	0.0	0.1	0.8	0.0	0.0
Brighton Division DS	SR-04.42	Convert 44:4.16kV 3MVA station to PDS 2x3MVA unit with electronic reclosers and SCADA	1	Poor	0.0	0.0	3.0	0.0	0.0
Brunelle DS	SR-04.43	Refurbish 44:8.32kV 5MVA station with 7.5MVA unit	1	Poor	0.0	2.9	0.3	0.0	0.0
Burford DS	SR-04.44	Convert 27.6:8.32kV 3.6MVA station to PDS 2.5MVA with additional real estate	1	Poor	0.0	0.0	1.5	0.0	0.0
Castleton DS	SR-04.45	Replace 44:8.32kV 5MVA transformer with 5MVA unit	1	Poor	0.0	0.1	0.8	0.0	0.0

Project Name	Project ID	Project Description	Number of Transformers to be Addressed	Transformer Condition Rating	Net Capital Investment ($ Millions)				
					2023	2024	2025	2026	2027
Devlin DS**	SR-04.46	Refurbish 44:12.5kV 2MVA station with 7.5MVA unit	2	Poor / Good	0.0	0.0	3.2	0.0	0.0
Drumbo DS	SR-04.47	Replace 27.6:8.32kV 2MVA transformer with 5MVA unit	1	Poor	0.0	0.1	0.5	0.0	0.0
Emo DS	SR-04.48	Refurbish 44:12.5kV 3MVA station with 7.5MVA unit	2	Poor / Poor	0.0	0.0	3.2	0.0	0.9
Forest Jefferson DS	SR-04.49	Convert 27.6:8.32kV 3.6MVA station to PDS 2x3MVA unit	1	Poor	0.0	0.4	1.8	0.0	0.0
Forest McNab DS	SR-04.50	Convert 27.6:4.16kV 5.6MVA station to PDS 2x3MVA unit with electronic reclosers	1	Poor	0.0	0.4	1.8	0.0	0.0
Guthrie DS	SR-04.51	Convert 44:8.32kV 3MVA station to PDS 3x3MVA unit	1	Poor	0.0	0.2	1.6	0.0	0.0
Kemptville West DS	SR-04.52	Replace 44:8.32kV 5MVA 7.5MVA unit with electronic recloser and SCADA	1	Poor	0.0	0.0	0.9	0.0	0.0
Shedden DS	SR-04.53	Replace 27.6:8.32kV 3.6MVA transformer with 7.5MVA unit	1	Poor	0.0	0.0	1.0	0.0	0.0
Thorold Front DS	SR-04.54	Replace 13.8:4.16kV 5.4MVA 5MVA unit with electronic recloser and SCADA	1	Poor	0.0	0.0	1.0	0.0	0.0
Vanastra DS	SR-04.55	Refurbish 27.6:8.32kV 3.6MVA station to 7.5MVA unit with electronic recloser and SCADA	1	Poor	0.0	0.8	2.2	0.0	0.0
Cameron DS	SR-04.56	Replace 44:12.5kV 6MVA transformer with 7.5MVA unit	1	Poor	0.0	0.0	0.0	1.0	0.0
Espanola DS	SR-04.57	Replace 44:12.5kV 6MVA transformer with 7.5MVA unit	1	Poor	0.0	0.0	0.1	0.8	0.0

Project Name	Project ID	Project Description	Number of Transformers to be Addressed	Transformer Condition Rating	Net Capital Investment ($ Millions)				
					2023	2024	2025	2026	2027
Grand Valley DS #2	SR-04.58	Replace 44:12.5kV 3MVA transformer with 7.5MVA unit, electronic reclosers and SCADA	1	Poor	0.0	0.1	0.8	0.1	0.0
Lucan Market DS 8kV	SR-04.59	Replace 27.6:8.32kV 3.6MVA transformer with 5MVA unit	1	Poor	0.0	0.0	0.1	0.8	0.0
Nakina DS	SR-04.60	Refurbish 44:12.5kV 3MVA station to 7.5MVA unit with electronic reclosers and SCADA	2	Poor / Poor	0.0	0.0	0.3	3.0	0.0
Red Rock DS	SR-04.61	Refurbish 115:12.5kV 6.24MVA station to 7.5MVA unit	2	Poor / Poor	0.0	0.1	0.9	3.2	0.0
Russell DS	SR-04.62	Replace 115:8.32kV 6MVA transformer with 7.5MVA	3	Poor / Poor / Poor	0.0	0.0	0.0	1.2	0.0
Shabaqua DS	SR-04.63	Refurbish 115:25kV 6MVA and 25:12.5kV 2MVA station with 115:25kV 7.5MVA unit	2	Poor / Poor	0.0	0.0	0.3	4.6	0.0
Thedford DS	SR-04.64	Replace 27.6:8.32kV 3.6MVA transformer with 5MVA	1	Poor	0.0	0.0	0.1	0.8	0.0
Virginiatown DS	SR-04.65	Convert 44:4.16kV 2MVA station to PDS 3MVA unit on greenfield site	1	Poor	0.0	0.0	0.2	2.9	0.0
Washago DS	SR-04.66	Refurbish 44:8.32kV 5MVA transformer with 7.5MVA unit	1	Poor	0.0	0.0	0.0	3.3	0.0
Wellington DS	SR-04.67	Replace 44:8.32kV 5MVA transformer with 5MVA with SCADA	1	Poor	0.0	0.0	0.1	0.8	0.0
Aguasabon DS	SR-04.68	Refurbish 13.8:12.5kV 6MVA transformer with 12.5MVA unit	1	Poor	0.0	0.0	0.0	0.0	3.3

Project Name	Project ID	Project Description	Number of Transformers to be Addressed	Transformer Condition Rating	Net Capital Investment ($ Millions)				
					2023	2024	2025	2026	2027
Colborne DS #2	SR-04.69	Replace 44:8.32kV 3MVA station with 7.5MVA unit and electronic reclosers	1	Poor	0.0	0.0	0.0	0.3	1.1
Coldstream DS	SR-04.70	Replace 27.6:8.32kV 5MVA with 5MVA unit	1	Poor	0.0	0.0	0.1	0.8	0.2
Dack DS	SR-04.71	Convert 44:12.5kV 3MVA station to PDS 3MVA unit	2	Poor / Poor	0.0	0.0	0.0	0.2	1.1
Ennismore DS	SR-04.72	Replace 44:8.32kV 5MVA transformer with 5MVA unit	1	Poor	0.0	0.0	0.0	0.1	0.0
Haycroft DS	SR-04.73	Replace 27.6:8.32kV 5MVA transformer with 7.5MVA unit	1	Poor	0.0	0.0	0.0	0.0	0.6
Hinchinbrooke DS	SR-04.74	Replace 115:12.5kV 7.2MVA transformer with 7.5MVA unit	2	Poor / Poor	0.0	0.0	0.0	0.1	1.0
Holland Centre RS	SR-04.75	Replace 44:44kV 15MVA transformer with 44MVA unit	1	Poor	0.0	0.0	0.0	0.6	0.3
Hornepayne DS	SR-04.76	Refurbish 44:4.16kV 10MVA station with 15MVA	2	Poor / Poor	0.0	0.0	0.0	2.2	1.1
Kimberley DS	SR-04.77	Replace 44:8.32kV 5MVA transformer with 7.5MVA unit	1	Poor	0.0	0.0	0.0	0.1	1.2
Longlac East DS	SR-04.78	Refurbish 44:12.5kV 3MVA station to 7.5MVA unit	1	Poor	0.0	0.0	0.0	0.3	2.9
Maxville Prince DS	SR-04.79	Refurbish 44:4.16kV 2MVA station with 5MVA unit	1	Poor	0.0	0.0	0.0	0.1	0.8
McGregor DS	SR-04.80	Replace 27.6:8.32kV 5MVA transformer with 7.5MVA unit	1	Poor	0.0	0.0	0.1	0.6	0.3
Napanee DS #2	SR-04.81	Convert 44:8.32kV 5MVA station to PDS 2x3MVA units with electronic reclosers and SCADA	1	Poor	0.0	0.0	0.0	0.1	1.0

Project Name	Project ID	Project Description	Number of Transformers to be Addressed	Transformer Condition Rating	Net Capital Investment ($ Millions)				
					2023	2024	2025	2026	2027
Picton Disraeli DS	SR-04.82	Replace 44:4.16kV 5MVA with breakers to 5MVA unit with electronic reclosers and SCADA	1	Poor	0.0	0.0	0.0	0.4	0.5
Picton DS	SR-04.83	Replace 44:8.32kV 5MVA transformer with 7.5MVA unit, electronic reclosers and SCADA	1	Poor	0.0	0.0	0.0	0.1	1.0
Port Lambton DS	SR-04.84	Replace 27.6:8.32kV 5MVA transformer with 7.5MVA unit	1	Poor	0.0	0.0	0.1	0.6	0.3
Rainy River DS***	SR-04.85	Convert 44:8.32kV 3MVA station to PDS 3MVA unit	2	Poor / Good	0.0	0.0	0.0	0.3	0.8
Reach Road RS	SR-04.86	Replace 44:44kV 25MVA transformer with 25MVA unit	1	Poor	0.0	0.0	0.1	1.0	0.5
Rondeau DS	SR-04.87	Convert 27.6:8.32kV 3MVA station to PDS 3x2.5MVA unit with additional real estate	1	Poor	0.0	0.0	0.1	0.6	0.2
Rutherglen DS	SR-04.88	Convert 44:12.5kV 2MVA station to PDS 3MVA unit	1	Poor	0.0	0.0	0.0	0.2	3.3
Sleeman DS	SR-04.89	Refurbish 44:12.5 3MVA and 44:25kV 6MVA to 44:12.5 5MVA and 44:25kV 12.5MVA unit	3	Poor / Poor / Poor	0.0	0.0	0.0	0.3	4.7
Springvale DS	SR-04.90	Replace 27.6:8.32kV 5MVA transformer with 5MVA unit	1	Poor	0.0	0.0	0.0	0.1	1.0
Stardale DS	SR-04.91	Replace 44:8.32kV 5MVA station to 7.5MVA with electronic reclosers and SCADA	1	Poor	0.0	0.0	0.0	0.0	0.1
Whitedog DS	SR-04.92	Refurbish 13.8:12.5kV 2MVA station with 5MVA unit	1	Poor	0.0	0.0	0.0	0.2	2.9

*Schreiber Winnipeg DS T1 and R1: The R1 regulator failed causing a fire that damaged the station structure. Station refurbishment is required in order to address the damaged station structure and address the failed regulator with a new transformer equipped with an Under Load Tap Changer.

**Devlin DS T1 and R1: The T1 transformer in poor condition is being replaced with a new transformer that includes regulation through an Under Load Tap Changer (ULTC) thereby making the R1 regulator redundant.

***Rainy River T1 and R1: The R1 regulator is in poor condition and is to be replaced with a transformer that includes regulation through a ULTC.

b)

Year	Station Name	# Of Transformers Planned to be Addressed	Transformer Condition	Planned Cost ($M)
2018	Creemore DS	1	Poor	11.75
2018	Sowerby DS	1	Transformer condition was not the driver[1]	
2018	Bobcaygeon Anne DS	1	Transformer condition was not the driver[1]	
2019	Burford DS	1	Poor	18.65
2019	Hurondale DS	2	Poor / Poor	
2019	Thorold Allanport DS	1	Poor	
2019	Brigden DS	1	Poor	
2019	Blenheim DS	1	Poor	
2019	Ostrander DS	1	Poor	
2019	Arnprior Airport DS	1	Transformer condition was not the driver[2]	
2019	Arnprion McLachin DS	1	Poor	
2019	Meaford Vincent DS	1	Poor	
2020	Drumbo DS	1	Poor	14.18
2020	Clarence DS	2	Poor / Poor	
2020	Eugenia RS	1	Poor	
2020	La Salle RS	1	Poor	
2020	Rutherglen DS	1	Poor	

2020	Adams Point DS	1	Poor	
2020	Woodland Beach DS	1	Poor	
2020	Owen Sound DS #2	1	Poor	
2020	Vanastra DS	1	Poor	
2021	Adams Point PDS	1	Poor	12.37
2021	Gorrie DS	1	Poor	
2021	Ufford DS	1	Poor	
2021	Hawley DS	2	Poor/ Poor	
2021	Lucan Market Ph1 PDS	1	Poor	
2021	Troy DS	1	Poor	
2022	Thorold Front DS	1	Poor	27.58
2022	Shedden DS	1	Poor	
2022	Stratford DS	1	Poor	
2022	Brighton Pinnacle DS	1	Poor	
2022	Cameron DS	1	Poor	
2022	Perth North DS	1	Poor	
2022	Richardson RS	1	Poor	
2022	Williamstown RS	1	Fair[4]	
2022	Port Dover St Andrews DS	1	Poor	
2022	Simcoe Ireland DS	1	Poor	
2022	Goodwood DS	1	Poor	
2022	Moosonee DS	3	Transformer condition was not the driver[1]	
2022	Tory Hill DS	1	Poor	
2022	Aguasabon DS	1	Poor	
2022	Devlin DS	2	Poor / Good[3]	
2022	Emo DS	1	Poor	
2022	Russell DS	3	Good / Good / Poor[3]	
2022	Whitedog DS	1	Fair[4]	
2022	Uxbridge DS #2	1	Fair[4]	
2022	Shelburne DS	1	Fair[4]	
2022	Nottawaga DS	1	Fair[4]	
2022	Eels Lake RS	1	Fair[4]	
2022	Commanda DS	1	Fair[4]	
2022	Tralee DS	1	Transformer condition was not the driver[1]	

2022	Haliburton DS	1	Transformer condition was not the driver[1]	
2022	Kirkfield DS	1	Poor	

[1]Station Refurbishment was driven due to poor station structures or sub standard design which necessitated addressing the transformer.
[2]Station Refurbishment was driven due to load growth expected in the area.
[3]At least one of the transformers or regulating units in poor condition is being replaced with a new transformer that includes regulation through a ULTC thereby making the regulator redundant.
[4] These transformers were expected to be in poor condition by the time they were to be addressed.

c)

Year	Station Name	# Of Transformers Addressed	Transformer Condition	Total Cost ($M)
2018	Creemore DS	1	Poor	11.75
2018	Sowerby DS	1	Transformer condition was not the driver[1]	
2018	Bobcaygeon Anne iMDS	1	Transformer condition was not a driver[1]	
2019	Hurondale PDS	2	Poor / Poor	16.54
2019	Brigden DS	1	Poor	
2019	Blenheim DS	1	Poor	
2019	Ostrander DS	1	Poor	
2019	Madsen DS	1	Poor	
2019	Meaford Vincent iMDS	1	Poor	
2019	Arnprior Airport iMDS	1	Transformer condition was not the driver [2]	
2019	Arnprior McLachin iMDS	1	Poor	
2019	Brockville Cedar iMDS	1	Transformer condition was not the driver[1]	
2020	Chatham Raleigh DS	1	Poor	8.69
2020	Joyceville DS	1	Poor	
2021	Ufford DS	1	Poor	8.09
2021	Gorrie DS	1	Poor	
2021	Hawley DS	2	Poor / Poor	
2021	Adams Point PDS	1	Poor	
2022	No Planned Stations to be In-Serviced. Forecasted spend for 2022			3.18

[1]Station Refurbishment was driven due to poor station structures or sub standard design which necessitated addressing the transformer.

[2]Station Refurbishment was driven due to load growth expected in the area.

d) Please see I-03-B3-Staff-141

e) Hydro One Distribution is forecasting 21 PDS type stations over the filing period.

Year	# of PDS type stations
2023	4
2024	6
2025	5
2026	1
2027	5

f) Between 2018-2021, a total of 7 PDS type stations were placed in-service

Year	# of PDS type stations
2018	1
2019	3
2020	2
2021	1
2022	0

O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 133

Reference:

Exhibit I-03-B3-AMPCO-093, part b)

Interrogatory:

Please update the table in part (b) to include 2021 year end actuals and the 2022 forecast.

Response:

Please refer to I-22-O-SEC-266, part e).

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 134

Reference:

Exhibit O-2-1

Interrogatory:

Please update the following interrogatories to include 2021 year-end actuals and any changes to the 2022 forecast - and include updated excel spreadsheets as applicable.

a) B3-AMPCO-094
b) B3-AMPCO-097
c) B3-AMPCO-098
d) B3-AMPCO-099
e) B3-AMPCO-100
f) B3-AMPCO-102
g) B3-AMPCO-103
h) B3-AMPCO-104
i) B3-SEC-121

Response:

Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

a) Please refer to I-22-O-SEC-266, Attachment 6
b) See Attachment 1.
c) See Attachment 2.
d) See Attachment 3
e) See Attachment 4.
f) See Attachment 5.
g) Please refer to I-03-O-AMPCO-142 and Attachment 1.
h) Please refer to Attachment 6.
i) Please refer to Attachment 7.

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B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 097

Reference:

DSP Section 3.11, D-SR-08, Page 7

Interrogatory:

Table 1 provides the Number of Cross Arms to be Replaced in the Plan Period.

Please provide the number of cross arms replaced over the period 2018-2022.

Response:

Year	2018	2019	2020	2021	2022
Cross Arms Replaced	0	700	755	1,581	1730

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B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 098

Reference:

DSP Section 3.11, D-SR-08, Page 8

Interrogatory:

Table 2 provides the Number of Transformers to be Replaced over the Plan Period.

Please provide the number of transformers replaced over the period 2018-2022.

Response:

Year	2018	2019	2020	2021	2022
Transformers Replaced	0	19	65	76	231

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B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 099

Reference:

DSP Section 3.11, D-SR-08, Page 9

Interrogatory:

Table 4 provides the Number of Sentinel Lights to be Replaced or Removed in the Plan Period.

Please provide the number of sentinel lights to be replaced or removed over the 2018-2022 period.

Response:

Year	2018	2019	2020	2021	2022
Lights Replaced/Removed	2,114	1,797	2,264	2,297	2,858

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B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 100

Reference:

DSP Section 3.11, D-SR-08, Page 4

Interrogatory:

Please complete the following table on the basis of Gross Investment costs:

D-SR-08	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Cross Arms Replaced										
Transformers Replaced										
Nests Addressed										
Sentinel lights replaced/removed										
Removals										
Net Investment Cost										

Response:

D-SR-08	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Cross Arms Replaced	0.0	1.9	2.2	4.4	4.6	4.7	4.8	4.9	5.0	5.1
Transformers Replaced	0.0	1.5	2.5	3.2	6.1	6.2	8.8	7.8	2.3	0.7
Nests Addressed	0.1	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2
Sentinel lights replaced/removed	1.7	1.8	2.2	2.5	3.0	2.8	2.6	2.4	2.2	2.0
Removals	-0.5	-0.6	-0.9	-1.3	-1.6	-1.6	-1.9	-1.8	-1.2	-1.0
Net Investment Cost	1.4	4.9	6.3	9.0	12.3	12.4	14.5	13.5	8.6	7.1

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B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 102

Reference:

DSP Section 3.11, D-SR-09, Page 3

Interrogatory:

The Submarine Cable Replacement Program is expected to replace or refurbish all submarine cables with currently known defects and additional cables that become damaged or exposed over the planning period.

a) Please provide the data on the submarine cables replaced or refurbished for the 2018-2022 period.

b) Please provide the data on the submarine cables to be replaced or refurbished for the 2023-2027 period.

Response:

a)

Year	2018	2019	2020	2021	2022
Cables Replaced/Refurbished	25.1 km	235	298	292	400

Note:
For 2018, the number of kilometres of submarine cable replaced is reported. From 2019 onwards, the reporting unit for the submarine cable program was changed to the number of cable installations replaced or refurbished.

b)

Year	2023	2024	2025	2026	2027
Cables Replaced/Refurbished	400	400	400	400	400

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B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 104

Reference:

DSP Section 3.11, D-SR-11, Page 12, Appendix A

Interrogatory:

a) Please provide Appendix A Planned for the years 2018 to 2022.

b) Please provide Appendix A Actual for the years 2018 to 2022.

c) Please identify the projects in part (a) that were not completed as planned and why.

Response:

For this response we assumed the reference to SR-11 was incorrect and that the intent was to reference SR-10 as SR-11 does not have a page 12.

a) Below is a summary of planned investments for the years 2018 to 2022 based on the Draft Rate Order (EB-2017-0049) made in response to the March 7, 2019 decision on the 2018 to 2022 Distribution Revenue Requirements for Hydro One Networks Inc.

Year	Project Name	Total Net Planned ($M)
2018	Brockville TS 24M2 Feeder Rehab Phase 5	8.1
	City of Owen Sound Line Refurbish - PH 2	
	Projects <$1M	
2019	Sidney TS M7 Reconductor and Relocate	6.9
	Dymond TS M3 Rebuild - Stage 1	
	Otonabee TS 128M28 Phase 3 - Part 1	
	Projects <$1M	
2020	Palmerston TS M1 Relocation	16.6
	Muskoka TS M1 Relocation - Part 1 of 5	
	Manitoulin TS M25 - Relocate Line	
	G3K Towerline Relocate - Part 1	
	Otonabee TS 128M28 Phase 3 – Part 2 of 2	
	Wanstead TS M4 Bridgen Rebuild Stage 2	
	Projects <$1M	

Witness: FALTAOUS Peter

2021	Wallace TS M6 Madawaska Relocate	22.0
	Douglas Point TS 44kV U/G Cables	
	Muskoka TS M1 Relocation - Part 3 of 5	
	Muskoka TS M1 Relocation - Part 2 of 5	
	Dymond TS M3 Rebuild - Stage 2	
	Owen Sound TS M24 Refurbishment - Stage 2	
	Cobden TS M6 Relocation	
	Havelock TS M2 Rebuild Part 2	
	Duart TS M5 Relocation	
	Margach DS F3 Line Relocate (SD 3201)	
	Projects <$1M	
2022	Gardiner TS M14 Relocation	33.8
	Morrisburg TS M23 Relocate	
	Napanee TS M2 Relocate	
	Kent TS M16 Relocation	
	Fergus TS M8 Relocation Eden Mills	
	Tillsonburg TS M4 Relocation	
	Muskoka TS M1 Relocation - Part 4 of 5	
	Val Caron DS - Maple Elms Street Rebuild	
	Weston Lake DS F1 – Kukatush Line Section Relocate	
	Town of Schreiber Rebuild Phase 2	
	Owen Sound TS M24 Refurbishment - Stage 3	
	Aguasabon DS F1 F2 - Terrace Bay Town Rebuild	
	Brant TS M22 Relocation Line Relocate	
	Dobbin TS 20M4 M6 M8 Reconstruction-Ackinson Rd	
	G3K Towerline Refurbishment - Part 2	
	Havelock TS M2 Rebuild Part 1	
	Longueuil TS M23 Relocate	
	Minden TS 87M2 Feeder Relocation Phase 2 Line Relocate	
	Muskoka TS M3 Relocate	
	Norfolk M3 Tillsonburg M10 Tie Relocation	
	Palmerston TS M3 Relocation	
	Projects <$1M	

Below is a summary of actuals incurred in the year 2018-2021 and forecasted values for 2022.

b)

Year	Project Name	Total Net Actuals ($M)
2018	Brockville TS 24M2 Feeder Rehab Phase 5	8.1
	City of Owen Sound Line Refurbish - PH 2	
	Projects <$1M	
2019	Dymond TS M3 Rebuild - Stage 1	8.2
	Otonabee TS 128M28 Phase 3 - Part 1	
	Turkey Point - Vittoria DS F2 Relocation	
	Wanstead TS M4 Oil Springs	
	Projects <$1M	
2020	Haldimand-Jarvis TS M6 Lakeshore Rebuild	14.1
	Murillo DS F2 assets upgrade and acquisition	
	Crysler DS F2 Future Proof Pilot Project	
	Dryden Wilde DS F2-Dryden Downtown East	
	Otonabee TS 128M28 Phase 3 – Part 2 of 2	
	Wanstead TS M4 Brigden Rebuild Stage 2	
	WPF - Muskoka TS M9 Section Reconductor	
	Projects <1M	
2021	Lake TS M4M6 Rebuild	12.9
	Dryden Town Rebuild Ph. 4 -Dryden Downtown East	
	Allanburg TS M7 Rebuild	
	Brant TS M22 Relocation	
	Woodstock OPC Conversion-NorthEast 4kV	
	Duart TS M5 Relocation	
	Sidney TS M7 Reconductor and Relocate	
	Cote Boulevard Rebuild – Hanmer DS	
	Errington Street Rebuild	
	Underground Cable Injection Program	
	Projects <$1M	
2022	Underground Cable Injection Program	13.7
	Virginiatown DS - HWY 66 Rebuild	
	Projects <$1M	

c)

Please see response to B3-Staff-146.

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B3 - SCHOOL ENERGY COALITION INTERROGATORY - 121

Reference:

Exhibit B-3-1, DSP Section 3.2, Page 62

Interrogatory:

For each year between 2018 and 2027, please provide the total cost and number of kilometers of underground cable that Hydro One has extended the live via cable injection.

Response:

For the years 2018 to 2027, see table below for actual and forecasted dollars and length of cable injection.

Year	Net Dollars ($M)	Distance (km)
2018	$0.1	2
2019	$0.1	0
2020	$0	0
2021	$2.7	12
2022	$3.0	30
2023	$3.9	39
2024	$4.0	40
2025	$4.1	41
2026	$4.0	40
2027	$4.0	40

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 135

Reference:

Exhibit O-2- 1

Interrogatory:

Please add 2021 year end actuals to the table provided in the response to the following interrogatories:

a) B3-AMPCO-060
b) B3-AMPCO-061
c) B3-AMPCO-062
d) B3-AMPCO-064
e) B3-AMPCO-070
f) B3-AMPCO-071
g) B3-AMPCO-072

Response:

a) Please see Attachment 1.
b) Please see Attachment 2.
c) Please see Attachment 3.
d) Please see Attachment 4.
e) Please see Attachment 5.
f) Please see Attachment 6.
g) Please see Attachment 7.

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B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 060

Reference:

Exhibit B-3-1, DSP Section 3.5

Interrogatory:

With respect to the number of asset failures resulting in a customer interruption, please complete the attached excel spreadsheet.

Response:

Hydro One is unable to provide the data as requested. The following table provides the number of incidents resulting in a customer interruption attributed to the failure of a given asset type, for all asset types where this data is available. Total number of asset failures for each asset type is only available for station transformers and mobile unit substations.

Asset Category	Asset Failures 2018	Asset Failures 2019	Asset Failures 2020	Asset Failures 2021	Interruptions 2018	Interruptions 2019	Interruptions 2020	Interruptions 2021
Station Transformers	17	13	17	18	5	4	9	3
Mobile Unit Substations	1	0	0	0	1	0	0	0
Circuit Breakers	N/A				N/A			
Station Service Transformers								
Insulators					166	250	211	196
Protection Relays					N/A			
IEDs								
MUS Structures								
Poles					285	325	360	428
Line Transformers					1,159	1,186	1,266	1,287
Submarine Cables					95	111	96	82
O/H Conductor					750	994	740	765
Switches					2,891	3,545	3,653	3,058
Reclosers					280	444	364	361
Regulators					24	15	26	15
Capacitor Banks					N/A			
AMI					0	0	0	1

B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 061

Reference:

Exhibit B-3-1, DSP Section 3.5, Page 19

Interrogatory:

Please provide SAIDI for the years 2016 to 2020 excluding Loss of Supply, Excluding Force Majeure and Excluding Planned Outages.

Response:

Year	SAIDI
2016	6.4
2017	7.1
2018	5.7
2019	5.7
2020	6.2
2021	5.7

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B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 062

Reference:

Exhibit B-3-1, DSP Section 3.5, Page 21

Interrogatory:

Please provide SAIFI for the years 2016 to 2020 excluding Loss of Supply, Excluding Force Majeure and Excluding Planned Outages.

Response:

Year	SAIFI
2016	1.9
2017	1.9
2018	1.8
2019	2.1
2020	2.1
2021	2.0

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B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 064

Reference:

EB-2017-0049, Exhibit I-24-AMPCO-22

Interrogatory:

Please update Table 1 to reflect the variance between annual forecast quantities compared to actuals for the years 2017 to 2021.

Response:

Please see the table below.

Notes:

1. The table below represents the variance of actual values minus the DRO plan value. Negative numbers therefore represent under-accomplishment relative to the plan.
2. N/A indicates the referenced ISD 2021 data does not exist for the full year. As a result, variances have not been reported since comparisons between planned values (full year) and actual values (partial year) are not appropriate. These variances are indicated as "unavailable".

	ISD	2017	2018	2019	2020	2021
Transformer Replacements	S-01	-1	N/A	N/A	N/A	N/A
Transformer Spares	S-01	-21	0	-1	-3	-2
MUS Trailer Replacements	S-02	-1	N/A	N/A	N/A	N/A
MUS Purchases	S-02	0	0	0	-1	-2
Stations targeted for Spill Containment	S-03	-2	0	N/A	N/A	N/A
Feeders identified for Recloser Upgrades	S-05	-8	0	-11	5	15
Station Refurbishments	S-07	-29	0	0	-7	-15
Pole Replacements	S-10	-3558	0	-2986	-3639	-3,989
PCB Lines Equipment Replacements	S-11	-2200	0	-1196	-1957	-2,285

Large Sustainment Initiatives	S-12	-9	0	1	1	0
Development Capital - New Connections	D-01	1423	0	-974	2,108	4,469
Development Capital - Service Upgrades	D-01	-719	0	99	559	1,100
Development Capital - Service Cancellations	D-01	-1556	0	-1,956	-2,386	-2,265
Upgrades Driven by Load Growth	D-02	2	0	-5	-29	-30
Asset Life Cycle Optimization and Operational Efficiency	D-05	0	0	-4	-2	-4
Reliability Improvements	D-06	-1	0	-2	2	1
Distribution Station Security Upgrades	C-05	-3	0	N/A	N/A	N/A

B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 070

Reference:

Exhibit B-3-1, DSP Section 3.5, Page 20

Interrogatory:

Figure 2 below provides a breakdown of contributors to SAIDI.

a) Please confirm Figure 2 excludes Loss of Supply and Force Majeure.

b) Pease provide a further breakdown of the contribution to Defective Equipment by equipment type for each of the years 2016 to 2020.

Response:

a) Confirmed. Figure 2 excludes Loss of Supply and Force Majeure.

b)

Equipment Type	2016	2017	2018	2019	2020	2021
Cross Arm	0.054	0.093	0.096	0.080	0.045	0.081
Station Transformer	0.016	0.023	0.018	0.010	0.019	0.004
Overhead Conductor	0.194	0.217	0.303	0.326	0.247	0.214
Overhead Transformer	0.011	0.012	0.012	0.011	0.011	0.011
Pole	0.218	0.170	0.208	0.186	0.276	0.271
Station Recloser	0.006	0.026	0.005	0.000	0.003	0.009
Submarine Conductor	0.040	0.031	0.036	0.017	0.038	0.026
Underground Conductor	0.006	0.013	0.014	0.021	0.006	0.007
Underground Transformer	0.002	0.002	0.002	0.002	0.002	0.003
Other	1.373	1.731	1.388	1.860	1.644	1.466

The 'Other' category consists of equipment types outside of the types listed in the table that contributed to SAIDI defective equipment, such as insulators and surge arrestors.

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B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 071

Reference:

Exhibit B-3-1, DSP Section 3.5, Page 22

Interrogatory:

Figure 3 below provides a breakdown of contributors to SAIFI.

a) Please confirm Figure 3 excludes Loss of Supply and Force Majeure.

b) Please provide a further breakdown of the contribution to Defective Equipment by equipment type for each of the years 2016 to 2020.

Response:

a) Yes. Figure 3 excludes Loss of Supply and Force Majeure.

b)

Equipment Type	2016	2017	2018	2019	2020	2021
Cross Arm	0.020	0.023	0.027	0.022	0.018	0.027
Station Transformer	0.005	0.004	0.004	0.001	0.005	0.006
Overhead Conductor	0.051	0.061	0.098	0.084	0.067	0.058
Overhead Transformer	0.002	0.002	0.002	0.002	0.002	0.002
Pole	0.035	0.039	0.050	0.042	0.045	0.053
Station Recloser	0.004	0.012	0.002	0.000	0.001	0.002
Submarine Conductor	0.002	0.002	0.003	0.002	0.002	0.002
Underground Conductor	0.001	0.007	0.003	0.004	0.003	0.002
Underground Transformer	0.000	0.000	0.000	0.001	0.001	0.001
Other	0.487	0.587	0.570	0.803	0.714	0.671

The 'Other' category consists of equipment types outside of the types listed in the table that contributed to defective equipment SAIFI, such as insulators and surge arrestors.

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B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 072

Reference:

EB-2017-0049, Exhibit I-23-AMPCO-11a

Interrogatory:

Please update the table (Power Outage Causes %) in response to part (a) for the years 2018 to 2021.

Response:

Percentages by SAIFI:

Power Outage Causes	2018	2019	2020	2021
Tree damage	26%	19%	24%	24%
Equipment failure	29%	31%	29%	29%
Unconfirmed causes	9%	9%	11%	10%
Scheduled outages	10%	13%	12%	11%
Loss of power supply	20%	20%	16%	18%
Animal or vehicle damage	6%	8%	8%	8%

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 136

Reference:

Exhibit I-03-B3-AMPCO-065

Interrogatory:

Please update the excel spreadsheet to reflect 2021 year end actuals and file the excel spreadsheet.

Response:

Please refer to Attachment 1 of this interrogatory response.

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Asset Condition

Asset Category		# asset units				# asset units				# asset units				# asset units			
		Population	2018 Condition			Population	2019 Condition			Population	2020 Condition			Population	2021 Condition		
			Poor	Fair	Good		Poor	Fair	Good		Poor	Fair	Good		Poor	Fair	Good
Station Transformers	All	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	In Service	1,184	24%	21%	55%	1,186	28%	32%	40%	1,197	20%	19%	61%	1,193	24%	17%	60%
	Spares	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mobile Unit Substations		29	45%	7%	48%	32	44%	9%	47%	35	51%	9%	40%	35	34%	26%	40%
Reclosers	All	2256	30%	15%	56%	2270	27%	15%	58%	2288	19%	14%	67%	2281	16%	14%	71%
	Oil	**Note 1**															
	Vaccum	**Note 1**															
Circuit Breakers	All	**148**	**1%**	**0%**	**99%**	**149**	**1%**	**0%**	**99%**	**152**	**3%**	**0%**	**97%**	**148**	**2%**	**0%**	**98%**
	Metalclad	146	1%	0%	99%	147	1%	0%	99%	149	3%	0%	97%	145	2%	0%	98%
	SF6	1	0%	0%	100%	1	0%	0%	100%	2	0%	0%	100%	3	0%	0%	100%
	Oil	1	0%	0%	100%	1	0%	0%	100%	1	0%	0%	100%	0	0%	0%	0%
Switches		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fuses		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Station Structures		2143	2%	4%	94%	2143	2%	4%	94%	2143	3%	5%	91%	2139	4%	6%	89%
Fences		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Station Grounding Systems		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Station Service Transformers		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Insulators		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bus Work		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Protection Relays		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
IEDs		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Spill Containment Systems		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MUS Structures		785	8%	24%	68%	781	5%	35%	60%	787	9%	26%	65%	787	7%	30%	63%
Poles	All	**1,608,042**	**5%**	**95%**		**1,609,945**	**5%**	**95%**		**1,612,341**	**5%**	**95%**		1,611,705	**5%**	**95%**	
	Wood	1,576,251	4%	96%		1,578,745	4%	96%		1,582,395	4%	96%		1,582,915	4%	96%	
	Steel	6,218	0%	100%		6,243	0%	100%		6,202	0%	100%		6,251	0%	100%	
	Concrete	2,462	0%	100%		2,496	0%	100%		2,497	1%	99%		2,368	1%	99%	
	Composite	3,073	0%	100%		3,403	0%	100%		3,876	0%	100%		4,281	0%	100%	
	Red Pine Wood	20,038	100%	0%		19,059	100%	0%		17,371	100%	0%		15,890	100%	0%	
Rights of Way		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Line Transformers	All	520,875	NA	NA	NA	523,120	NA	NA	NA	527,050	NA	NA	NA	530,785	NA	NA	NA
	Pole Mounted Transformers	459,818	NA	NA	NA	460,422	NA	NA	NA	461,940	NA	NA	NA	463,192	NA	NA	NA
	Pad Mounted Transformers	61,057	NA	NA	NA	62,698	NA	NA	NA	65,110	NA	NA	NA	67,593	NA	NA	NA
	Submersible transformers		NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA
	Transclosures and Pole-Trans Transformer		NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA
Submarine Cables (circuit km)		3,849	NA	NA	NA	3,896	NA	NA	NA	3,953	NA	NA	NA	3,975	NA	NA	NA
Conductor (circuit km)	All	123,176	NA	NA	NA	123,139	NA	NA	NA	123,489	NA	NA	NA	123,748	NA	NA	NA
	Overhead	113,618	NA	NA	NA	113,390	NA	NA	NA	113,478	NA	NA	NA	113,576	NA	NA	NA
	Underground	5,709	NA	NA	NA	5,853	NA	NA	NA	6,058	NA	NA	NA	6,197	NA	NA	NA
AMI	All	1,412,126	NA	NA	NA	1,425,521	NA	NA	NA	1,440,623	NA	NA	NA	1,511,633	NA	NA	NA
	Retails Meters	1,362,318	NA	NA	NA	1,375,647	NA	NA	NA	1,390,746	NA	NA	NA	1,461,725	NA	NA	NA
	Collectors	11,031	NA	NA	NA	11,113	NA	NA	NA	11,125	NA	NA	NA	11,199	NA	NA	NA
	Repeaters	38,777	NA	NA	NA	38,761	NA	NA	NA	38,752	NA	NA	NA	38,709	NA	NA	NA
Switches	Air Break & Load Break - 3 Phase	3,539	NA	NA	NA	3,539	NA	NA	NA	3,545	NA	NA	NA	3,600	NA	NA	NA
Reclosers (Note 3)	All	12,387	NA	NA	NA	12,414	NA	NA	NA	12,616	NA	NA	NA	12,756	NA	NA	NA
	Hydraulic	12,039	NA	NA	NA	12,011	NA	NA	NA	12,029	NA	NA	NA	12,022	NA	NA	NA
	Electronic	348	NA	NA	NA	403	NA	NA	NA	587	NA	NA	NA	734	NA	NA	NA
Regulators		2,288	NA	NA	NA	2,326	NA	NA	NA	2,374	NA	NA	NA	2,381	NA	NA	NA
Capacitor Banks		2,832	NA	NA	NA	2,824	NA	NA	NA	2,794	NA	NA	NA	2,774	NA	NA	NA

NA	This implies that there is no condition algorithm for this asset class, however defect and/or testing data exists
Note 1	Condition algorithms have not been developed to this level of granularity for this asset sub-type.
Note 2	Feeder lengths are provided are from Q3-2021 (row 46-49). All other population counts provided in column O (excluding pole counts) are as of Nov. 12, 2021.
Note 3	Assumed this refers to line reclosers

Note 4

The Q3 numbers erroneously included some LDC acquired line assets that belonged to acquired LDCs (Peterborough and Orillia). This error has been rectified in the 2021 year-end counts.

The data provided in I-24-AMPCO-23, Attachment 1 for AMI was incorrect. Below is the corrected data for AMI for the 2014-2017 period.

		# asset units				# asset units				# asset units				# asset units			
		Population	2014 Condition			Population	2015 Condition			Population	2016 Condition			Population	2017 Condition		
			Poor	Fair	Good		Poor	Fair	Good		Poor	Fair	Good		Poor	Fair	Good
AMI	All	1,305,012	NA	NA	NA	1,334,486	NA	NA	NA	1,382,085	NA	NA	NA	1,397,106	NA	NA	NA
	Retails Meters	1,256,020	NA	NA	NA	1,284,898	NA	NA	NA	1,332,305	NA	NA	NA	1,347,295	NA	NA	NA
	Collectors	10,545	NA	NA	NA	10,871	NA	NA	NA	10,982	NA	NA	NA	10,999	NA	NA	NA
	Repeaters	38,447	NA	NA	NA	38,717	NA	NA	NA	38,798	NA	NA	NA	38,812	NA	NA	NA

O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 137

Reference:

Exhibit I-03-B3-AMPCO-066-01

Interrogatory:

Please update the excel spreadsheet to reflect 2021 year end actuals and any changes to the 2022 forecast and file the excel spreadsheet.

Response:

Please refer to Attachment 1 of this interrogatory response.

Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

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Asset Replacment - Planned

Asset Category		Population	# Asset Units									
			# Replaced 2018	# Replaced 2019	# Replaced 2020	# Replaced 2021	# Forecast to be Replaced 2022	# Forecast to be Replaced 2023	# Forecast to be Replaced 2024	# Forecast to be Replaced 2025	# Forecast to be Replaced 2026	# Forecast to be Replaced 2027
Station Transformers	All		22	21	14	22	2	20	31	23	21	33
	In Service **(Note 8)**		20	15	12	19	0	18	29	21	19	31
	Spares		2	6	2	3	2	2	2	2	2	2
Mobile Unit Substations **(Note 6)**			0	3	2	0	2	1	2	2	2	2
Reclosers **(Note 7)**	All		46	274	284	298	276	307	244	54	81	126
	Oil		**Note 2**									
	Vaccum											
	Metalclad		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Circuit Breakers	All		**Note 3**									
	Oil											
	Vaccum											
	Metalclad											
Switches			18	23	10	20	19	10	14	12	11	20
Fuses			**Note 4**									
Station Structures												
Fences												
Station Grounding Systems												
Station Service Transformers												
Insulators												
Bus Work												
Protection Relays												
IEDs												
Spill Containment Systems			0	0	0	0	0	0	0	0	0	0
MUS Structures			10	16	22	23	20	23	26	23	25	34
Poles	All		5,982	3,984	4,519	5,344	5,050	10,300	10,300	10,300	10,300	10,300
	Wood	Note 1	**Note 2**									
	Steel											
	Concrete											
	Composite											
	Red Pine Wood		1,166	1,437	1,720	1,819	**Note 5**					
Rights of Way	kilometers of line clearing completed		26,070	28,009	22,716	33,298	33,053	31,364	30,318	30,319	30,320	30,322
Line Transformers	All		1,753	1,558	1,093	1,241	1,684	1,555	1,558	1,423	70	20
	Pole Mounted Transformers		1,753	1,539	1,028	1,165	1,453	1,325	1,248	1,153		
	Pad Mounted Transformers											
	Submersible transformers		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Transclosures and Pole-Trans Transformer		0	19	65	76	231	230	310	270	70	20
Submarine Cables (Note 9)			25.1 km	155 units	199 units	163 units	280 units	280 units	280 units	280 units	280 units	280 units
Conductor	All		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Overhead (metres)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Underground		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Switches	Air Break & Load Break - 3 Phase		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Reclosers/Regulators	All		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Hydraulic		**Note 2**									
	Electronic											
Capacitor Banks			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
AMI	All		24,513	28,141	29,806	34,707	108,382	116,402	101,030	67,889	40,429	21,725
	Retails Meters		22,397	25,894	27,833	32,770	106,387	114,402	99,025	65,982	38,871	20,664
	Collectors		972	741	778	655	914	917	919	874	714	486
	Repeaters		1,144	1,506	1,195	1,282	1,081	1,083	1,086	1,033	844	575

NA	Not applicable/Not available.
Note 1	Please refer to Exhibit I-03-B3-AMPCO-65 and Exhibit B1, Tab 1, Schedule 1, DSP Section 3.2 for the population information.
Note 2	Hydro One does not track plannned replacements to this level of granularity for subtype.
Note 3	When distribution station breakers are replaced, they are replaced with reclosers.
Note 4	Hydro One does not track planned replacements to this level of granularity; as these assets are generally addressed as part of the integrated distribution station refurbishments not as individual component replacements.
Note 5	Hydro One does not have a forecast for red pine poles specifically as they will be addressed based on condition and priority relative to other poles.
Note 6	The 2023-2027 forecast represent the number of MUS replacements and MUS transformer replacements.
Note 7	These replacements include the total number replaced under both the component replacement program and station refurbishments.
Note 8	The 2023-2027 forecast is based on 106 and 12 poor condition transformers identified in SR-04 and SR-11, respectively. The forecast numbers do not include unplanned repalcements due to failures.
Note 9	2018 submarine cable replacement units were reported in metres of cable replaced. Since 2019, submarine cable replacement units are reported in number of cables replaced.

O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 138

Reference:

Exhibit O-2-1
Exhibit I-03-B3-AMPCO-077

Interrogatory:

With respect to Station Transformer data, the response indicates 62 station transformers will be addressed over the 2018 to 2022 period and 118 transformers will be addressed over the 2023 to 2027 period, 106 transformers in SR-04 and 12 transformers in SR-11.

Please complete the following table:

# Station Transformer Units by ISD												
Investment Summary Document ID	2018	2019	2020	2021 Forecast	2021 Actual	2022 Bridge	2022 Update	2023 Test	2024 Test	2025 Test	2026 Test	2027 Test

Response:

In Procedural Order Number 5 (PO5), the Commission stated: "*The OEB is providing for written interrogatories on Hydro One's application update. Parties are to only file interrogatories pertaining to the evidence filed by Hydro One on March 31, 2022 and April 8, 2022. Such interrogatories are not to be used as an opportunity for further exploration and questioning of evidence previously filed in this proceeding*."

This interrogatory is related to Hydro One's original evidence, does not seek clarification or information on Hydro One's updated evidence and is outside the scope of interrogatories permitted by PO5. Hydro One respectfully declines to respond to this interrogatory.

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 139

Reference:

I-03-B3-AMPCO-078, Updated March 31,2022

Interrogatory:

Please add the following columns to the spreadsheet provided in the response.

a) 2021 year end actuals.

b) Any changes to 2022 forecast.

c) Please file the updated excel spreadsheet.

Response:

a) Please refer to Attachment 1 of this interrogatory response.

b) Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

c) Addressed in part (a) of this response.

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Appendix 2-AA: On the basis of ISA

Capital Projects Table ($M)

												Forecast Period (As-Filed)					Forecast Period (Updated for Inflation)*				
Projects	**2018 Plan (DRO)**	**2018**	**2019 Plan (DRO)**	**2019**	**2020 Plan (DRO)**	**2020**	**2021 Plan (DRO)**	**2021 Bridge**	**2021 Year End Actuals**	**2022 Plan (DRO)**	**2022 Bridge**	**2023 Test**	**2024 Test**	**2025 Test**	**2026 Test**	**2027 Test**	**2023 Test**	**2024 Test**	**2025 Test**	**2026 Test**	**2027 Test**
Reporting Basis		USGAAP		USGAAP		USGAAP		USGAAP			USGAAP	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP
System Access																					
D-SA-01 Joint Use and Relocations	23.4	23.4	17.1	26.9	17.7	24.6	17.7	23.8	28.7	17.9	19.3	24.4	28.7	27.1	26.5	27.2	25.6	30.2	28.5	27.9	28.6
D-SA-02 New Load Connections, Upgrades, Cancellations	124.5	124.5	101.8	134.8	106.0	147.3	104.7	137.0	173.7	105.6	141.6	150.7	154.5	158.4	162.4	166.5	158.6	162.6	166.8	171.0	175.3
D-SA-03 Customer Demand Distributed Energy Resources	15.7	15.7	8.0	8.2	2.7	3.8	2.2	5.0	1.0	1.6	1.7	2.4	2.4	1.4	1.4	1.4	2.6	2.6	1.5	1.5	1.5
D-SA-04 Metering Sustainment	32.0	32.0	20.8	20.0	18.4	21.7	36.2	16.9	22.6	18.0	18.6	62.1	56.1	40.5	22.2	8.9	65.3	59.1	42.6	23.3	9.4
D-SA-Other	1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sub-Total System Access	**196.9**	**196.9**	**147.7**	**189.9**	**144.7**	**197.5**	**160.8**	**182.7**	**226.1**	**143.1**	**181.2**	**239.6**	**241.8**	**227.5**	**212.5**	**204.1**	**252.1**	**254.5**	**239.4**	**223.7**	**214.8**
System Renewal																					
D-SR-01 Distribution Stations Demand Capital Program	3.9	3.9	5.3	4.8	4.7	5.2	4.8	5.9	10.9	4.9	4.9	6.2	6.7	7.3	6.0	6.1	6.5	7.1	7.7	6.3	6.4
D-SR-02 Mobile Unit Substation Program	0.0	0.0	3.3	7.2	4.6	5.3	4.3	3.5	0.1	4.8	3.2	4.0	3.8	3.8	3.0	3.7	4.2	4.0	4.0	3.2	3.9
D-SR-03 Distribution Station Planned Component Replacement Program	4.4	4.4	7.4	7.9	6.4	8.0	6.7	9.9	10.2	6.8	7.0	6.5	3.3	1.1	1.1	1.2	6.8	3.5	1.2	1.2	1.2
D-SR-04 Distribution Station Refurbishment	15.0	15.0	33.1	26.7	21.3	7.6	23.9	15.4	11.7	28.0	7.4	26.4	56.3	34.0	26.8	38.0	27.7	59.2	35.8	28.2	40.0
D-SR-05 Distribution Lines Trouble Call and Storm Damage Response	112.0	112.0	75.6	74.5	80.2	117.6	78.7	92.2	119.6	79.5	93.8	107.1	109.2	111.4	113.6	115.9	112.4	114.9	117.2	119.6	122.0
D-SR-06 Distribution Lines PCB Equipment Replacement Program	6.3	6.3	9.9	8.1	11.0	4.8	12.4	9.5	6.0	12.5	9.5	9.4	9.5	9.5	0.0	0.0	9.9	9.9	10.0	0.0	0.0
D-SR-07 Pole Sustainment Program	51.8	51.8	53.2	44.2	59.7	43.5	58.8	73.3	60.4	58.3	60.1	107.9	110.0	112.2	114.4	116.7	113.2	115.8	118.1	120.4	122.8
D-SR-08 Distribution Lines Minor Component Replacement Program	4.1	4.1	7.0	4.9	4.1	6.3	7.2	9.9	9.0	7.6	12.5	12.5	12.4	12.2	8.3	6.5	13.1	13.1	12.8	8.7	6.9
D-SR-09 Submarine Cable Replacement Program	3.6	3.6	9.1	6.2	9.7	6.6	9.8	10.2	6.6	9.9	11.1	12.1	12.4	12.7	12.9	13.2	12.7	13.1	13.3	13.6	13.9
D-SR-10 Distribution Lines Sustainment Initiatives	7.6	7.6	11.1	9.4	12.8	9.8	26.4	13.0	14.1	30.4	11.2	30.3	33.1	37.2	31.9	47.6	31.8	34.8	39.2	33.6	50.1
D-SR-11 Life Cycle Optimization & Operational Efficiency Projects	18.2	18.2	6.2	5.1	4.9	2.4	3.1	4.4	3.7	6.2	0.0	1.0	6.0	8.5	3.0	0.2	1.0	6.4	8.9	3.1	0.2
D-SR-12 Advanced Meter Infrastructure 2.0 (AMI 2.0)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	3.9	30.9	62.0	153.7	154.4	157.3	32.5	65.3	161.7	162.6	165.6
D-SR-Other	2.7	2.7	2.2	2.8	6.1	0.9	5.8	0.6	1.1	2.3	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0
Sub-Total System Renewal	**229.6**	**229.6**	**223.3**	**201.9**	**225.3**	**217.8**	**241.9**	**248.7**	**253.3**	**251.2**	**225.5**	**355.2**	**425.6**	**504.4**	**476.3**	**507.3**	**372.9**	**447.9**	**530.9**	**501.3**	**533.9**
System Service																					
D-SS-01 System Upgrades Driven by Load Growth	34.4	34.4	15.8	24.7	125.0	58.1	94.3	20.4	19.1	74.0	95.4	147.8	52.6	150.4	90.9	83.9	151.6	55.3	158.3	95.7	88.3
D-SS-02 Reliability Improvements	2.1	2.1	7.8	4.2	5.3	5.0	5.9	2.8	5.2	0.0	5.5	5.5	3.2	5.5	13.4	13.2	5.7	3.4	5.8	14.1	13.9
D-SS-03 Demand System Modifications	12.5	12.5	8.8	11.4	8.8	12.9	8.6	8.1	14.3	10.6	8.9	12.1	13.0	13.3	13.5	13.8	12.4	13.7	14.0	14.2	14.5
D-SS-04 Energy Storage Solutions	0.0	0.0	8.1	0.0	0.0	0.0	0.0	8.5	11.1	0.0	3.4	16.3	34.6	35.2	35.9	36.2	16.7	36.3	37.1	37.8	38.1
D-SS-05 Worst Performing Feeders	4.7	4.7	18.5	18.6	15.8	17.2	15.2	26.9	24.3	12.8	21.0	40.6	41.4	42.7	43.0	43.8	41.7	43.5	44.9	45.2	46.1
D-SS-06 Power Quality and Stray Voltage	1.0	1.0	0.8	1.3	0.9	1.2	0.9	3.3	3.2	0.9	3.4	3.8	3.9	4.0	4.0	4.1	3.9	4.1	4.2	4.2	4.3
D-SS-Other	59.2	59.2	21.8	28.9	15.2	2.8	13.9	0.8	3.3	14.2	0.1	0.13	0.13	0.13	0.14	0.14	0.1	0.1	0.1	0.1	0.1
Sub-Total System Service	**113.9**	**113.9**	**81.6**	**89.2**	**170.9**	**97.3**	**138.8**	**70.8**	**80.5**	**112.4**	**137.7**	**226.3**	**148.8**	**251.2**	**200.9**	**195.1**	**232.1**	**156.3**	**264.4**	**211.4**	**205.4**
General Plant Allocated to Distribution																					
Fleet	18.1	18.1	27.8	29.0	29.4	25.7	28.3	28.3	16.9	28.2	28.5	50.6	51.7	52.2	53.0	54.7	52.5	54.4	55.0	55.8	**57.6**
Facilities & Real Estate	13.0	13.0	11.4	12.0	34.5	41.4	15.1	14.4	17.4	50.6	29.5	31.1	82.4	58.8	29.1	63.5	32.3	86.7	61.9	30.6	**66.8**
Information Solutions	45.0	45.0	56.7	63.2	67.8	80.1	36.7	65.7	31.5	22.3	50.5	54.6	51.7	105.3	85.1	78.5	56.9	54.4	110.8	89.6	**82.6**
System Operations	7.3	7.3	6.6	2.2	4.2	6.3	84.1	89.5	83.2	2.3	3.5	10.5	23.1	4.0	3.3	3.5	10.9	24.3	4.3	3.4	**3.7**
System Capability Reinforcement	4.1	4.1	1.5	0.3	0.0	-0.7	0.0	0.0	2.2	0.0	0.0	3.0	2.2	0.0	1.1	1.0	3.2	2.3	0.0	1.2	**1.1**
Other	0.0	0.0	0.0	-2.7	0.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	**0.0**
Sub-Total General Plant	**87.4**	**87.4**	**103.9**	**104.1**	**135.9**	**155.5**	**164.1**	**197.9**	**151.2**	**103.4**	**112.0**	**149.9**	**211.1**	**220.4**	**171.5**	**201.2**	**155.5**	**222.2**	**231.9**	**180.5**	**211.8**
Subtotal (SA, SR, SS)	**540.4**	**540.4**	**452.6**	**481.1**	**540.9**	**512.6**	**541.4**	**502.2**	**559.9**	**506.7**	**544.4**	**821.0**	**816.2**	**983.1**	**889.7**	**906.5**	**857.0**	**858.8**	**1,034.7**	**936.4**	**954.1**
GRAND TOTAL	**627.8**	**627.8**	**556.5**	**585.1**	**676.8**	**668.1**	**705.5**	**700.1**	**711.1**	**610.1**	**656.4**	**970.9**	**1,027.3**	**1,203.4**	**1,061.2**	**1,107.8**	**1,012.5**	**1,080.9**	**1,266.6**	**1,116.9**	**1,165.9**

*The 2023-2027 forecast reflects updated inflation assumptions calculated using the methodology described in Section 2.3 of Exhibit O-1-2

Notes:

1 Please provide a breakdown of the major components of each capital project undertaken in each year. Please ensure that all projects below the materiality threshold are included in the miscellaneous line. Add more projects as required.

2 The applicant should group projects appropriately and avoid presentations that result in classification of significant components of the capital budget in the miscellaneous category.

O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 140

Reference:

Exhibit I-22-B3-SEC-115

Interrogatory:

Please update the table for 2021 year end actuals and any changes to the 2022 forecast.

Response:

Please see Attachment 1.

Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

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B3 - SCHOOL ENERGY COALITION INTERROGATORY - 115

Reference:

Exhibit B-3-1, DSP Section 3.2

Interrogatory:

For all assets that were replaced between 2018 and 2021, please provide a table that shows for each major asset type, please provide a table the condition of the asset at the time of replacement.

Response:

Hydro One does not internally report on specific assets replaced on every program or project. Reporting is focused on the objectives of the originating program or project. As an example, the reportable units for the new connection program are the number of connections made whereas the reportable units on the pole replacement program are poles replaced. Reportable units for Stations Transformers, Distribution Poles and are outlined in the table below:

	2018		2019		2020		2021	
	Assets Replaced	% Poor Condition	Assets Replaced	% Poor Condition	Assets Replaced	% Poor Condition	Assets Replaced	% Poor Condition
Station Transformer	20	70%	15	87%	12	100%	19	89%
Poles*	5,962	100%	3,984	100%	4,519	100%	5,344	100%
Meters	22,397	100%	25,894	100%	27,833	100%	32,770	100%

***Poles completed on the pole replacement program.**

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 141

Reference:

I-22-B3-SEC-148, Updated March 31,2022

Interrogatory:

Please update the table for 2021 year end actuals and any changes to the 2022 forecast.

Response:

Please see Attachment 1.

Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

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B3 - SCHOOL ENERGY COALITION INTERROGATORY - 148

Reference:

Exhibit B-3-1, DSP Section 3.11, D-SA-02

Interrogatory:

With respect to new Load Connections, Upgrade and Cancellations program:

a) [p.3] Please expand Table 1 to include actual/forecast amounts for 2018 to 2022.

b) [p.9] Please provide tables that shows in same format as Table 3, the cost of i) new connections, ii) service upgrades, and iii) service cancellations, for each year between 2018 and 2027.

Response:

a)

Table 1 - New Connection, Service Upgrade and Service Cancellation Volumes by Year

Description	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
New Connections	17,385	15,355	17,786	20,404	17,178	18,130	18,230	18,330	18,430	18,540
Service Upgrades	4,174	4,154	4,604	5,145	4,330	4,500	4,530	4,550	4,580	4,600
Service Cancellations	3,376	3,168	2,733	2,864	4,992	5,130	5,130	5,130	5,130	5,130

b)

Table 2 - New Connection Costs by Year

$M	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Gross Investment Costs	118.3	141.0	146.4	166.4	141.4	157.9	161.9	166	170.1	174.4
Less Removals	1.1	1.4	1.4	1.4	1.4	1.6	1.6	1.7	1.7	1.8
Capital and Minor Fixed Assets	117.2	139.7	145.0	165.0	140.0	156.3	160.2	164.3	168.4	172.7
Less Capital Contributions	19.2	24.8	29.7	25.8	26.3	29.4	30.1	30.8	31.6	32.3
Net Investment Costs	97.9	114.9	115.3	139.2	113.7	126.9	130.2	133.5	136.8	140.3

**The 2023-2027 forecast reflects updated inflation assumptions calculated using the methodology described in Section 2.3 of Exhibit O-1-2.*

Table 3 - Service Upgrade Costs by Year

$M	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Gross Investment Costs	34.9	46.0	52.6	53.3	43.4	48.6	49.9	51.2	52.4	53.7
Less Removals	4.1	5.4	6.3	5.6	5.2	5.8	6.0	6.1	6.3	6.4
Capital and Minor Fixed Assets	30.8	40.6	46.4	47.7	38.2	42.8	43.9	45.0	46.1	47.3
Less Capital Contributions	7.6	13.8	15.6	11.0	10.2	11.2	11.4	11.7	11.9	12.2
Net Investment Costs	23.3	26.8	30.7	36.7	28.0	31.7	32.5	33.4	34.2	35.0

** The 2023-2027 forecast reflects updated inflation assumptions calculated using the methodology described in Section 2.3 of Exhibit O-1-2.*

Table 4 - Service Cancellation Costs by Year

$M	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Gross Investment Costs	2.5	2.9	1.5	2.5	4.1	4.5	4.5	4.6	4.7	4.8
Less Removals	2.5	2.9	1.1	2.4	4.1	4.5	4.5	4.6	4.7	4.8
Capital and Minor Fixed Assets	0.0	0.0	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Less Capital Contributions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Investment Costs	**0.0**	**0.0**	**0.4**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

** The 2023-2027 forecast reflects updated inflation assumptions calculated using the methodology described in Section 2.3 of Exhibit O-1-2.*

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 142

Reference:

Exhibit O-2-1
Exhibit I-03-B3-AMPCO-103

Interrogatory:

Please complete the following tables:

D-SR-10 Distribution Lines Sustainment Initiatives	2018	2019	2020	2021 Forecast	2021 Actual	2022 Bridge	2022 Update	2023 Test	2024 Test	2025 Test	2026 Test	2027 Test
# Units												
Rebuild (km)												
Relocation (km)												
Cable Replacement (km)												
Direct Buried Cable Injection (km)												
Other - Relocations/Rebuilds (km)												
Other - Cable Replacment km												

D-SR-10 Distribution Lines Sustainment Initiatives	2018	2019	2020	2021 Forecast	2021 Actual	2022 Bridge	2022 Update	2023 Test	2024 Test	2025 Test	2026 Test	2027 Test
$												
Rebuild ($)												
Relocation ($)												
Cable Replacement ($)												
Direct Buried Cable Injection ($)												
Other - Relocations/Rebuilds ($)												
Other - Cable Replacment ($)												

Response:

Hydro One has updated the first table for 2021 Actuals. The values for the 2023 to 2027 figures in the first table were provided in I-03-B3-AMPCO-103. Please see Attachment 1.

For the 2022 Update columns in both tables, Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

For the second table in its entirety, In Procedural Order Number 5 (PO5), the Commission stated: "The OEB is providing for written interrogatories on Hydro One's application update. Parties are to only file interrogatories pertaining to the evidence filed by Hydro One on March 31, 2022 and April 8, 2022. Such interrogatories are not to be used as an opportunity for further exploration and questioning of evidence previously filed in this proceeding." This interrogatory is related to Hydro One's original evidence, does not seek clarification or information on Hydro One's updated

evidence and is outside the scope of interrogatories permitted by PO5. Hydro One respectfully declines to respond to this interrogatory.

B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 103

Reference:

DSP Section 3.11, D-SR-11, Page 12, Appendix A

Interrogatory:

Please complete the following table:

D-SR-11	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Planned Line Rebuild (km)										
Planned Line Relocation (km)										
Total										

a) Please provide the total km of actual line rebuild for the period 2018 to 2021.

b) Please provide the total km of actual line relocation for the period 2018 to 2021.

c) Please provide the total number of poles replaced for the period 2018 to 2022.

d) Please provide the forecast number of poles to be replaced for the period 2023 to 2027.

e) Please provide the average quantity of conductors and insulators per km of line.

Response:

For this response it was assumed the reference to SR-11 was incorrect and that the intent was to reference SR-10 as SR-11 does not have a page 12.

Planned line work is as follows:

D-SR-10*	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Planned Line Rebuild (km)	25	1	11	11	26	0	10	1	10	40
Planned Line Relocation (km)	30	8	47	66	83	41	23	56	17	10
Planned Line Rebuild/ Relocation (km) projects < $1M**	12	3	12	7	7	49	52	55	57	60
Total	67	12	70	84	116	90	85	112	84	110

**kms of overhead distribution line rebuilds/relocations only include work that is part of ISD D-SR-10.*

***For projects less than $1M, km accomplishments are not tracked and the values provided are estimated.*

and b) actual line work is as follows:

a)

D-SR-10	**2018**	**2019**	**2020**	**2021**
Actual Line Rebuild (km) *	25	21	22	11.8
Actual Line Relocation (km) *	30	4	2	8.9
Total	55	25	24	20.7

**kms of overhead distribution line only include material investments that were part of the ISD D-SR-10, as km accomplishments for projects less than $1M are not tracked.*

c) & d) The number of pole replacements is not tracked by projects completed under this investment.

e) The quantity of conductors and insulators per km of line are not tracked by projects completed under this investment. For information on Hydro One's Distribution Lines assets, see B-3-1 Section 3.2.3.

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 143

Reference:

Exhibit O-2-1
Exhibit I-08-B3-Energy Probe-043, part a)

Interrogatory:

Please provide the table in the response to part (a) for the years 2018 to 2022.

Response:

Hydro One has updated the table in I-08-B3-Energy Probe-043, part a), as part of Attachment 1 of this response to reflect 2021 actuals.

The remainder of this request is outside the scope established for interrogatories. Regarding the request for 2022 information, Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4.

Regarding the information requested for 2018 to 2020, in Procedural Order Number 5 (PO5), the OEB stated: "The OEB is providing for written interrogatories on Hydro One's application update. Parties are to only file interrogatories pertaining to the evidence filed by Hydro One on March 31, 2022 and April 8, 2022. Such interrogatories are not to be used as an opportunity for further exploration and questioning of evidence previously filed in this proceeding." This interrogatory is related to Hydro One's original evidence, does not seek clarification or information on Hydro One's updated evidence and is outside the scope of interrogatories permitted by PO5. Hydro One respectfully declines to respond to this interrogatory.

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B3 - ENERGY PROBE INTERROGATORY - 043

Reference:

Exhibit B-3-1, DSP Section 3.11, D-SS-05, Pages 10-11, Table 2

Interrogatory:

a) Please explain how the forecast of the Gross Investment Cost was developed showing all calculations.

b) Are all costs of the three alternatives assumed to be capital costs or are some of the costs expected to be OM&A? Please explain your answer.

c) Was the decision to select Alternative 3, Continue with the WPF Investment to Improve Reliability for 600,000 Customers, based on a quantitative analysis such as discounted cash flow or a quantitative risk analysis, or was it based on a qualitative analysis that did not use any numerical methods? If a quantitative analysis was used, please file the analysis. If the answer is no, please explain why not.

Response:

a) The average gross cost to deploy remote controllable switching equipment and communicating faulted circuit indicators was estimated per device. The expected number of devices needed per feeder was determined based on historical deployments under this program. The number of devices was then multiplied by expected cost per device.

The table below shows the calculation over the plan period:

	2021	2023	2024	2025	2026	2027
Feeders with Switches	14	44	45	46	46	46
# of Feeders with CFCIs	70	60	60	60	60	60
Total Feeders	84	104	105	106	106	106
Number of CFCIs	564	1070	1070	1070	1070	1070
Expected Cost per CFCI ($k) ($3k/device in 2023)	2.4*	3.0	3.0	3.1	3.1	3.2
Expected cost for CFCIs ($M)	1.4*	**3.2**	**3.3**	**3.3**	**3.4**	**3.4**
Number of Switches	152	243	247	252	253	254
Expected Cost per Switch ($k) ($150k/Device in 2023)	150*	150.0	152.3	154.5	156.9	159.2
Expected Cost for Switches ($M)	22.8*	**36.5**	**37.6**	**38.9**	**39.7**	**40.4**
Total Program Cost ($M)	24.2*	**39.6**	**40.9**	**42.2**	**43.0**	**43.8**

* Actual cost of switches and CFCIs In-serviced.

b) There is no cost associated with Alternative 1 (Do nothing alternative). The associated cost with Alternative 2 and 3 are all capital cost as it involves the installation of new equipment.

c) The alternative selected was based on a quantitative risk assessment using the methodology detailed in B-03-01 Section 3.7, Pg.9, Line 4, and the taxonomy tables found in B-01-01 Section 1.7, pg.19-20. The table below summarizes the results of total lifecycle risk mitigated as well as the Risk Spend Efficiency for each of the two major categories under this investment: installation of remote operable devices, and installation of communicating fault current

indicators (CFCI). Furthermore, Customer Engagement results supported Hydro One's Accelerated Plan Pace, to provide reliability improvements for 600,000 customers.

The table below shows risk mitigated and Risk Spend Efficiency (RSE) for Remote Operable devices:

Plan Year	Risk Mitigated	Risk Spend Efficiency
2023	2,449,691	67,236
2024	624,685	16,818
2025	568,682	15,017
2026	502,441	12,688
2027	439,653	10,893

The table below shows risk mitigated and Risk Spend Efficiency (RSE) for Communicating Fault Current Indicators:

Plan Year	Risk Mitigated	Risk Spend Efficiency
2023	161,293	50,247
2024	144,598	44,355
2025	128,773	39,022
2026	113,773	33,962
2027	34,842	10,248

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O - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 144

Reference:

Exhibit O-2-1
Exhibit I-22-B3-SEC-153

Interrogatory:

a) For Other Projects (<$1 M), please provide the work completed by work type for 2021 (actuals) and 2022 (forecast).

b) For each work type in part (a), please provide the investment cost for 2021 (actuals) and 2022 forecast.

Response:

a) As noted in I-03-B3-AMPCO-103, for projects less than $1M, km accomplishment are not tracked.

b) In Procedural Order Number 5 (PO5), the Commission stated: "The OEB is providing for written interrogatories on Hydro One's application update. Parties are to only file interrogatories pertaining to the evidence filed by Hydro One on March 31, 2022, and April 8, 2022. Such interrogatories are not to be used as an opportunity for further exploration and questioning of evidence previously filed in this proceeding." This interrogatory is related to Hydro One's original evidence, does not seek clarification or information on Hydro One's updated evidence and is outside the scope of interrogatories permitted by PO5. Hydro One respectfully declines to respond to this interrogatory.

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O - CANADIAN MANUFACTURERS & EXPORTERS INTERROGATORY - 022

Reference:

Exhibit O-1-1, Page 2
Exhibit O-1-2, Page 17

Interrogatory:

At Schedule 1, p. 2, HONI stated "With evolving circumstances continuing to impact forecast inflation levels (and the trend) for 2022 and 2023, Hydro One has developed an approach to help protect its customers from the impacts of this uncertainty on their electricity transmission and distribution rates and to deliver on our public commitments by deferring the recovery of approved revenue requirements that reflect the updated inflation assumptions impacting capital and OM&A forecasts."

At Schedule 2, p. 17, HONI states:
"If the cumulative inflation for 2022 and 2023 exceeds 10%, Hydro One will aim to manage its work program to the capped amount through investment reprioritization and redirection and will adjust the outcomes outlined in TSP Section 2.5 and DSP Section 3.5 accordingly."

a) Why did HONI determine that it was appropriate to begin reprioritization and redirection of capital budgets with a cumulative inflation of 10%?

b) Were other thresholds considered to trigger reprioritization and redirections? Please explain fully.

c) Were any other approaches considered to help protect HONI's customers from the impact of inflation on HONI's revenue requirement request for 2024 and onwards? For instance, did HONI consider curtailing or reducing its capital investment plan in order to attempt to offset some of the increase caused by higher inflation for those years?

d) If the answer to (c) is no, why not?

e) If the answer to (c) is yes, please outline what other options were considered and why HONI felt deferral was the most appropriate response.

Response:

a) Please refer to interrogatory response O-VECC-149.

b) Please refer to interrogatory response O-VECC-149.

c) There are two main options to help mitigate inflationary pressures on customers:

1. Adjust costs for inflation but defer the incremental revenue requirement to the next rate period
    i. Hydro One selected this option because it allows the company to complete the proposed workplan and address system risks without putting additional upward pressures on customers' bills during a period of economic uncertainty
2. Defer work to the next rate period
    i. Doing less work exposes the system to risks that are inconsistent with Hydro One's safety and reliability commitments and this approach is inconsistent with customer expectations as articulated in the customer engagement exercise. In addition, the deferred work would need to be addressed in the next rate period, in addition to all the work that will arise between now and then. In other words, deferring the work will require a larger workplan in the next rate application.

d) Not applicable.

e) Please refer to part c) above.

O - CANADIAN MANUFACTURERS & EXPORTERS INTERROGATORY - 023

Reference:

Exhibit O-1-1, Page 2
Exhibit O-1-3, Page 1

Interrogatory:

At p. 2, HONI stated: "The 2021 APO contains materially higher forecasts for CDM in Ontario, averaging a 19% increase in CDM compared to the forecast used in the pre-filed evidence over the test period (2023-2027). As a result of the change in the IESO's CDM forecast, from its 2020 APO to its 2021 APO, the CDM assumptions used to establish Hydro One's load forecasts for both transmission and distribution have become outdated. Updating the CDM assumptions in Hydro One's load forecasts has a material impact on the load forecasts for both distribution and transmission, which must be taken into account to ensure that the billing determinants underpinning rates appropriately allow for recovery of Hydro One's approved rates revenue requirements."

i. Please confirm whether HONI reviewed any other aspects of load forecasting, for instance, load growth due to population growth forecasts or increased electrification to determine whether those inputs of the load forecast should also be updated.

ii. If the answer to (a) is no, please explain why not.

iii. If the answer to (a) is yes, please describe what other factors HONI reviewed, and why it decided not to include them in this update.

Response:

i. Yes. While the material changes to the IESO's forecasts of CDM drove the need to update its load forecasts, Hydro One reviewed many other aspects of load forecasting as part of its due diligence in preparing its updated evidence.

ii. Not applicable in view of response to part i) above.

iii. Apart from the CDM update by the IESO that was the major factor for updating the forecast, Hydro One reviewed many other factors (e.g., population growth, electrification, etc.) however, the changes were not significant. Some notable factors include:

1. In view of increasing inflation, supply chain constraints, declining consumer confidence, and the prospect of rising interest rates at the time of the forecast update, the small upward manual adjustment, which was applied to the transmission forecast in the original forecast under the "Other" category, was reduced as discussed in the updated response to Exhibit JT-VECC-TCQ-04.

2. In the case of the distribution direct customers forecast (i.e., sub-transmission class), our industry monitoring and analysis pointed to more potential growth in the future than was expected in the original forecast. Consequently, the distribution forecast was increased to avoid any bias in this regard.

3. Hydro One also observed an increase in housing starts in 2021 but this was not expected to last in view of the prospects of rising interest rates and affordability issues. The latter factors have already started to reduce the actual values of housing starts. For example, according to the April issue of Altus Group Backpage Statistics, the housing starts in March 2022, seasonally adjusted an annual rate, decreased by 33% compared to March 2021. Consequently, no change to the forecast in this regard was made.

4. As noted in response to DRC-11, Hydro One also reviewed the EV assumptions in its forecast relative to the updated amounts in the 2021 APO and determined that the EV forecast embedded in Hydro One's load forecast remained consistent with the revised amounts in the 2021 APO.

O - CANADIAN CONSUMERS COUNCIL INTERROGATORY - 045

Reference:

Exhibit O-1, Page 2

Interrogatory:

Please provide all correspondence provided to HON's Board of Directors and Senior Leadership Team regarding inflation impacts for the 2023-2027 rate period. Please indicate when HON made the decision to request that the settlement conference be deferred pending an evidence update to reflect the impact of inflation on its proposed Investment Plan. Was this decision subject to Board of Directors approval?

Response:

Please see response to O-SEC-242 for Hydro One's response regarding materials provided to the Board of Directors and Executive Leadership Team.

Hydro One made the decision to request a postponement of the settlement conference on February 3, 2022. The Board of Directors was advised of the decision and rationale but approval was not required.

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O - CANADIAN CONSUMERS COUNCIL INTERROGATORY - 046

Reference:

Exhibit O-1, Page 2

Interrogatory:

The evidence states that HON's five-year Investment Plans for transmission and distribution used a 2% Ontario Consumer Price Index (CPI) assumption. Please explain, in detail how the 2% CPI was used in determining the Investment Plans.

Response:

When Hydro One developed the investment plan, cost estimates for candidate investments reflected recent actuals or estimates (Present Values). The original 2% CPI assumption was used to escalate these estimated costs for the 2023-2027 period (Future Values).

A simplified example is provided below. The candidate investment is expected to cost $5M/yr based on recent actuals/estimate. The cost of this investment in Year 1 will be escalated by 2% to reflect the cost of the investment in that year. The cost in Year 2 will be based on escalating Year 1 by 2%.

	Year 0	Year 1	Year 2	Year 3
Estimate (Present Value)	5.0	5.0	5.0	5.0
Forecast Period (Future Value)	5.0	5.1	5.2	5.3
Escalation (annual year-over-year)	-	2%	2%	2%

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O - CANADIAN CONSUMERS COUNCIL INTERROGATORY - 047

Reference:

Exhibit O-1, Page 3

Interrogatory:

HOH has provided the impacts on the 2023 revenue requirements for transmission resulting from the CPI inflation forecasts provided by Scotia Capital. The impacts for transmission and distribution are $26.1 and $36.7 million respectively. The evidence states that a further update was provided in March indicating that the 2022 inflation forecast is now 6.3% (previously 4.5%). What are the impacts on the 2023 revenue requirements resulting from this change?

Response:

Please refer to interrogatory response to O-SEC-246.

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O - CANADIAN CONSUMERS COUNCIL INTERROGATORY - 048

Reference:

Exhibit O-1, Page 3

Interrogatory:

The evidence states that HON is proposing to defer the Transmission and Distribution revenue requirement increases arising from the higher assumed inflation to the next rate period. The incremental revenue requirements associated with this inflation update will be recorded in deferral accounts for recovery in 2028. As a result, there will be no material changes to the proposed transmission or distribution rates for the 2023-2027 rate period due to the proposed changes in inflation assumptions. Please explain the extent to which HON considered other options to address inflationary pressures. For example, did HON consider project reprioritization? Did HON look for projects to defer? If not, why not. If so, please explain what options were considered and why they were rejected.

Response:

Please see Interrogatory O-CME-022.

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O - CANADIAN CONSUMERS COUNCIL INTERROGATORY - 049

Reference:

Exhibit O-1, Page 4

Interrogatory:

No interrogatory received.

Response:

No response.

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O - CANADIAN CONSUMERS COUNCIL INTERROGATORY - 050

Reference:

Exhibit O-1, Pages 1-4

Interrogatory:

Please explain why HON has essentially provided a "selective update" with respect to its Application. The updates are related to changes in inflation and changes in the IESO's Conservation and Demand Management (CDM) forecasts that impact the load forecasts. In addition, there is a update regarding he External Station Maintenance, E&CS and Other External Revenues Account (a correction). Did HON consider updating other components of its Application? If so, please discuss what was considered. If not, why have the updates been limited to the impacts resulting from changes to inflation and CDM?

Response:

As explained in Exhibit O-01-02, at p. 1, Hydro One has an obligation under the OEB's Rules of Practice and Procedure to amend its evidence to reflect new information that constitutes a material change to the evidence that is already before the OEB in this Application. The scope of Hydro One's evidence update is a direct reflection of Hydro One fulfilling this obligation. No other new information constituting a material change to the evidence was identified and, as such, Hydro One did not consider updating other components of the evidence. The inclusion of updated information regarding the Transmission External Revenues Variance Account follows up on a commitment made by Hydro One during the Technical Conference to correct for an inconsistency identified earlier in the proceeding. Additionally, Hydro One provided an update to 2021 actuals along with the associated interrogatory responses and undertakings materially affected by this evidence update in response to Procedural Order #4.

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O - CANADIAN CONSUMERS COUNCIL INTERROGATORY - 051

Reference:

Exhibit O-1-2, Page 6

Interrogatory:

The evidence discusses the fact that essential commodities have a significant impact on HON's costs. Equipment purchased by HON like power transformers, breakers and tower steel is heavily impacted by certain raw material indices such as copper aluminium and steel which have undergone price increases and supply shortages. In addition, shipping costs have contributed to price inflation. Shipping issues have resulted in limited supplies. Please explain the extent to which these factors may contribute to HON's ability to complete its capital plans as proposed. Please provide any studies or reports that HON has produced or relied on regarding commodity price increases and supply costs and the potential impact on its plans.

Response:

Please refer to Interrogatory O-Staff-363, part f) for the impact on Hydro One's capital plan and to Interrogatory O-SEC-261 for details on the study completed.

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O - CANADIAN CONSUMERS COUNCIL INTERROGATORY - 052

Reference:

Exhibit O-1-2, Page 15

Interrogatory:

The evidence states that it is important for the distribution management program to be sustained as proposed to target vegetation defects in a timely manner. Please indicate what factor may cause delays or interruptions in the vegetation management program.

Response:

To successfully achieve the reliability and safety benefits of Hydro One's proposed vegetation management plan, the forecast costs must be updated to include the impacts of inflation. If current inflation impacts are not accounted for, Hydro One will need to scale down the planned accomplishments and will not be able to complete the necessary vegetation work included in the investment plan.

As noted in Exhibit O-1-2, it is important for the distribution vegetation management program to be sustained as proposed to target vegetation defects in a timely manner. Delays or interruptions in vegetation management on a right of way allows vegetation defects to multiply, resulting in worsening reliability, safety risks and increased future forestry clearing work at a higher cost.

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O - CANADIAN CONSUMERS COUNCIL INTERROGATORY - 053

Reference:

Exhibit O-1-2, Page 16

Interrogatory:

HON is proposing that as part of the Draft Rate order process it will update the inflation forecast for 2022 and 2023.

1. What process is HON proposing that will allow OEB Staff, Intervenors and the OEB to provide input/submissions regarding those updates?

2. Why should HON's ratepayers bear all of the inflation risk going forward?

Response:

1. Hydro One's proposed process for confirming and adjusting the inflation forecast is described in Exhibit O-01-02, at section 2.5.2. Using the process described in that section of the evidence, Hydro One proposes to reflect the updated inflation forecast/actual inflation for 2022 and 2023 in the Draft Rate Order that it files with the OEB. Assuming that the OEB approves the confirmation and adjustment process in its Decision and Order, it is not expected that this update would necessitate any distinct process for submissions from OEB staff or intervenors. However, to the extent that parties want to comment on the manner in which Hydro One has incorporated the updated inflation forecast into the Draft Rate Order, it is expected that parties will have an opportunity to do so as part of their submissions on the Draft Rate Order and that Hydro One would have an opportunity to file a reply submission before the OEB issues the Final Rate Order, all of which is consistent with the OEB's typical process.

2. Hydro One disagrees with the premise of the question. It is incumbent on ratepayers to pay for the capital and OM&A plans that provide them with regulated service and corresponding benefits. Hydro One has an obligation to present to the OEB its best forecast of its capital and OM&A plans for the purposes of approving the associated revenue requirements and establishing just and reasonable rates. In the plan that was filed in August 2021, forecasted costs included a 2.0% inflation assumption. Because of circumstances beyond Hydro One's control, that inflation assumption is no longer appropriate, and has materially changed, so the evidence needed to be updated.

To ensure that the forecast of approved capital and OM&A are appropriate with respect to the underlying inflation assumptions, Hydro One has proposed that forecast/actual inflation for 2022 and an updated forecast of inflation for 2023 be used as part of the DRO process. Hydro One recognizes that inflation may continue to escalate over the course of the application and has proposed an Inflation Forecast Cap (Cap), whereby the sum of inflation in 2022 and 2023 will be capped at 10%, to mitigate this concern (See Exhibit O-01-02, p. 17). In other words, the risk to ratepayers is capped at a cumulative 10% and, to the extent inflation is higher than this cap, Hydro One will manage within the approved capital and OM&A envelopes by the OEB leveraging its internal redirection process.

Hydro One further notes that the update to actual and/or forecasted inflation for 2022 and 2023 at the time of the DRO may result in lower inflation rates relative to the rates used to update the evidence in Exhibit O-01-02, which would also serve to limit the risk to ratepayers. As such, the current update for inflation combined with the Confirmation and Adjustment and the Inflation Forecast Cap does not result in ratepayers bearing all of the inflation risk going forward. Furthermore, rates for 2024-2027 will be set in accordance with the proposed Custom IR framework which takes into account the annually issued OEB inflation factors.

O - CANADIAN CONSUMERS COUNCIL INTERROGATORY - 054

Reference:

Exhibit O-1-2, Pages 18-19

Interrogatory:

Please recast the following tables and provide the actual 2021 and the 2022 forecast numbers. Table 6 – Summary of Transmission Recoverable OM&A Expenses and Table 7 – Summary of Distribution Recoverable OM&A Expenses.

Response:

Tables 6 and 7 in Exhibit O-01-02 have been updated to reflect 2021 actuals below.

Table 6 - Summary of Transmission Recoverable OM&A Expenses ($M)

Transmission	Historical					Bridge (As-Filed)	Test Year (As-Filed)	Inflation Update	Variance
	2018	2019	2020		2021	2022	2023	2023	2023
	Actual	Actual	Actual	OEB-Approved	Actual	Forecast	Forecast	Forecast	Forecast
Sustainment	229.4	207.8	200.9	-	205.6	208.3	219.6	231.2	11.5
Development	5.2	4.4	6.7	-	7.0	8.9	8.6	9.0	0.5
Operations	53.4	51.0	47.9	-	47.6	48.6	49.0	51.6	2.6
Customer Care	11.0	7.2	7.0	-	5.8	6.7	6.9	7.3	0.4
Common and Other	54.9	26.7	70.5	-	71.9	50.7	65.0	68.4	3.4
Property Taxes and Rights Payments	65.3	60.8	65.4	-	63.9	70.2	71.4	75.1	3.7
Total	**419.2**	**357.9**	**398.5**	**385.0**	**401.8**	**393.4**	**420.5**	**442.6**	**22.1**

Exhibit reference: E-02-01, Table 2

Table 7 - Summary of Distribution Recoverable OM&A Expenses ($M)

Distribution	Historical					Bridge (As-Filed)	Test Year (As-Filed)	Inflation Update	Variance
	2018	2018	2019	2020	2021	2022	2023	2023	2023
	OEB-Approved	Actual	Actual	Actual	Actual	Forecast	Forecast	Forecast	Forecast
Sustainment	-	312.3	347.1	324.9	345.5	303.6	311.4	327.7	16.3
Development	-	7.5	7.1	6.0	8.5	10.2	11.0	11.6	0.6
Operations	-	37.3	36.6	33.0	38.5	41.3	40.8	42.9	2.1
Customer Care	-	111.7	97.8	111.2	107.8	107.9	118.3	124.5	6.2
Common and Other	-	84.9	66.3	79.7	77.0	67.0	110.0	115.8	5.8
Property Taxes and Rights Payments	-	5.1	4.6	5.4	5.1	5.8	6.0	6.3	0.3
Total	**544.4**	**558.8**	**559.6**	**560.2**	**582.3**	**535.8**	**597.5**	**628.9**	**31.4**

Exhibit reference: E-03-01, Table 2

Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

O - CANADIAN CONSUMERS COUNCIL INTERROGATORY - 055

Reference:

Exhibit O-1-2, Pages 20-22

Interrogatory:

Please recast the following tables and provide the 2021 actual and 2022 forecast numbers. Table 8 – Updated Transmission Capital Expenditures for 2023-2027 and Table 10 – Updated Distribution Capital Expenditures for 2023-2027.

Response:

Please see Exhibit O-02-01 Attachment 1 and Attachment 7 for the 2021 actual amounts.

Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

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O - CANADIAN CONSUMERS COUNCIL INTERROGATORY - 056

Reference:

Exhibit O-1-2, Pages 23 and 24

Interrogatory:

Please recast the following Tables to include 2021 actuals and 2022 forecast. Table 12- Updated Capital in-Service Additions for 2023-2027 and Table 14 – Updated Distribution Capital In-Service Additions for 2023-2027.

Response:

Please see Exhibit O-02-01, Attachment 5 and Attachment 9 for the 2021 actual amounts.

Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

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O - CANADIAN CONSUMERS COUNCIL INTERROGATORY - 057

Reference:

No reference provided

Interrogatory:

Please provide the 2021 actual numbers and 2022 updated forecast for the following interrogatories posed on behalf of the Consumers Council of Canada.

- CCC-8
- CCC-12
- CCC-25
- CCC-33

Response:

The 2021 actual numbers for the first three requested interrogatories are attached as follows:

- Attachment 1 – CCC-008
- Attachment 2 – CCC-012
- Attachment 3 – CCC-025

Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

For Interrogatory CCC-033 - This interrogatory is related to Hydro One's original evidence, does not seek clarification or information on Hydro One's updated evidence and is outside the scope of interrogatories permitted by Procedural Order Number 5. Hydro One respectfully declines to respond to this interrogatory.

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A - CONSUMERS COUNCIL OF CANADA INTERROGATORY - 008

Reference:

Exhibit A-3-1, Page 37

Interrogatory:

Please provide a schedule that sets out historical General Plant Expenditures for the period 2015-2021 in the same format as Table 10. Please include Board approved amounts.

Response:

The General Plant expenditures for the period of 2015-2022[1] are provided in Table 1.

As noted in B-4-1, GSP Section 4.9.2:

> *Given the separate Transmission and Distribution Applications in prior years, the previous OEB approval envelopes differ between the two businesses due to evolving plans and the time elapsed between the separate filings. Therefore, any historical comparisons to the plan amounts are kept separate for Hydro One Transmission and Distribution.*[2]

The General Plant OEB approval amounts for Hydro One's Transmission and Distribution businesses are provided in Table 2.

[1] 2022 is included to also address the request under B4-CCC-20.

[2] Historical OEB approval on general plant has occurred on overlapping rate filings. Each of these filings use different underlying business plans based on the timing of the prior applications. The following applications are the sources of the referenced OEB Approved amounts: EB-2019-0082 (Transmission, 2020-2022) and EB-2017-0049 (Distribution, 2018-2022).

Table 1 - Net capital expenditures for General Plant from 2015-2022

General Plant Area	Actual ($M)							Bridge ($M)
	2015	2016	2017	2018	2019	2020	2021	2022
Fleet	74.2	72.2	48.6	27.4	44.0	39.2	26.0	43.4
Facilities & Real Estate	47.1	47.0	32.3	37.1	31.6	64.7	42.8	42.0
Information Solutions	53.8	95.0	77.0	94.4	114.6	118.4	116.4	73.0
System Operations	21.2	17.8	17.0	9.1	10.7	71.6	110.1	27.5
Other	4.3	7.1	3.6	6.3	5.5	8.9	3.6	22.6
General Plant Total	**200.6**	**239.1**	**178.5**	**174.3**	**206.4**	**302.9**	**298.9**	**208.5**
General Plant - Transmission Allocation	88.6	94.8	76.9	83.6	92.1	124.7	127.7	102.8
General Plant - Distribution Allocation	112.0	144.3	101.6	90.7	114.3	178.2	171.1	105.7

Table 2 - OEB approved amounts for General Plant net capital expenditures for Transmission and Distribution

	OEB Approved ($M)							
	2015	2016	2017	2018	2019	2020	2021	2022
Transmission	116.3	114.6	86.0	119.7	-	111.1	94.4	94.7
Distribution	119.5	117.0	114.3	90.7	142.8	150.3	95.3	100.4

A - CONSUMERS COUNCIL OF CANADA INTERROGATORY - 012

Reference:

Exhibit A-3-1, Page 52

Interrogatory:

Please provide the Board Approved and Actual ROE for Transmission and Distribution for the years 2015-2020.

Response:

Please see updated tables below for the 2021 ROE:

Hydro One Transmission	2015	2016	2017	2018	2019[1]	2020	2021
Approved	9.30%	9.19%	8.78%	9.00%	-	8.52%	8.52%
Achieved	10.93%	10.02%	9.03%	11.08%	9.53%	9.29%	9.30%

[1]*For 2019, Hydro One Transmission did not have an OEB Approved ROE*

Hydro One Distribution	2015	2016	2017	2018	2019	2020	2021
Approved	9.30%	9.19%	8.78%	9.00%	9.00%	9.00%	9.00%
Achieved	8.77%	8.41%	7.94%	8.07%	10.90%	10.56%	10.99%

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E - CONSUMERS COUNCIL OF CANADA INTERROGATORY - 025

Reference:

Exhibit E-2-1, Page 4, Table 2

Interrogatory:

Please provide Transmission OM&A in the same format as Table 2 – Summary of Recoverable OM&A Expenses for the period 2015-2023. Please include the most updated forecast for 2021.

Response:

Please see updated table below for 2021 actuals by the following Transmission OM&A cost categories and also 2015 to 2017 figures. Please also see A-SEC-002 for further details.

Table 2 - Summary of Recoverable OM&A Expenses ($M) from Exhibit E-02-01

	Historical										Bridge	Test
	2015	2016	2017	2018	2019	2020	2020	2021	2021	2021	2022	2023
Transmission	Actual	Actual	Actual	Actual	Actual	OEB Approved	Actual	Q3 YTD Actuals	Forecast	Actual	Forecast	Forecast
Sustainment	233.6	215.1	218.1	229.4	207.8		200.9	158.7	205.2	205.6	208.3	219.6
Development	6.1	4.6	5.1	5.2	4.4		6.7	5.4	8.3	7.0	8.9	8.6
Operations	59.0	62.5	61.1	53.4	51.0		47.9	35.3	48.8	47.6	48.6	49.0
Customer Care	5.1	4.5	8.5	11.0	7.2		7.0	4.3	6.0	5.8	6.7	6.9
Common and Other	73.9	60.1	41.5	54.9	26.7		70.5	46.9	51.6	71.9	50.7	65.0
Property Taxes and Rights Payments	63.9	61.3	50.7	65.3	60.8		65.4	47.1	69.1	63.9	70.2	71.4
Total	**441.6**	**408.1**	**385.0**	**419.2**	**357.9**	**385.0**	**398.5**	**297.6**	**389.0**	**401.8**	**393.4**	**420.5**

Witness: JODOIN Joel

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O - DISTRIBUTED RESOURCE COALITION INTERROGATORY - 011

Reference:

Exhibit O-1-1, Section 1.3
Exhibit O-1-3, Section 1.0

Preamble:

Hydro One has updated its transmission and distribution load forecasts to reflect the IESO's new CDM forecasts, as reflected in the IESO's 2021 Annual Planning Outlook (**2021 APO**).

Interrogatory:

a) Please place a copy of the 2021 APO on the record in this proceeding (or, if it is already on the record, please identify where it can be found).

b) The 2021 APO electric vehicle (**EV**) forecast is in line with federal government zero-emission vehicle sales targets, which projects 6.6 million EVs in Ontario by 2042, with an annual charging demand of 24.4 TWh and a peak demand of 1,200 MW. Please comment on whether Hydro One's updated load forecast is consistent with this forecast and discuss the factors that inform this determination.

Response:

a) Please see the attachment to this response.

b) The long term forecast of EV usage is out of the scope of this Application. Hydro One notes that, over the forecast period 2021-2027, the APO 2021 forecast of EV has not materially changed compared to APO 2020. Hydro One's EV forecast is higher compared to APO 2020. As noted in the updated Exhibit JT-VECC-TCQ-04, Hydro One's forecast of EV is consistent with APO 2021 and is based on confidence interval for potential impact of EV on load.

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Annual Planning Outlook

Ontario's electricity system needs: 2023-2042

December 2021

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Connecting Today.
Powering Tomorrow.

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Foreword

The Annual Planning Outlook (APO) provides an assessment of Ontario's energy landscape to help understand potential changes in demand and available supply that will assist the IESO in shaping its plans to meet future needs. It is the first step in an annual cycle aimed at ensuring a reliable energy supply for the future.

This year, economic and population growth and an increasing focus on electrification are shifting the province's electricity system into a period of sustained demand growth, requiring action on a number of fronts.

As this report shows, demand for electricity is forecast to rise at rates not seen in many years. Economic growth coming out of the pandemic, along with electrification in many sectors, is driving energy use up across the province. These trends also bring with them new levels of uncertainty. The demand forecast, which is higher than that projected in last year's APO, may continue to be impacted by ongoing economic and policy changes, as well as evolving consumer preferences.

On the supply side, nuclear refurbishments and retirements, as well as expiring contracts, are creating medium-term capacity shortfalls. While some of this need will be managed by new commitments to existing supply through competitive mechanisms, there are also opportunities, particularly over the longer-term, to open the system up further to new supply and demand-side options and ways to procure and integrate them.

With these dynamics in play, the IESO has recalibrated its activities so that it can continue to deliver on its core mandate to ensure a reliable and affordable energy service for years to come.

Through its Resource Adequacy Framework, the IESO has established a multipronged approach to address reliability needs identified in the APO. This framework provides clarity around how it expects to meet those needs, so that the sector can anticipate and respond accordingly.

With the release of the first Annual Acquisition Report (AAR) in July, the IESO set out the steps it will take to meet reliability needs across a range of timeframes.

The Capacity Auction, which adjusts to changing energy needs from one year to the next, now secures capacity with minimum thresholds all year round, providing certainty and continuity to suppliers.

A first-ever medium-term RFP for up to 750 MW of unforced capacity (UCAP) is expected to be issued in early 2022 to bridge capacity gaps created by expiring contracts. This RFP will be open to existing generators and storage facilities whose contracts are expiring. This effort will maintain reliability, as the system prepares for greater transformation.

With more significant needs emerging in the middle and latter part of this decade that cannot be satisfied with existing resources alone, an RFP is expected to be launched in 2022 with a longer commitment period to allow a broad range of technologies to compete on a level playing field.

Upcoming RFPs will also ensure that resources are addressing needs where they are happening. Unique pockets of demand are emerging in different regions across the province – resulting from local economic growth, changes in local supply or even large electrification projects. These needs are identified with recommendations for transmission, supply and demand-side solutions through the IESO's planning processes. Planning efforts provide a platform for municipal government and Indigenous communities to weigh in on needs, and these efforts are evolving to consider potential local solutions or non-wires alternatives to traditional transmission and supply solutions.

The longer-term RFP complements the IESO's ongoing effort to enable the contribution of non-emitting forms of supply and unleash new opportunities for local energy projects and distributed energy resources.

The APO assesses the evolving energy sector on an ongoing basis, pointing to what adjustments are needed to ensure reliability. As Ontario's electricity system continues on its path of fundamental transformation, the speed of change will be influenced by public policy, growing experience and improvements in new technologies, consumer preferences and economic drivers. This report, and the actions that follow, provide a window into the scope and scale of that change.

Lesley Gallinger

President and CEO

Independent Electricity System Operator

Key Findings

The APO is updated annually to provide the most current information available, and its conclusions are informed by regular feedback from a wide variety of stakeholders, as well as ongoing economic and policy considerations.

Consistent with the needs forecasted in the 2020 APO, the 2021 APO is characterized by some notable findings:

Ontario is entering a period of increasing electricity demand.

With the pandemic recovery well underway, the IESO's forecasts show steady average growth of about 1.7 per cent a year. Continued robust growth in the agricultural sector is coupled with economic recovery incentives that are supporting potential new sources of electricity demand in the mining and steel sub-sectors. In addition, decarbonization measures are driving strong transportation electrification over the long-term.

Future policy decisions, customer choice and economic growth mean long-term demand has the potential to be even higher.

Many things that affect the electricity sector are quickly evolving. As such, predicting the timing, location and scale of increases in electricity demand is becoming more challenging. In light of these uncertainties, a high demand scenario forecast has been developed to reflect factors, such as government policy, changing customer preference and industrial projects, that could increase demand by as much as 10 per cent over the reference scenario in the coming decades.

Ontario's supply mix could look very different in coming years.

The IESO's resource outlook shows the potential for considerable change through the 2020s and early 2030s due to the combined effect of nuclear retirements, ongoing nuclear refurbishment outages, and expiring supply contracts and commitments. Evolving carbon policies could also result in less gas-fired generation, while new technologies such as distributed energy resources, storage and demand response could take on greater prominence in the system.

Projected demand from electrification of transportation is forecast to grow an average of nearly 20 per cent a year over the outlook period.

The transportation sector is seeing commitments for a number of large transit electrification projects, as well as government incentives for both industry and consumers, and an ongoing shift to EV offerings from auto makers. All of these elements are contributing to increasing projected demand that rises rapidly in the early 2030s. An upcoming in-depth analysis of electrification in Ontario will help the IESO ensure the province is prepared for the growing need.

Accelerated growth is taking place in parts of the province that will need transmission support or local supply.

With the retirement of the Pickering Nuclear Generating Station (NGS) and the refurbishment of Darlington NGS, Toronto and areas east of the city are expected to account for the majority of Ontario's needs starting mid-decade. Greenhouse growth, mining and industrial electrification are also creating pockets of demand throughout the province. Integrated planning processes, including system planning and regional and community engagements, are working to identify and develop cost-effective solutions, such as targeted conservation and demand management programs and initiatives, that will support the provincial grid and local and regional needs. Work to improve the processes for considering non-wires alternatives within regional electricity planning is also being pursued.

Broader electrification is expected to lead to significant economy-wide GHG emissions reductions in Ontario over the next two decades.

Electrifying technologies across various sectors, particularly transportation, manufacturing and industry, could mean real progress in reducing overall provincial emissions. Projections for just two elements of the APO's electrification forecast – electric vehicles and a single steel plant furnace upgrade - estimate emissions reductions of more than 18 megatonnes (Mt) by 2040. Though just a small piece of the broader decarbonization picture, this would more than offset emissions from the electricity sector alone.

Ontario's Emerging Needs

Through the implementation of the Resource Adequacy Framework, capacity needs that have been identified will largely be met through to 2028. However, nuclear retirements and refurbishments create a capacity gap in the mid-2020s that will require careful consideration and potential actions. Needs begin to climb substantially by 2029 and continue throughout the next decade due to increases in demand and resources reaching the ends of their contracts.

Potential energy shortfalls are forecast to begin in 2026 and grow substantially over the next 20 years if today's supply is reduced through expiring contracts. If current supply levels are maintained, energy needs are not forecast to emerge until the late-2030s. New non-emitting resources that can supply energy or reduce or more actively manage demand will be required to address these needs.

A Timeline of Growing Electricity Needs

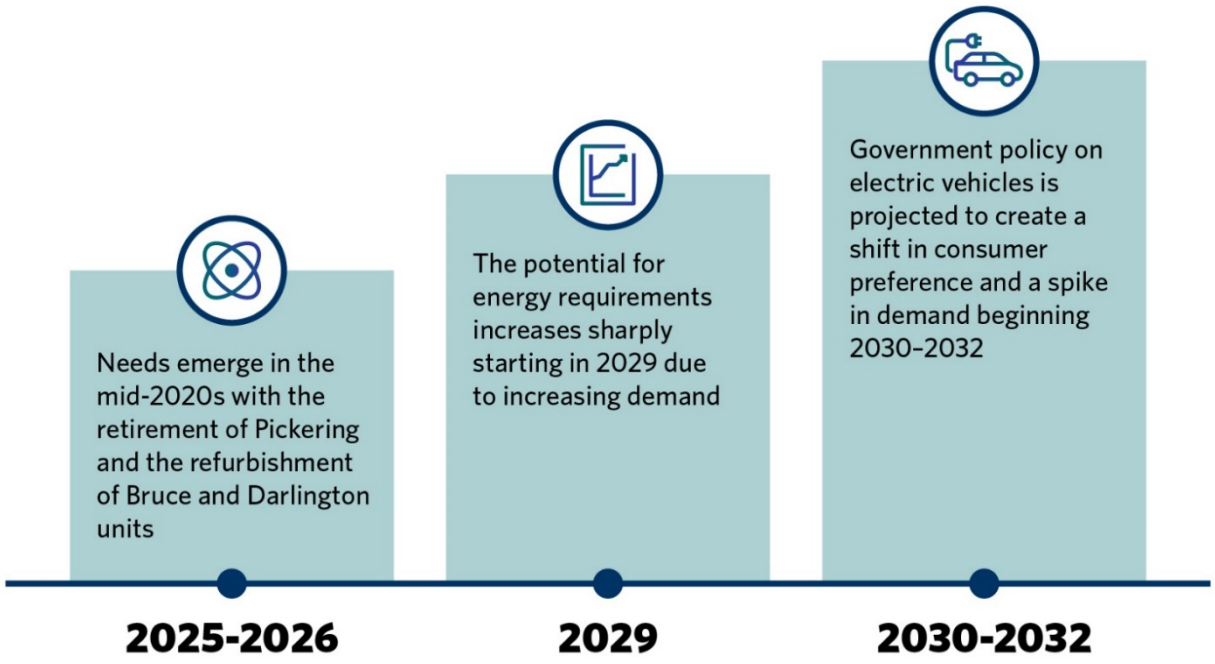


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1. Introduction

1.1 How to Interpret the Outlook

Grounded in data and market intelligence, the IESO's Annual Planning Outlook identifies future system needs and the factors that influence them, and provides insights into what will be required to prepare for a reliable and affordable energy future in Ontario. The findings will inform the development of actions described in the IESO's 2022 Annual Acquisition Report including providing inputs into the target-setting process for the IESO's upcoming procurements.

This outlook covers the period from 2023-2042.

The APO is intended to provide stakeholders, including market participants, with the data and analyses to make informed decisions, and to communicate valuable information to policy-makers and others interested in learning more about the developments shaping Ontario's electricity system.

1.2 Report Contents

Chapter 2 (Demand Forecast) explores long-term demand, and walks readers through the changing composition of demand by sector and the resulting effect on overall demand. It also examines the projected impact of conservation programs, building codes and equipment standards and the Industrial Conservation Initiative on reducing that demand.

Chapter 3 (Supply and Transmission Outlook) assesses the availability of resources over the outlook period and the ability of existing bulk transmission interfaces and interties to continue to supply electricity when and where it is needed. This chapter also looks at the transmission projects expected to come into service within the outlook period that are considered in the base case for resource adequacy and transmission security assessments.

Chapter 4 (Resource Adequacy) compares the demand forecast with anticipated resource performance, taking into account transmission constraints and risks such as extreme weather conditions and equipment outages. This chapter also looks at Ontario's energy adequacy, and the impact of energy production on imports and exports.

Chapter 5 (Transmission Security) explores system needs arising from the requirement to meet transmission planning standards. These needs will be referred to as transmission security needs in this report and could be more or less restrictive than the resource adequacy needs.

Chapter 6 (Integrating Electricity Needs) builds on the outcomes and findings of the previous chapters, and summarizes the system needs discussed in Chapters 4 and 5.

Chapter 7 (Outcomes and Other Considerations) concludes with a discussion on marginal resources and marginal costs, the impacts of carbon pricing in Ontario and neighbouring

jurisdictions, and the expected increase in greenhouse gas (GHG) emissions resulting from decreased nuclear production, increased gas-fired generation and growing demand.

Finally, Chapter 8 (Uncertainties) outlines the potential impact of a number of significant yet highly uncertain developments on rising electricity demand and capacity needs over the course of this outlook period.

1.3 Changes/Updates Since Last Publication

This outlook supersedes the outlook published in December 2020.

In 2020, the IESO held a stakeholder engagement session focused on evaluating the appropriate level of non-firm imports to be used in resource adequacy assessments. The result was a proposal to include non-firm imports in the IESO's resource adequacy assessments starting in the 2021 APO. This current supply outlook includes 250 MW of non-firm imports in the summer and 240 MW in the winter, as compared to zero in the last APO. The IESO will continue to assess these values and may adjust them in future outlooks.

1.4 An Integrated Bulk System Planning Process

The IESO has published an overview of the high-level design for a Bulk System Planning Process (BSPP) that further consolidates the IESO's Resource Adequacy and Transmission Planning activities under a single, integrated process. The high-level design was informed by the feedback received through stakeholder engagement.

The BSPP will build on the process for developing the APO and the stakeholder engagements carried out to inform its development, and communicate the results of the APO studies. Whereas the APO process has, up to now, been focused on the outlook for demand and Ontario's resource adequacy needs, the transmission security assessments have largely been done as a series of related, but separate processes.

For example, the transmission security outlooks have been informed by individual bulk system studies, regional plans, Northeast Power Coordinating Council (NPCC) and North American Electric Reliability Corporation (NERC) regulatory compliance-driven reviews, and the experience gathered through the operation of the IESO-controlled grid and IESO-administered electricity market in real-time. Essentially, the BSPP formalizes how all of these inter-related activities fit together within a process that is aimed at ensuring Ontario's bulk power system remains reliable and secure well into the future.

Some key features of the BSPP include:

- A regular, annual cycle in which the IESO will ensure an accurate and up-to-date outlook for all system issues, including resource adequacy and transmission security. This is the "Issues Identification" cycle, and starting in 2022, it will introduce a new annual transmission planning process and improve the integration of transmission and resource planning. This process will identify the system issues to be resolved.

- Enhanced transparency around triaging system issues that can be addressed by generation vs. transmission, i.e., whether to leverage competitive mechanisms and/or explore transmission options through an Individual Bulk System Study.
- Regular opportunities to engage with stakeholders to inform and seek feedback, and the publishing of a Schedule of Planning Activities to accompany the APO. The Schedule of Planning Activities will communicate the IESO's work plans for initiating Individual Bulk System Studies to address bulk system issues.

The Schedule of Planning Activities will be reserved for when solutions are not likely to be fully addressed using the Resource Adequacy Framework, and/or when integrated planning needs are required to consider a broader range of alternatives. Individual Bulk System Studies do not exist outside of the APO nor the Resource Adequacy Framework. It is possible that bulk study recommendations could be used to acquire capacity, and in such cases, the AAR will specify how the capacity would be acquired. For system issues to be addressed by transmission or integrated solutions, there will need to be sufficient time to complete the requisite bulk studies and still implement the solution.

2. Demand Forecast

Electricity demand is forecast in this APO to grow higher than in prior outlooks, driven primarily by economic development and government policy on climate change mitigation. Notable updates include: growth from electric vehicle charging demand in the mid-2030s; northern Ontario mining expansion and primary steel producer electrification in the near-to-medium-term periods; sustained residential sector demand growth through the 2030s; and increased Industrial Conservation Initiative response over the outlook period.

Trends highlighted in prior outlooks that are continuing include: greenhouse expansion in the west-of-London area, robust economic recovery in the commercial sector, electrification of rail transit and assumed persistent delivery of conservation programs beyond the existing framework period.

Forecasting electricity demand is a challenging exercise, as it incorporates inherent uncertainties surrounding economic growth, changing customer preferences and a rapidly evolving policy environment. The uncertainties associated with any forecast will naturally increase with the length of the outlook period and reflect the interdependencies of underlying assumptions. To help acknowledge and mitigate uncertainties in the 2021 demand forecast, a high demand scenario has been developed and is presented in Chapter 8 – Uncertainties.

2.1 Overview

The long-term demand forecast informs system reliability and investment decisions, and sets the context for the APO, the AAR, and the bulk power system planning process.

Future electricity demand is affected by many factors, including but not limited to: the state of the economy, population, demographics, technology, energy prices, input fuel choices, equipment purchasing decisions, consumer behaviour, government policy, and conservation.

In 2020, Ontario's electricity demand experienced significant fluctuations as a result of the COVID-19 pandemic. In the 2020 APO, the primary factor driving projected demand growth was the possible impact of the pandemic, including potential permanent and structural changes to the economy.

In this year's APO, the demand forecast represents a notable change from 2020. With the economic recovery from the pandemic well underway, primary factors driving demand are emerging electrification initiatives and growth of the economy, leading to higher electricity demand in the short, medium and long-terms.

The forecast demonstrates steady growth overall, including in the **residential** and **commercial** sectors, and continued robust growth in the **agricultural** sector. A strong

emphasis on decarbonization measures and economic recovery is also now leading to potential new sources of electricity demand in the **mining** and **steel** sub-sectors, and in the emergence of significant **transportation electrification**. Although the magnitude and exact timing of these demands is uncertain, the province is entering a time of demand growth.

Ongoing conservation and demand management programs are also factored into the forecast, which projects overall net energy demand to be 147 TWh in 2023, increasing an average of almost 2 per cent per year over the outlook period to 202 TWh in 2042, an increase of 56 TWh.

Summer and winter peak demands are expected to experience an average growth rate of approximately 1.3 and 1.8 per cent, respectively. Summer peak demand is projected to be about 24.4 gigawatts (GW) in 2023, increasing to 31.3 GW in 2042, while winter peak demand is projected to be 22.1 GW in 2023, increasing to 30.5 GW in 2042.

Figure 1 illustrates the forecasted changes in energy demand over the planning horizon and Figure 2 shows summer and winter peak demand.

Figure 1 | Energy Demand

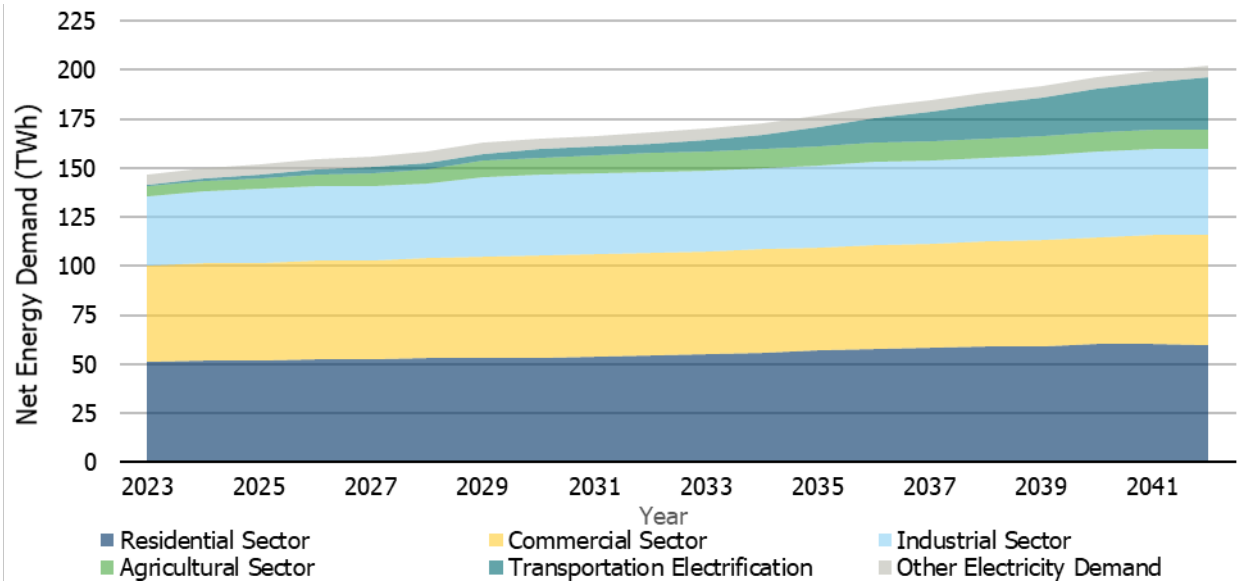
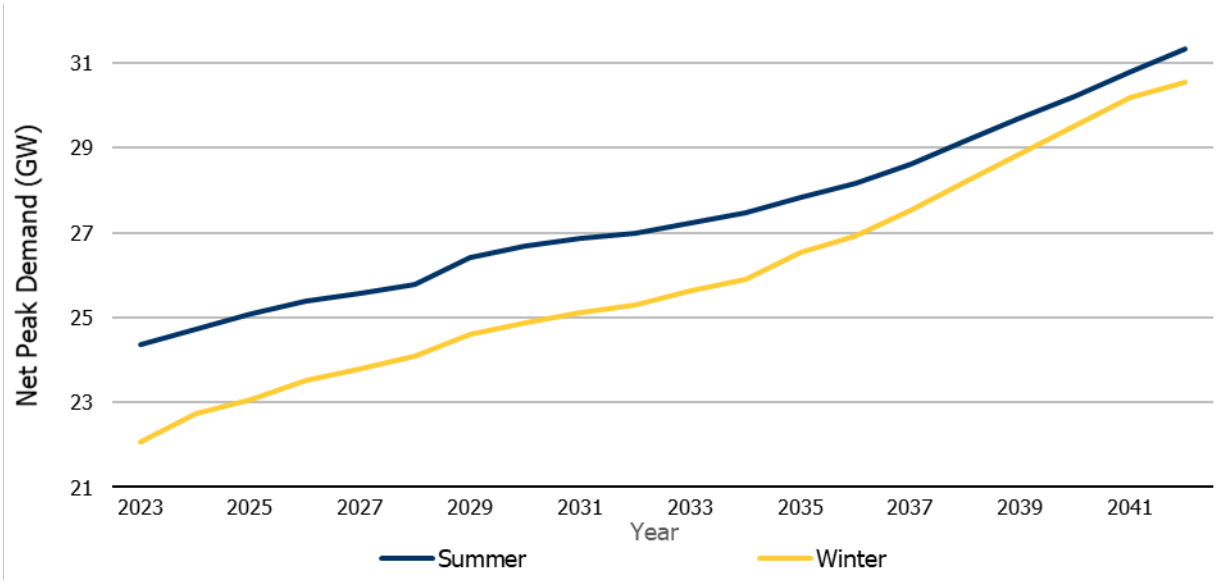


Figure 2 | Seasonal Peak Demand



2.2 Historical Energy Demand

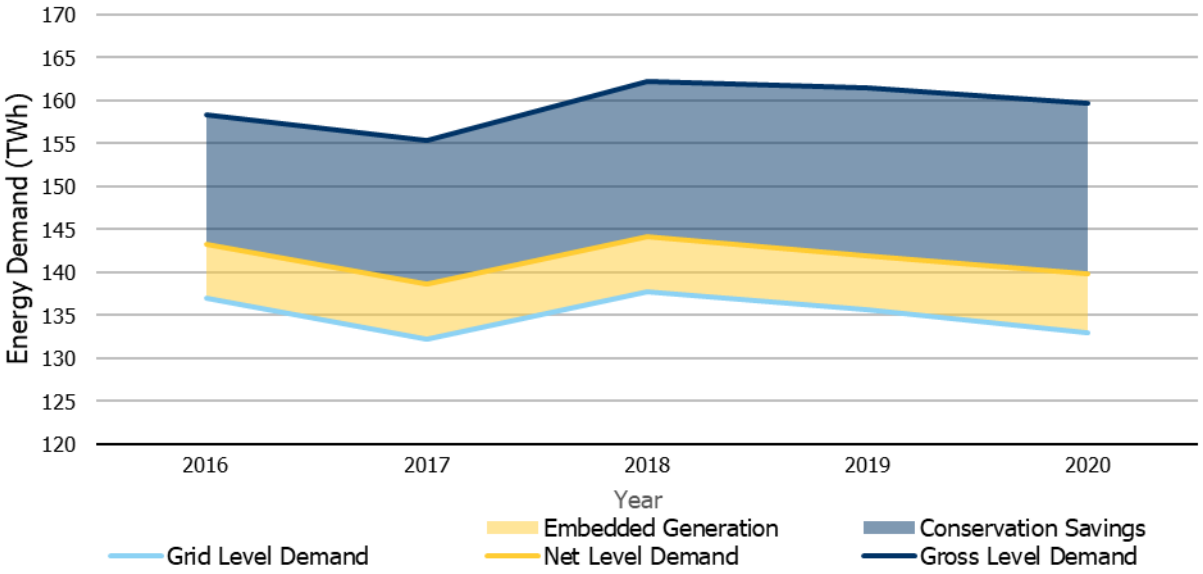
Grid-level demand[1] over the past five years has been mostly flat, ranging between 132 and 137 terawatt-hours (TWh), as shown in Figure 3.[2] This is primarily the result of changes in the economy, conservation program savings, and embedded generation[3] all reducing the need for grid-supplied energy. Embedded generation has provided approximately 6 TWh of energy each year.

[1] Gross-level demand is the total demand for electricity services in Ontario prior to the impact of conservation (including programs and regulations), but including the effects of naturally occurring conservation (energy savings that occurs without the influence of incentives or education programs, and regulations). Net-level demand is gross-level demand minus the impact of conservation. Grid-level demand is net-level demand minus the demand met by embedded resources. It is equal to the energy supplied by the bulk power system to wholesale customers and local distribution companies.

[2] Historical energy demand presented is actual observed demand based on actual weather and has not been weather normalized.

[3] Embedded generation describes generators that are not registered participants in the IESO administered wholesale electricity market, that are typically but not necessarily distribution system connected, and reduces demand through the bulk electricity system.

Figure 3 | Historical Energy Demand



Note: While historical energy demand has been presented on an actual weather basis and shown at the grid, net, and gross levels, the demand forecasts presented are on a weather-normalized basis and at the net level. For more information on weather normalization, see the 2021 APO Demand Forecast Methodology.

2.3 Demand Forecast Scenarios

Demand forecasting focuses on understanding the causes of future changes in demand by examining end-uses and sector trends. However, they also reflect many dependencies and incorporate inherent uncertainty that increases with the length of the outlook period. The potential impacts of increasing distributed energy resources deployment is another factor that affects demand forecasts, and this will be explored in more detail in future APOs.

The demand forecast presented in this chapter considers a number of factors: all known demographic projections; sector level market, economic announcements and trends; the current statuses and projections of large commercial and industrial sector projects with significant electricity demand; actual grid connection request queues; and committed policy.

With an emerging transformation of the economy driven by climate change mitigation, decarbonization and electrification, as well as potential economic development and policy stimulus, an unusually high level of uncertainty is present in the 2021 APO demand forecast. An assessment of these uncertainties and their potential impacts to the forecast are presented in a high demand scenario forecast in Chapter 8.

2.4 Drivers of Demand

All sectors of the economy – residential, commercial, institutional, industrial, agricultural, transportation and others – contribute to province-wide energy demand. This demand forecast has been developed using sector-level segmentation and corresponding individual assessments.

A projected increase in this forecast's consumption is supported by climate change mitigation policy, stable electricity rates and increasing natural gas rates over the outlook period.

2.4.1 Residential Sector

Electricity demand from the residential sector is expected to show steady growth over the outlook period. Several factors promote this growth, including progressive immigration policies contributing to new households, a persisting level of working from home resulting in higher daily household occupancy, and continued increases in the adoption of electronics.

Overall, total sector electricity demand is forecast to grow from 51 TWh in 2023 to 61 TWh in 2042, an average annual growth rate of 0.9 per cent.

2.4.2 Commercial Sector

With the current economic recovery, electricity demand from the commercial sector is expected to be stronger and recover earlier than forecasted in the 2020 outlook. The reduction of social distancing practices and travel restrictions is increasing near-term electricity demand for the office, education, retail, restaurant and lodging hospitality sub-sectors. Post-recovery, demand growth is expected to moderate over time.

Over the course of the outlook period, a continued shift to a digital economy has been accelerated due to the pandemic, which impacts electricity demand in many sub-sectors; an emerging shift to hybrid office work models moderates electricity demand in offices; meal preparation and delivery services reduce demand in restaurants; and e-commerce results in a decrease in electricity demand in physical retail spaces, but an increase in warehouses.

Overall, total sector electricity demand is forecast to grow from 49 TWh in 2023 to 57 TWh in 2042, an average annual growth rate of 0.9 per cent.

2.4.3 Industrial Sector

Ontario's industrial sector is facing significant uncertainty as supply chains adjust to new customer preferences and government policy. Sector level demand is expected to be similar to 2020 APO forecasts, with the exception of northern Ontario mining and primary metal production. The top five sub-sectors[4] will continue to account for roughly 60 per cent of the total sector demand.

[4] The top five industrial sub-sectors in Ontario, by electricity demand are: 1) mining; 2) primary metals; 3) paper manufacturing; 4) chemical manufacturing; and 5) petroleum refining.

In the mining sub-sector, concentrated in northern Ontario, electricity demand is expected to grow robustly in the near-term, supported by favourable resource prices and the development of Ontario's Critical Mineral Strategy, and then slowly decline as various mines reach end of life.[5]

The primary metal sub-sector, spread across the Southwest (Hamilton, Cambridge, and Nanticoke) and Northeast (Sault Ste. Marie) Zones, is expected to grow robustly, with electrification already beginning and expected to materialize in the medium-term. Electrification incorporated in the demand forecasts includes implementation of electric arc furnaces, as a switch from traditional blast furnaces, in order to reduce greenhouse gas emissions. The Algoma Steel Inc. project annouced July 5, 2021 is included in both scenarios of the demand forecast, while the ArcelorMittal Dofasco project announced July 30, 2021 has been included in the high demand scenario.

Expected growth in all other sub-sectors continues to be slow. In general, the industrial sector is expected to be influenced by emerging de-globalization trends, support for increasing local industrial production capability and economic development, and electrification and general carbon emissions reductions over the outlook period.

Overall, total industrial sector electricity demand is forecast to grow, from 35 TWh in 2023 to 41 TWh in 2042, an average annual growth rate of 1 per cent.

2.4.4 Agricultural Sector

Demand for electricity from Ontario's agricultural sector continues to grow, driven by both greenhouse expansion and the proliferation of artificial lighting in greenhouses producing fruits, vegetables, flowers and cannabis. Growth is primarily in the Kingsville-Leamington and Dresden areas[6]. Overall, sector electricity demand growth is largely unchanged from the 2020 APO and is forecast to grow from 5 TWh in 2023 to 10 TWh in 2042, an average annual growth rate of 4 per cent.

2.4.5 Transportation Electrification

In 2021, the federal government announced a focus on a green recovery intended to boost the economy post-pandemic while also working towards decarbonization and electrification. Overall, electricity demand from transportation electrification is forecast to grow from 0.9 TWh in 2023 to 26 TWh in 2042, an average annual growth rate of nearly 20 per cent.

2.4.5.1 Electric Vehicles

As part of the focus on a green recovery, the federal government created a mandatory target requiring 100 per cent of all new car and passenger truck sales in Canada to be zero-emission

[5] *Ontario's Critical Mineral Strategy* aims to develop sources of minerals that have specific industrial, technological and strategic applications in Ontario.

[6] The IESO's Need for Bulk System Reinforcements West of London was published to address needs arising from growing the greenhouse demand.

by 2035. The number of electric vehicles (EVs) in operation today, including light duty passenger vehicles and mass transit buses, is relatively low, but is expected to increase significantly over the outlook period as government policy is currently a key driver for EV adoption. Policy measures include purchase incentives and tax benefits for business vehicles, as well as support for EV charging infrastructure, automobile manufacturers and automobile parts suppliers.

As EV technology and production matures, and as costs fall and value increases, it is expected that consumer preferences will shift from internal combustion engine (ICE) vehicles to EVs. Many automobile producers have also announced plans and timelines to switch to EV-only offerings. The IESO's EV adoption forecast assumes EV sales to be relatively flat in the near-to-medium-terms, and to grow significantly in the years immediately preceding the 2035 milestone date.

Both EV sales and driving distance dropped in 2020 as a result of social and economic restrictions, but as the economic re-opening and recovery takes hold, EV charging is expected to increase in kind. Real-world charging data from the *Charge the North* project, the world's largest electric vehicle charging study, was used to develop the charging profile and EV hourly demand forecast.

The 2021 APO EV forecast is in line with federal government zero-emission vehicle sales targets, which projects 6.6 million EVs in Ontario by 2042, with an annual charging demand of 24.4 TWh and a peak demand of 1,200 MW.

2.4.5.2 Rail Transit Electrification

Broad rail transit electrification is also underway in Ontario.

Eight local light rail transit (LRT) projects are being planned or are in various stages of construction. In addition, early work on three new subway projects in the GTA is underway, as is the procurement process for the multi-year electrification of GO rail corridors. Some rail transit electrification projects are at the early planning stage with little information on electricity requirements.

2.4.6 Conservation

2.4.6.1 Conservation Programs

The Conservation Program forecast includes incremental updates from 2020 to the existing IESO 2021-2024 Conservation and Demand Management (CDM) Framework[7] delivered to consumers under the Save on Energy banner. The forecasted annual savings are 3 TWh in 2026.

[7] For more information, refer to the Ministerial Directive.

On June 4, 2021, the federal government announced the Canada Greener Homes Grant Program, providing 700,000 grants to help home owners across the country implement energy efficiency and emission reduction retrofits. The forecasted annual savings incorporated into the demand forecast are 290 GWh.

Other programs funded and/or delivered by the federal and municipal governments, including the Green Municipal Fund and the Climate Action Incentive Fund, are expected to result in additional electricity savings in Ontario. In the absence of program details, the amount of electricity savings is difficult to estimate.

It is also assumed that the delivery of conservation programs will continue after the 2021-2024 CDM Framework, and that annual savings will be consistent with levels forecast for the 2021-2024 CDM Framework on a proportion of gross demand basis. This will be updated when a post-2024 conservation program framework policy decision is made. Forecast CDM savings may also be revised based on the results of the current framework's Mid-Term Review, expected in late 2022.

Overall, the level of electricity demand savings from all conservation programs in Ontario is forecast to fluctuate, remaining at about 14 TWh from 2023 to 2028, and then declining to 10 TWh in 2042 as the demand savings attributable to past conservation programs expire.

2.4.6.2 Codes and Standards Regulations

Building codes and equipment standards are an effective energy-efficiency tool and have a relatively high level of certainty. These savings estimates are based on expected improvements in codes for new and renovated buildings and through the regulation of minimum efficiency standards for equipment.

The IESO estimates savings attributable to codes and standards by comparing the demand forecast at the gross level to the demand forecast adjusted for the impacts of regulations. Most of the savings from improved codes and standards will be realized in the residential and commercial sectors.

Overall, electricity demand savings from codes and standards are forecast to grow, from a base year of 2023 to 7.7 TWh in 2042.

2.4.7 Industrial Conservation Initiative

The Industrial Conservation Initiative (ICI) is a form of demand response that enables large customers (known as Class A customers) to reduce their electricity costs by curtailing electricity consumption during periods of peak demand.

With the onset of the pandemic, the Ontario government introduced a one-year hiatus on the program, allowing consumers to focus on economic recovery rather than responding to system peaks (i.e., curtailing). During the hiatus, the 2020 Ontario provincial budget[8] introduced the

[8]." For more information, refer to the November 5 news release, Ontario's Action Plan: Protect, Support.

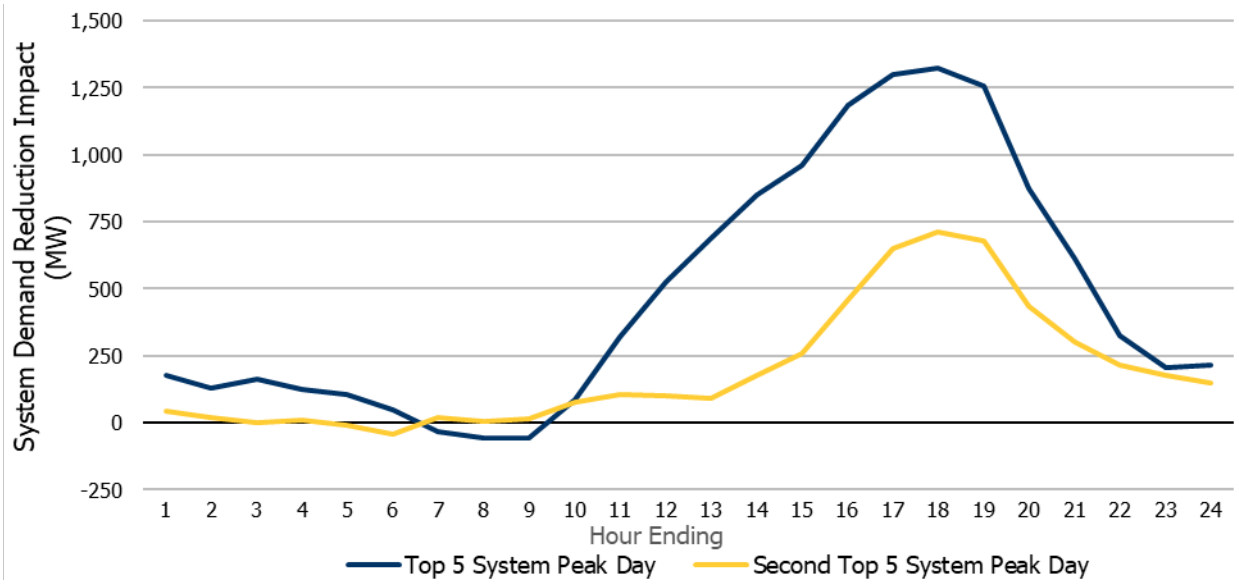
Renewable Cost Shift, a policy that reduces electricity rates and results in a dampened but still impactful price signal for curtailment. This increases the uncertainty surrounding the future impact of the ICI, but is expected to result in a lesser impact than previous years.

The IESO forecasts ICI top five system peak-day, system peak-hour demand reduction impacts to be 1,300 MW. This is an increase from 2020 APO levels, which is based on observed economic recovery and industrial electricity demand largely unaffected by pandemic impacts in 2020. The IESO also forecasts ICI demand reduction impacts of 650 MW in the next five system peak days. The ICI response is constant over the outlook period.

The IESO expects ICI drivers, including customer ICI program investment and Global Adjustment levels, will inevitably change over the course of the outlook period. ICI impacts on the demand forecast and ICI forecast methodology will be reassessed on an annual basis.

The projected impact from all ICI participants on the system peak day for each year in the outlook period is shown in Figure 4.

Figure 4 | Industrial Conservation Initiative Impact



2.4.8 Other Electricity Demand

This demand forecast accounts for all electricity energy and peak demand in the province. However, certain areas of demand do not fall under any of the previously discussed sectors and are classified as "other". These include:

- Connection of remote communities

- Electricity generators[9]
- Street lighting
- Municipal water treatment

Overall, "other sector" electricity demand is unchanged from the 2020 APO and is forecast to grow from 5.2 TWh in 2023 to 6.1 TWh in 2042, an average annual growth rate of 0.8 per cent.

2.5 Demand Forecast Uncertainties

To reiterate, the 2021 APO demand forecast presented in this chapter incorporates all known projections, announcements, status of projects with significant electricity demand and committed policy. The current level of change in the electricity sector, customer preference, economy, climate and policy environment has led to significant uncertainty regarding electricity demand. Chapter 8 outlines an assessment of the potential impact of a number of significant, yet highly uncertain, drivers of increased demand over the course of this outlook period.

[9] Electricity generators such as nuclear and gas/oil generating stations can have electricity demand when: 1) commencing operation of generating units; and 2) generating units are not in operation, for example, the facility would have electricity demand for lighting and HVAC loads.

3. Supply and Transmission Outlook

Ontario's supply mix will undergo significant change over the next two decades as the available capacity from the nuclear fleet continues to be impacted by refurbishments and retirements, and many resource contracts expire.

A number of transmission projects are also expected to come into service within the decade, contributing to the resource adequacy and transmission security assessments of this outlook.

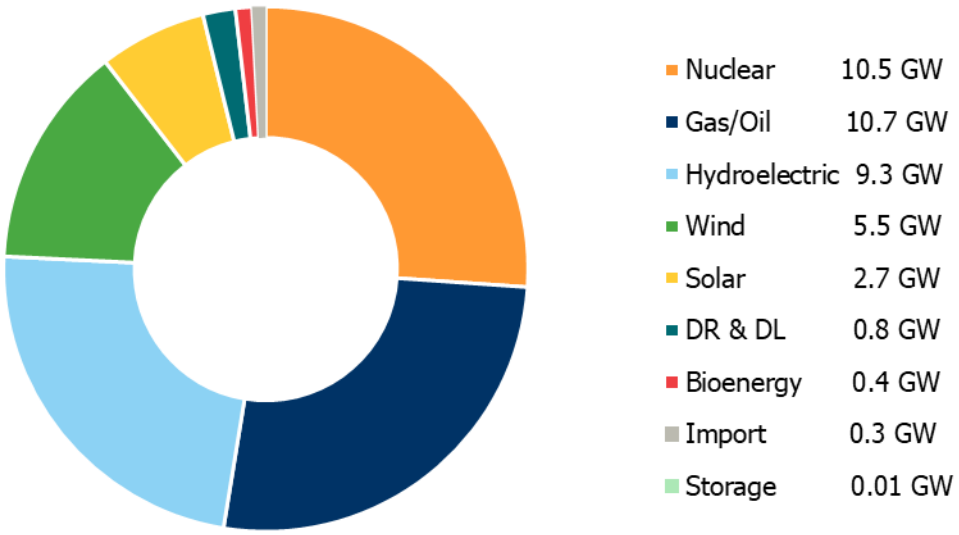
This chapter describes the availability of the province's existing supply resources over the outlook period, as well as the ability of the bulk transmission system to continue to supply electricity where it is needed.

3.1 Installed Capacity 2022

Ontario has 40.3 gigawatts (GW) of installed capacity made up of a diverse mix of resources, as shown in Figure 5.[10]

[10] This data includes both transmission- and distribution-connected resources, either market participants and/or contracted by the IESO. For further information, please see the 2021 APO Supply, Adequacy and Energy Outlook module.

Figure 5 | 2022 Installed Capacity by Fuel Type



The majority of Ontario's installed capacity comes from nuclear (26 per cent), gas (26 per cent), and hydroelectric (23 per cent) resources, with the remainder from wind (14 per cent), solar (7 per cent), demand response and dispatchable load (DR & DL) (2 per cent) and bioenergy (1 per cent).

Imports (1 per cent) include both system-backed imports from the 2020 capacity auction and non-firm imports. Both transmission- and distribution-connected resources (e.g., embedded generation) are included in the capacity assessment.

3.2 Supply Outlook

This chapter provides an outlook for both installed capacity, or a resource's maximum output, and effective capacity, which takes into account factors such as fuel availability, ambient conditions, and/or outages. This makes effective capacity a more meaningful measure of a resource's ability to meet reliability needs in each season.

Ontario's effective capacity for each fuel type, projected for summer and winter by the end of 2022, is shown in Table 1.[11] Going into the outlook period, the total installed capacity for the entire fleet is 40.3 GW, while summer and winter effective capacities are 28.0 GW and 30.2 GW, respectively. More detail by fuel type is provided in the data tables.

[11] Summer months are from May to October, and winter months are from November to April.

Table 1 | Ontario's Summer and Winter Effective Capacity by End of 2022

Fuel	2022 Installed GW	2022 Summer Effective GW	2022/23 Winter Effective GW
Nuclear	10.5	9.9	10.0
Gas/Oil	10.7	8.7	9.4
Hydroelectric	9.3	6.5	7.2
Wind	5.5	0.7	2.1
Solar	2.7	0.9	0.1
DR & DL[12]	0.8	0.6	0.7
Bioenergy	0.4	0.4	0.4
Import	0.3	0.3	0.2
Storage[13]	0.01	0.002	0.002
Total	40.3	28.0	30.2

Figure 6 shows the total installed capacity by fuel type for the outlook period assuming the continued availability of resources following the end of their contract term or commitment. Capacity varies between 38 and 40 GW during the 2020s, due to refurbishments and retirements in the nuclear fleet, before levelling off at 40 GW in the 2030s. This number may be lower than assumed, however, if some resources reach the end of their useful life and choose to retire.

[12] These reflect the results of the IESO's 2020 Capacity Auction

[13] Includes lithium-ion battery storage through the 2020 Capacity Auction

Figure 6 | Installed Capacity 2023-2042

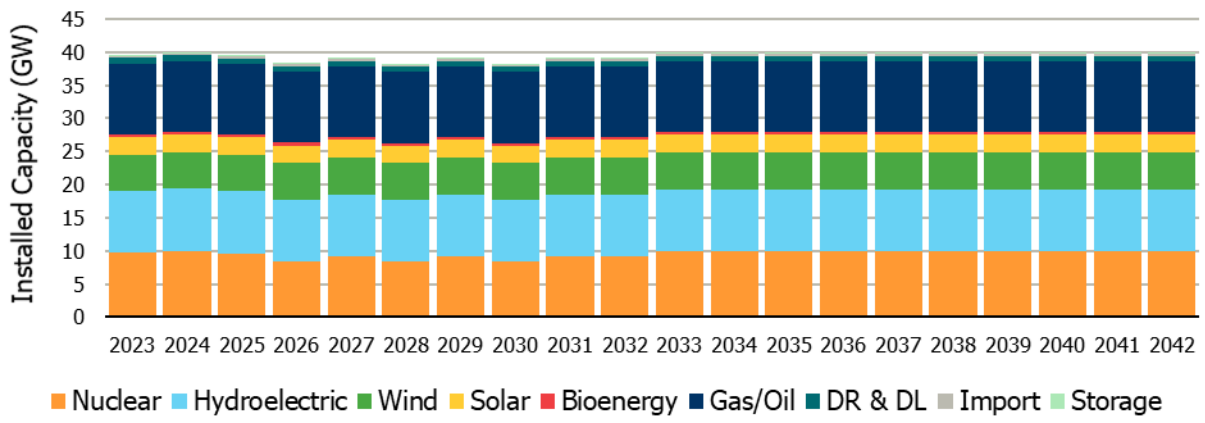


Figure 7 and 8 show the summer and winter effective capacities by fuel type for the outlook period. Summer capacity varies between 25 and 28 GW during the 2020s due to nuclear refurbishments, and then levels off at 27 GW in the 2030s. Similarly, winter availability ranges between 28 and 30 GW, plateauing at 30 GW in the long term. The supply mix over the course of the outlook generally reflects that shown in Table 1.

Figure 7 | Summer Effective Capacity 2023-2042

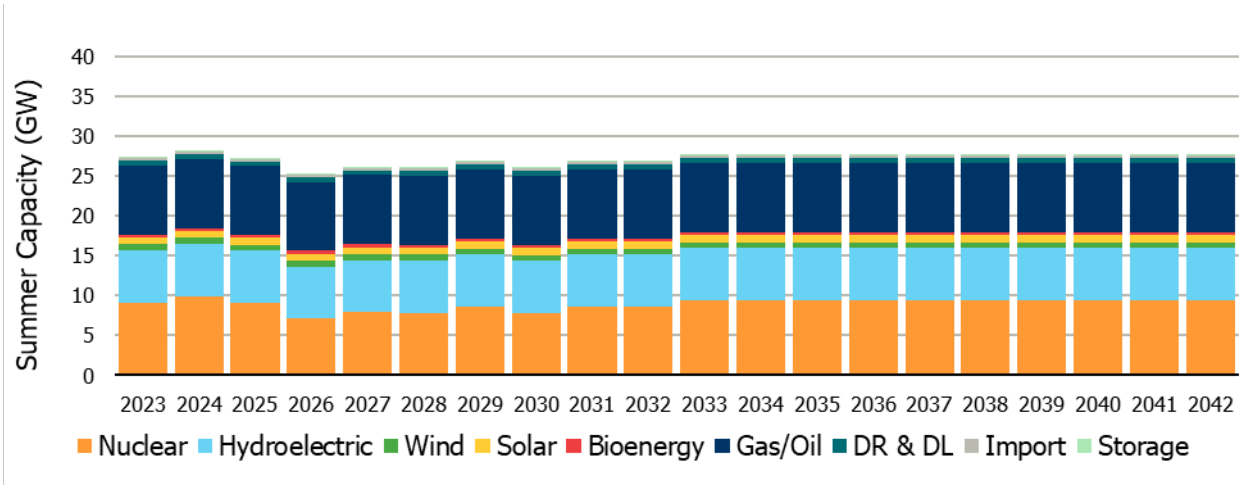
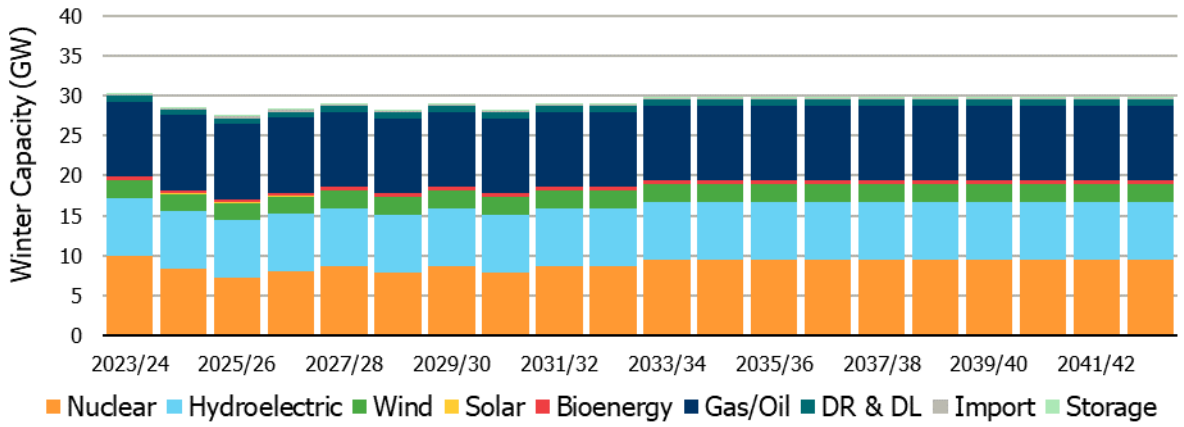


Figure 8 | Winter Effective Capacity 2023-2042



3.2.1 Nuclear Refurbishments and Retirements

Throughout the 2020s, Ontario's electricity system will see a significant change in the available capacity of its nuclear fleet. The retirement of Pickering NGS, as well as various refurbishments that will result in long-term outages at Darlington NGS and Bruce NGS, will increase resource needs.

Figure 9 | Nuclear Refurbishment and Retirement Schedule[14]

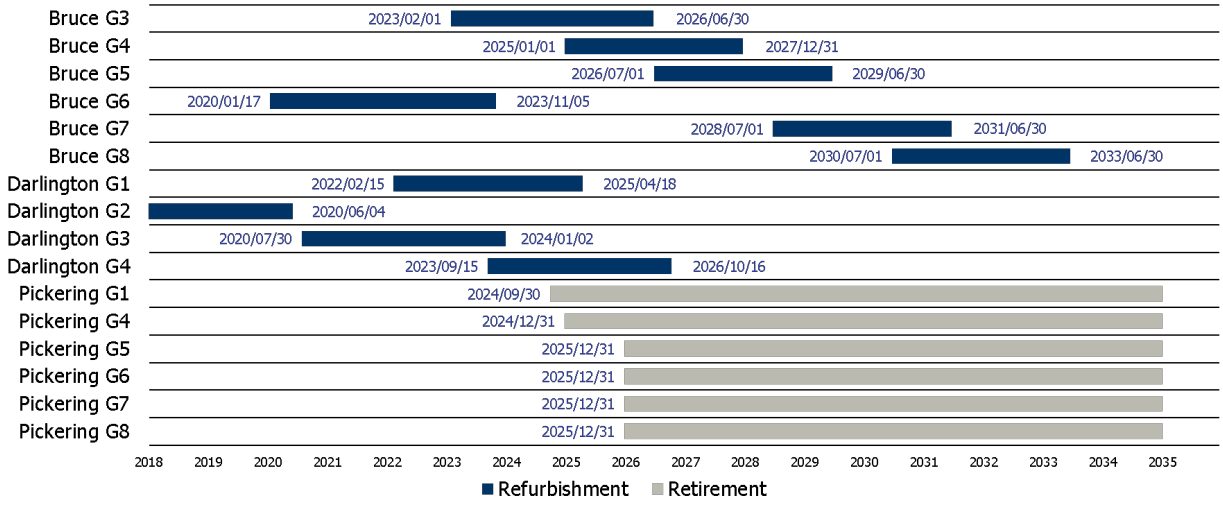
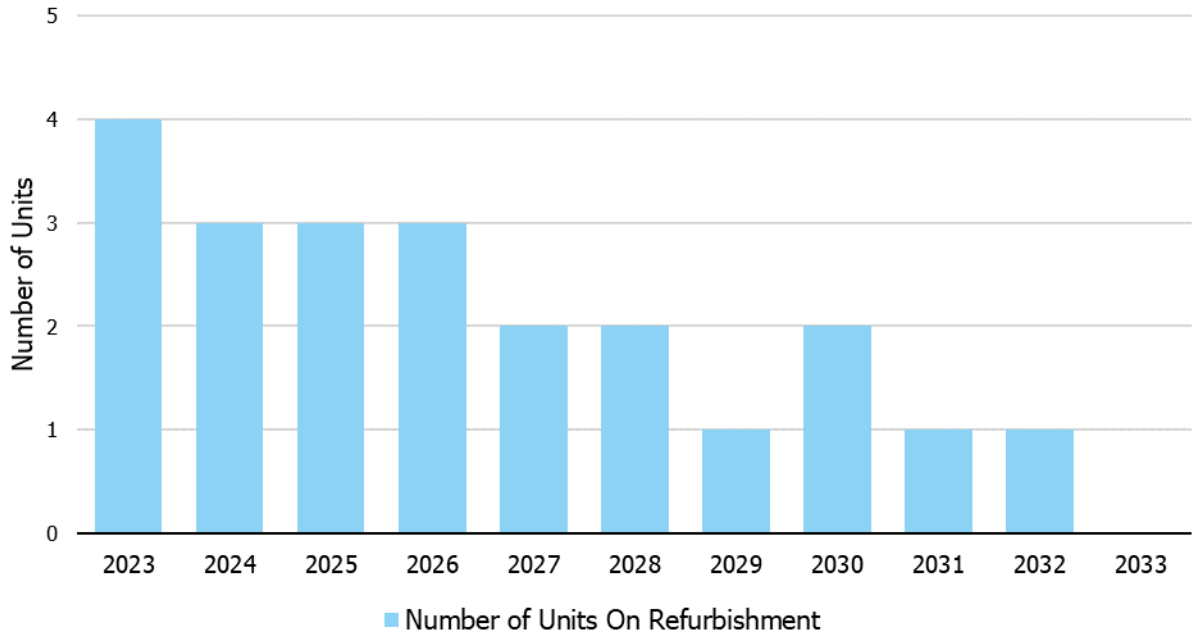


Figure 10 shows that activity will increase in the mid-2020s, with between two and four units undergoing refurbishment concurrently over the summer period. Darlington and Bruce

[14] The current schedule was provided by Ontario Power Generation (OPG) and Bruce Power.

refurbishments are expected to be complete in 2026 and 2033 respectively, and by the end of 2033, a total of 9.6 GW of nuclear capacity will have undergone refurbishment.

Figure 10 | Summer Refurbishment Outages



3.2.2 Contracts and Commitments Ending

Over the course of the outlook, many commitments and generation contracts held by the IESO or the Ontario Electricity Financial Corporation will expire. As shown in Figure 11, many contracts have already reached their end of term, and expirations increase significantly by the end of the decade.

This outlook assumes, however, that many facilities will still be viable post-contract, and could continue to provide services through the various competitive procurement mechanisms being developed under the Resource Adequacy Framework, resulting in resource adequacy with a different supply mix.

To provide insight into the extent of the contributions of existing resources, should they continue to be available, the APO examines scenarios both with existing resources after contract or commitments have expired, as shown in Figure 6, and without, detailed in the figures below.

Figure 11 | Existing Resources Post-Contract Expiry 2023-2042 by Fuel Type

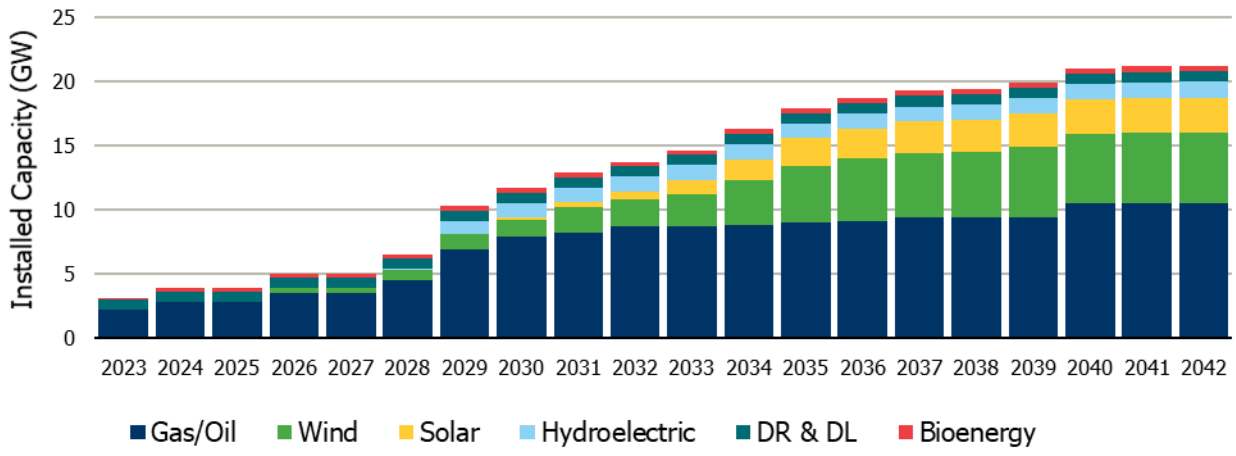


Figure 12 | Installed Capacity without Reacquisition of Expired Contracts 2023-2042

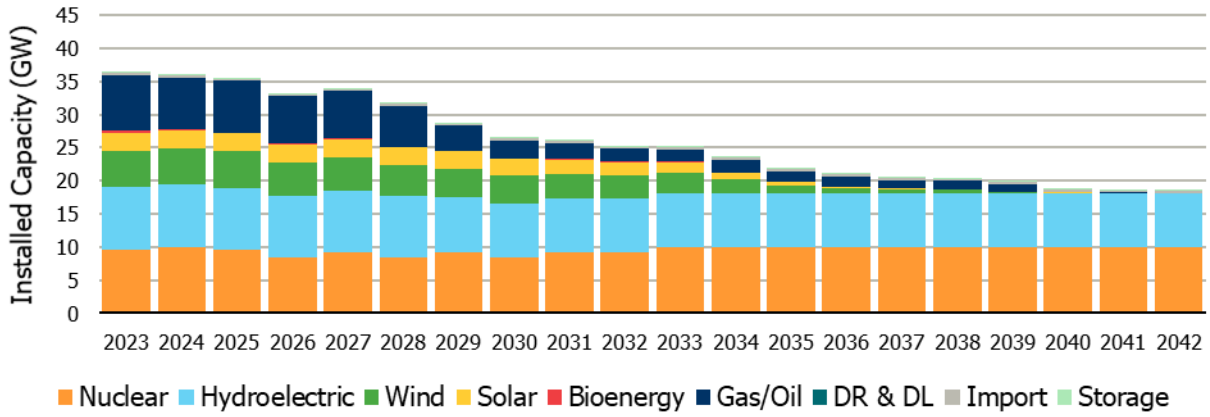


Figure 13 and Figure 14 show the summer effective and winter effective capacities, by fuel type, without availability of existing resources. Summer effective capacity is between 20 and 25 GW during the 2020s, and then levels off at 16 GW by the end of the planning horizon. Similarly, winter availability of the fleet ranges between 20 and 28 GW during the 2020s, then reaches about 16 GW by the end of the planning horizon.

Figure 13 | Summer Capacity without Reacquisition of Expired Contracts 2023-2042

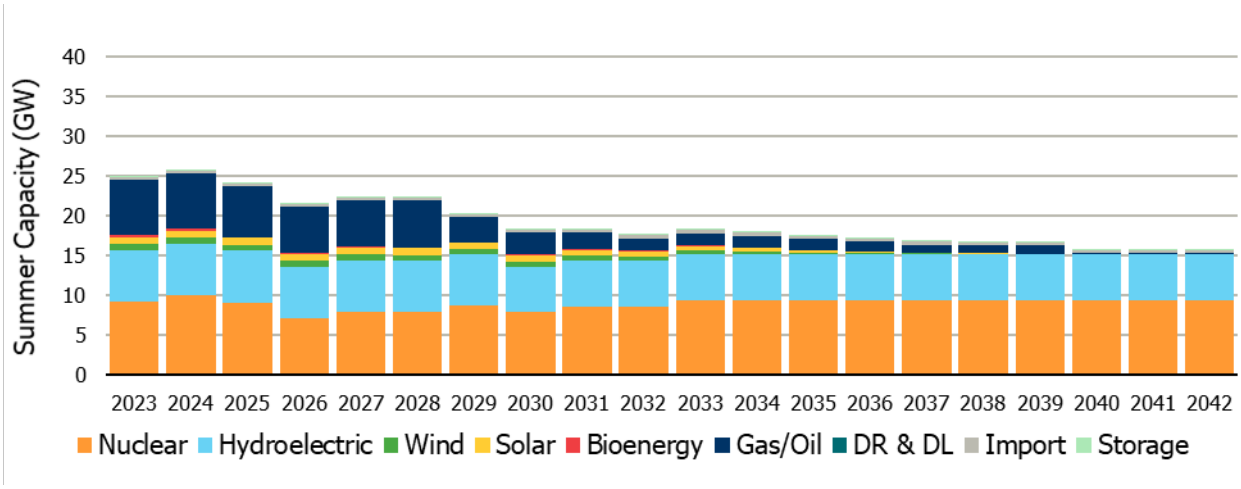
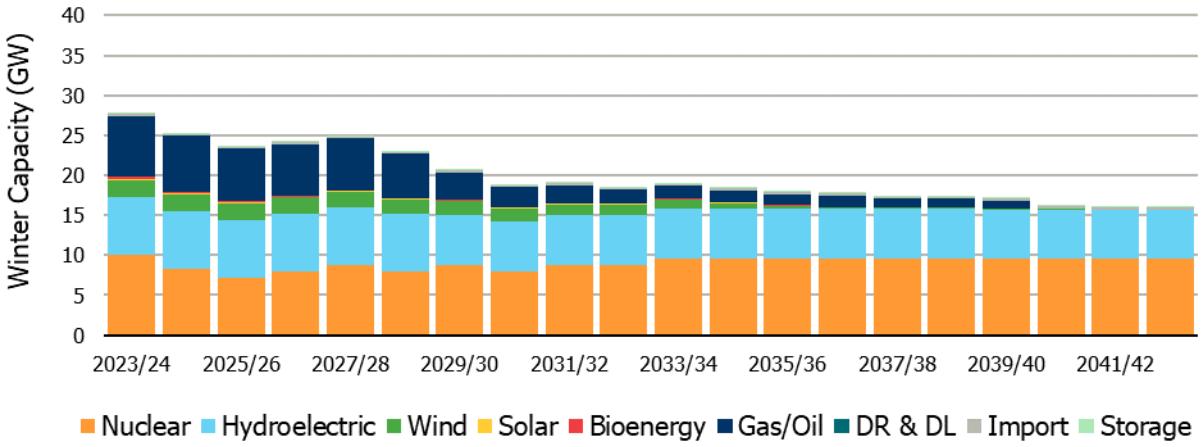


Figure 14 | Winter Capacity without Reacquisition of Expired Contracts 2023-2042



3.3 Transmission System Outlook

The following sections discuss the outlook for the bulk transmission system, which transfers electric power across the province, and highlights the transmission projects expected to come into service during this outlook period.

3.3.1 The Existing Bulk Transmission System

The bulk transmission system is critical for ensuring that the province's supply resources are able to meet system demand at all times. This includes operations under normal conditions[15] and during and after disturbance events.

The capability of the transmission system is defined by the internal transmission interfaces that form the boundaries between the 10 IESO electrical zones. The ability to flow power across these interfaces is a key input to reliability assessments, because limitations on moving power from one part of the province to another can contribute to demand-supply imbalances at a zonal level. The maximum amount of power that the transmission interfaces and interties can deliver is referred to as "transfer capability."

Over time, as the transmission system is reinforced or facilities reach their end-of-life, and as new generation resources are added and old resources retire, the nature of power flows will change and different restrictive interfaces may be observed.

Power is also imported to, and exported from, Ontario through a series of bulk transmission interties located on Ontario's borders. These interties provide a number of system benefits, including the opportunity to consider imports and exports for managing resource needs, as well as supporting system stability, frequency regulation and voltage support.

Ontario's transmission interfaces, the locations of interties with neighbouring jurisdictions, and the 10 IESO electrical zones are shown in Figure 15 and Figure 16.

[15] For example, when all transmission elements are in-service.

Figure 15 | Ontario's Transmission Interfaces and Interties

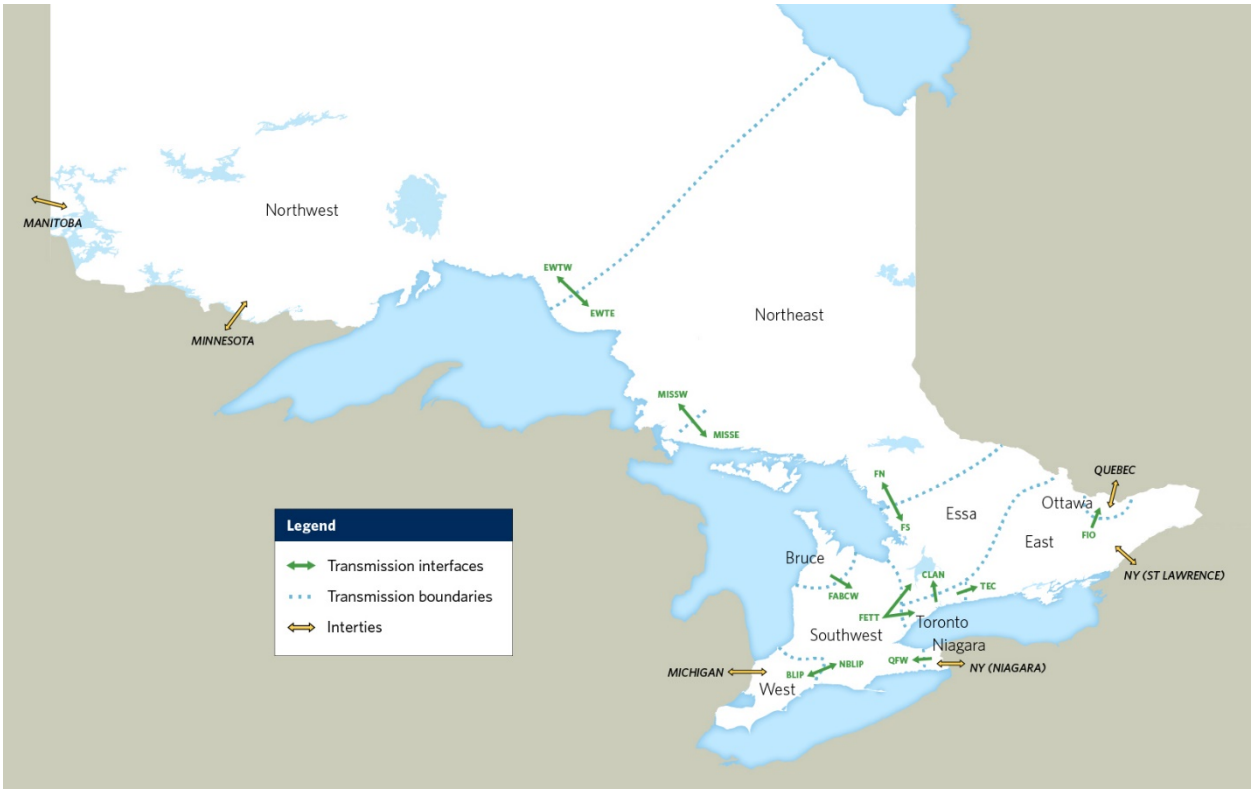
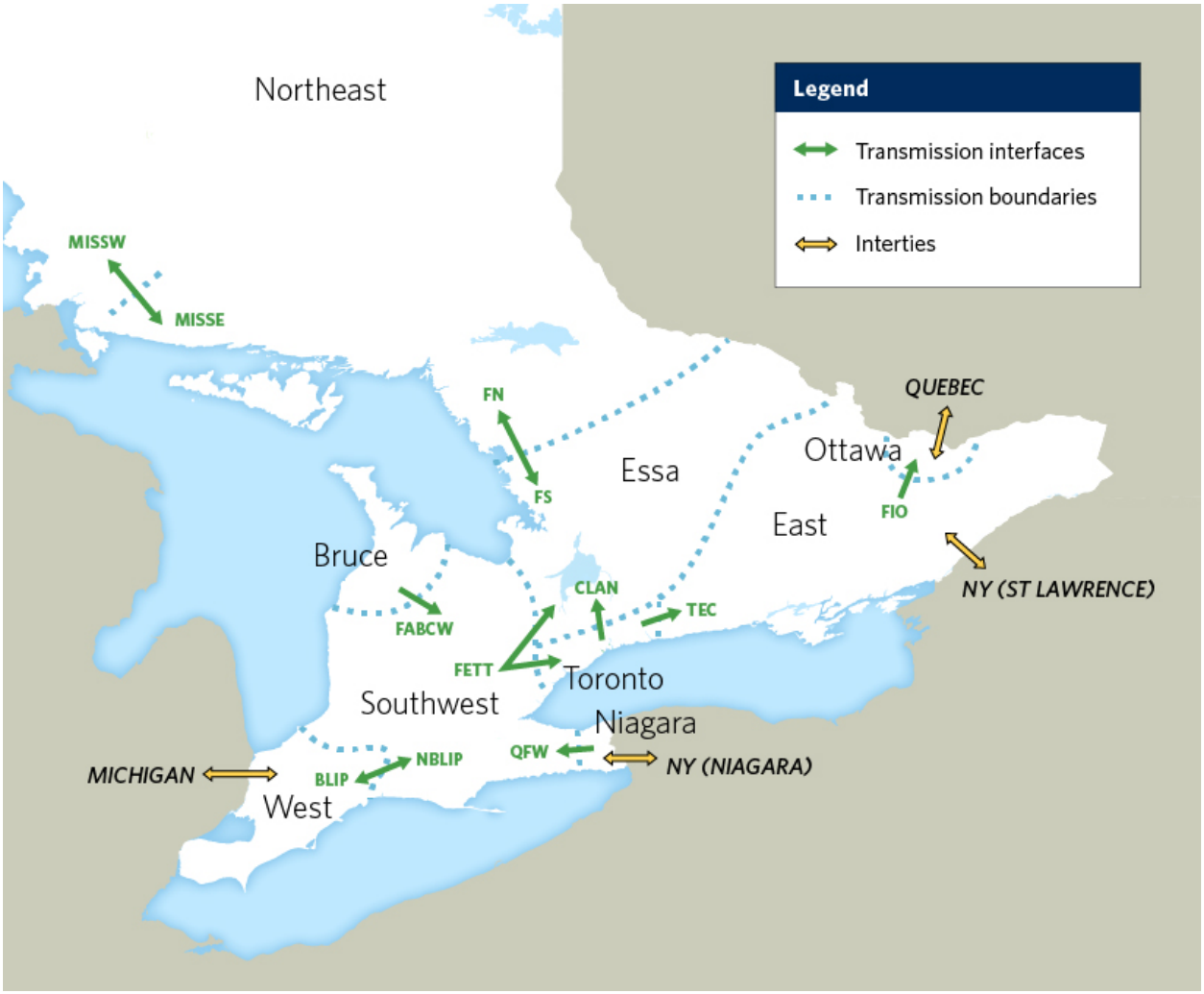


Figure 16 | Focus on the Interfaces and Interties in Southern Ontario



More information about the transfer capabilities of Ontario's transmission interfaces and interties is provided in the Transmission Interfaces and Interties Module.

3.3.2 Anticipated Transmission Projects

Transmission projects that are expected to come into service within the outlook timeframe are included in the base cases for the resource adequacy and transmission security assessments carried out for this APO. These projects are sufficiently far along in their planning and development to be considered committed projects for the purpose of long-range planning. The rationale for these projects has been described in detail in past bulk system planning studies, regional plans, or regulatory approval submissions to the Ontario Energy Board.

The locations of these transmission projects are shown in Figure 17 and a summary of each is provided in Table 2.

Figure 17 | Transmission Zones and Anticipated Transmission Projects



Table 2 | Anticipated Transmission Projects

Project	Description/Rationale	Expected In-Service Date
West of Chatham Area Reinforcements	Strong and sustained growth in the agricultural sector is one of the main drivers of increasing demand in Ontario, and has resulted in a need for additional capacity in the Windsor-Essex region. This multi-phase reinforcement project consists of: a new Lakeshore Transformer Station (TS) at Leamington Junction (located in Lakeshore), two load stations in Lakeshore (South Middle Road TS DESN[16] 1 and 2), and a new double-circuit, 230 kV transmission line, approximately 50 km in length, from Chatham SS to Lakeshore SS. A finalized addendum to the 2019 IRRP for the Windsor-Essex region is forthcoming (Q1 2022) and further recommendations to continue facilitating load connections are anticipated, namely two load stations in the Kingsville and Leamington areas, and a new double-circuit, 230 kV transmission line, approximately 20 km in length, supplying these new DESNs from Lakeshore TS.	Q2 2022 for Lakeshore TS and South Middle Road TS DESN 1 Q3 2025 for South Middle Road TS DESN 2 Q4 2025 for new Chatham SS to Lakeshore SS line

[16] DESN refers to "dual element spot network" which is a particular type of transformer station design employed to supply loads. The parallel dual supply ensures reliability can be maintained in the event of an outage or planned maintenance. A single transformer station can have multiple individual DESNs.

Project	Description/Rationale	Expected In-Service Date
West of London Area Reinforcements	In addition to the West of Chatham reinforcements, this project is required to supply the agricultural sector growth in the Windsor-Essex region. The reinforcement project consists of a new double-circuit 230 kV transmission line, approximately 60 km in length, from Lambton TS to Chatham SS, and a new single-circuit 500 kV transmission line, approximately 135 km in length, from Longwood TS to Lakeshore TS.	2028 for Lambton TS to Chatham SS lines 2030 for Longwood TS to Lakeshore TS line
Hawthorne-Merivale Reinforcement	The Hawthorne-Merivale transmission path supplies load in western Ottawa and delivers eastern Ontario resources and imports from Quebec to southern Ontario load centres. The reinforcement consists of upgrading the two 230 kV circuits between Merivale TS and Hawthorne TS, a length of 12 km.	Q4 2023
Lennox Reactors	This project will address acute operational challenges resulting from high system voltages in eastern Ontario and the GTA during low-demand periods. The reinforcement consists of two 500 kV line-connected shunt reactors to be installed at Lennox TS (near Napanee).	Q1 2022

Project	Description/Rationale	Expected In-Service Date
East-West Tie Reinforcement	This project aims to provide long-term, reliable electricity supply to Northwest Ontario to enable forecasted demand growth and changes to the supply mix in the region. The reinforcement consists of a new 230 kV transmission line roughly paralleling the existing East-West Tie Line between Wawa and Thunder Bay.	Q1 2022
FETT Capacity Upgrade (Richview-Trafalgar Reinforcement)	This project is required to address the transfer capability across the FETT interface, which is a concern during the summer peak demand periods, and will be exacerbated by the loss of a significant amount of supply capacity east of FETT related to the retirement of Pickering NGS and refurbishments at Darlington NGS. The Richview-Trafalgar reinforcement will increase the FETT transfer capability by approximately 2,000 MW through upgrades to sections of the existing 230 kV lines between Trafalgar TS and Richview TS. This reinforcement will enable some of the capacity that was lost east of the FETT interface to be replaced with capacity sited elsewhere in the province.	Q4 2025

4. Resource Adequacy

Capacity needs continue to emerge, with more significant needs appearing after the Pickering NGS retirement. The potential for energy requirements begins in 2026 and increases sharply starting in 2029 if existing resources do not remain available post contract expiry.

As demand increases, Ontario is projected to become a net energy importer beginning in the mid-2020s.

A key aspect of power system reliability is resource adequacy, which describes the balance of supply and demand on the system.

Risks to the power system, such as extreme weather and generator outages, can result in demand exceeding supply for a period of time. An adequate system has enough capacity to mitigate these risks.

The IESO calculates capacity requirements by performing a probabilistic resource adequacy assessment, which compares the demand forecast with anticipated resource performance to simulate the range of possible future system conditions. Loss of load expectation (LOLE), a measurement of resource adequacy, is defined as the average number of days per year during which supply is expected to be insufficient to meet demand. Reliability criteria[17] require that the IESO maintain enough capacity such that the LOLE is no greater than 0.1 days/year.

Probabilistic assessments are standard practice across North America and are part of the IESO's regulatory requirements. Over time, as forecasted demand changes or resources enter and exit the market, the IESO's capacity requirements will change.

The IESO also considers a number of risks in resource adequacy assessments. For example, actual demand may be higher or lower than forecast depending on weather conditions. Resources may be unavailable in real-time due to planned maintenance or equipment failures. Variable generators – like wind and solar – may provide relatively low levels of effective capacity since their production is dependent on environmental conditions. Finally, major projects, such as ongoing nuclear refurbishments, may face return-to-service delays and experience a higher outage rate after they return.[18]

[17] For additional information, refer to NPCC's Regional Reliability Reference Directory #1 Design and Operation of the Bulk Power System, Section R4, page 6; and the IESO's Ontario Resource and Transmission Assessment Criteria, Section 8.

[18] Consult the 2021 APO Resource Adequacy and Energy Assessment Methodology for additional information.

4.1 Reserve Margin

The IESO annually publishes a five-year forecast of reserve margin requirements at the time of projected annual peak. The reserve margin requirement is the amount of resources Ontario needs to have available over and above peak demand under normal weather conditions (represented as a percentage of peak demand).

There are various reasons for year-to-year variations in the reserve margin requirement. In addition to the allowances for uncertainties identified by NPCC, the IESO includes additional reserve to account for risks associated with nuclear refurbishments, with the amount varying depending on the refurbishment schedule. A year with higher-than-average planned outages will also have a higher reserve margin requirement.

In Ontario, summer capacity needs are generally much higher than winter capacity needs. The main driver of this difference is demand - summer peaks, driven by air conditioning demand, tend to be higher and more variable than winter peaks. Existing resources, particularly gas, hydroelectric, and wind, also provide less effective capacity in the summer than in the winter.

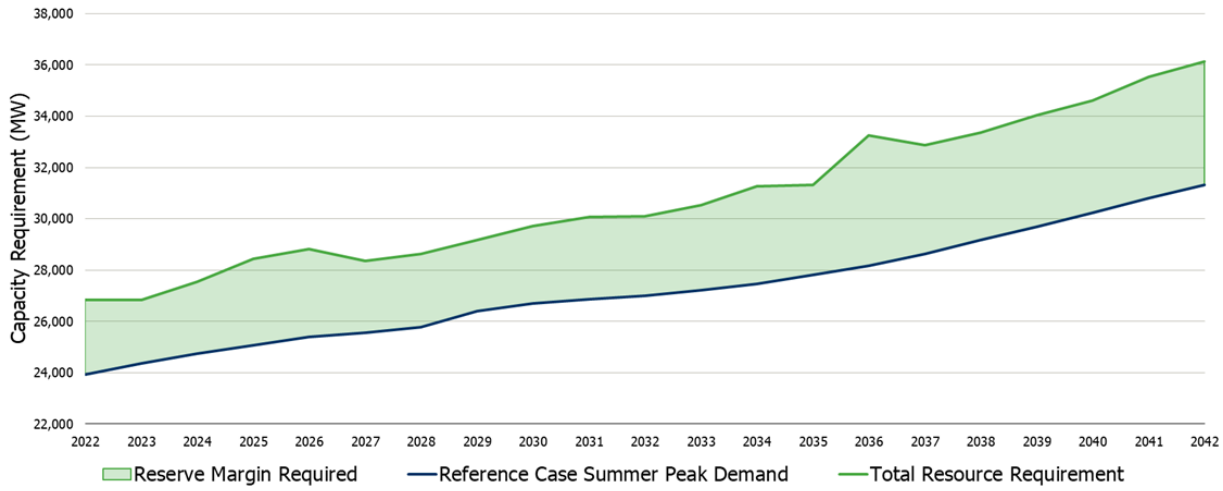
The methodology used to calculate effective capacity for each resource type also affects the reserve margin.

The reserve margin requirements for the next five years are shown in Table 3, and for the full horizon in Figure 18. Continued availability of existing resources is assumed in the calculation of the reserve margin. The 2021 APO Resource Adequacy and Energy Assessment Methodology describes how the reserve margin is calculated.

Table 3 | Five-Year Reserve Margin, with Continued Availability of Existing Resources

Five-Year Reserve Margin	2022	2023	2024	2025	2026
Reference Case Summer Peak Demand (MW)	23,916	24,365	24,732	25,074	25,399
Existing Summer Effective Capacity (MW)	27,951	27,205	28,001	27,134	25,151
Total Resource Requirement (MW)	26,851	26,826	27,553	28,438	28,831
Reserve Margin Available (MW)	4,035	2,841	3,269	2,059	-248
Capacity Surplus/Deficit (MW)	1,101	379	448	-1,304	-3,680
Reserve Margin Available (%)	17%	12%	13%	8%	-1%
Reserve Margin Requirement (%)	12%	10%	11%	13%	14%

Figure 18 | Reserve Margin Requirement, 2022-2042



4.2 Provincial Capacity Adequacy Outlook

Capacity adequacy can be represented in terms of surplus or deficit, relative to a set of demand and resource assumptions. Resource adequacy is assessed for the summer and winter seasons using the demand forecast outlined in Chapter 2, and the supply and transmission outlook in Chapter 3.

In this section, the capacity deficit represents the total amount of capacity, on an effective capacity basis, that the IESO must acquire to satisfy LOLE requirements. The capacity deficits for summer and winter periods with and without availability of existing resources post-contract/commitment are shown in Figures 19 and 20. Capacity needs without existing resources are included to provide insight into the contributions of existing resources. Summer capacity needs emerge through 2023, with long-term needs being driven by nuclear retirement and refurbishment, resources reaching the end of their contracts, and increases in demand.

Figure 19 | Summer Capacity Surplus/Deficit

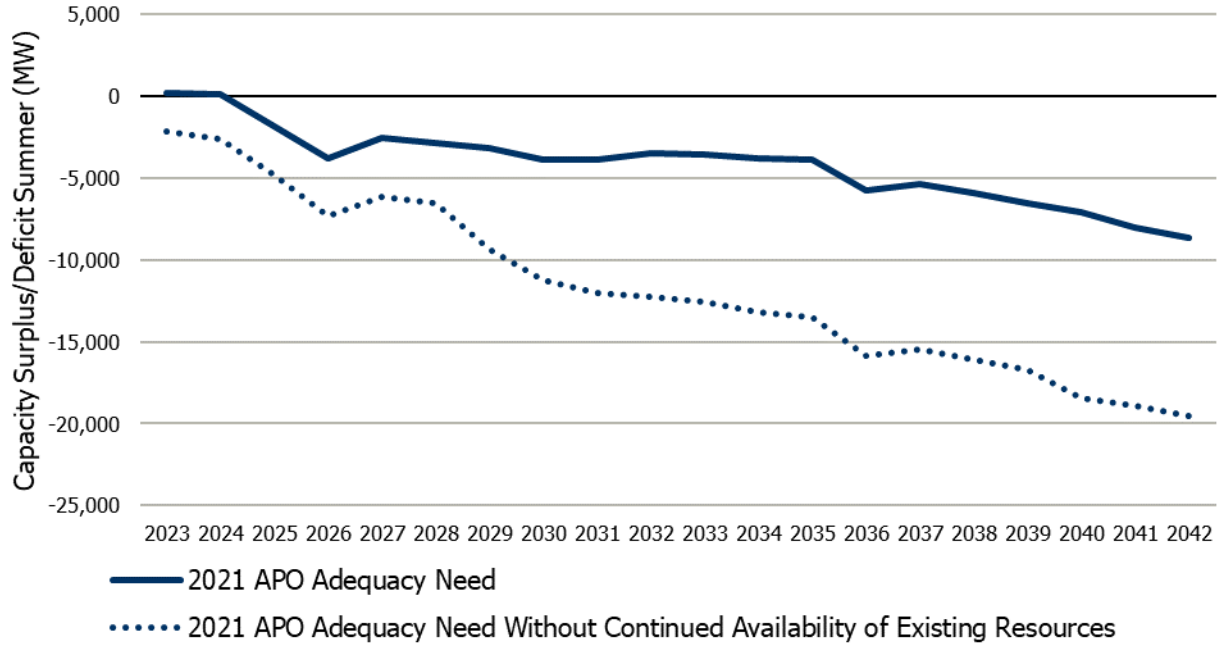
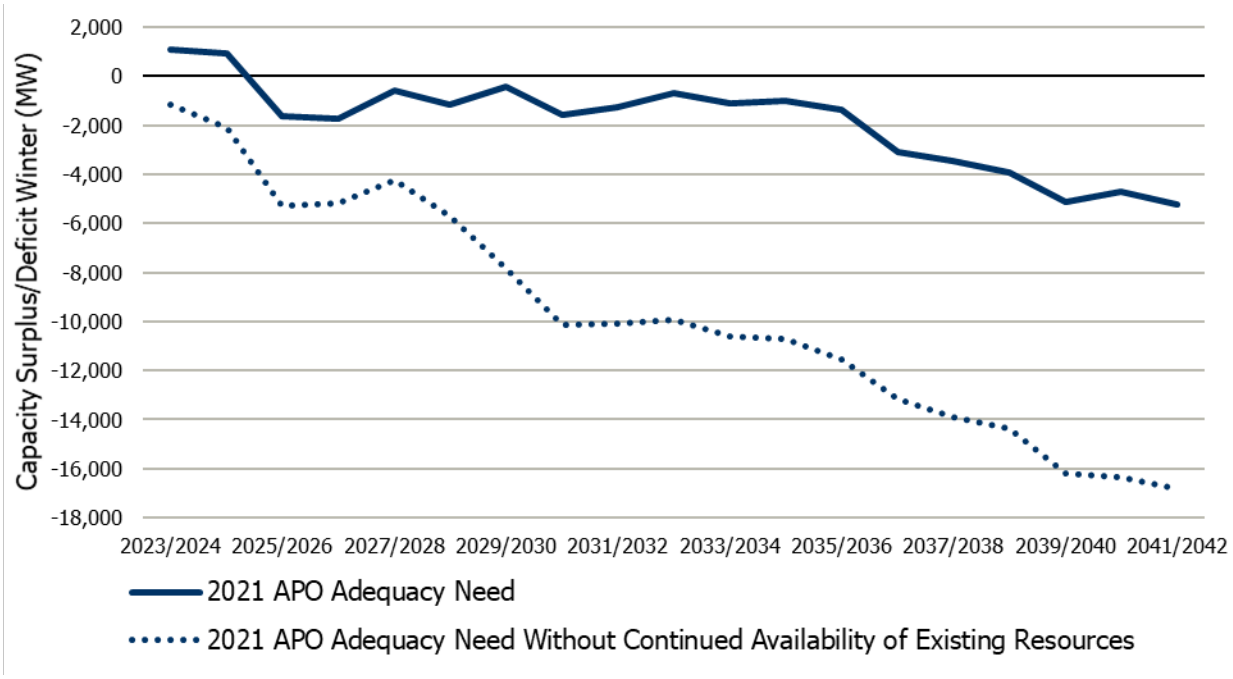


Figure 20 | Winter Capacity Surplus/Deficit



The IESO's Resource Adequacy Framework will provide the mechanism for effectively meeting needs as they occur, but influences identified below could also reduce needs in the years ahead.

4.3 Uncertainties

There are a number of potential sources of capacity and energy that may be added to the system over the outlook period, including new resources, recontracting existing resources, and new interties to neighbouring jurisdictions. These resources are not included in this outlook; the IESO will include them in future outlooks as more information becomes available.

Each of the items listed below would reduce the adequacy needs discussed above.

Oneida Battery (government policy - under negotiation): The Ministry of Energy (ENERGY) has asked the IESO to enter into contract negotiations with NRStor Inc. and Six Nations of the Grand River Development Corp. to explore a 10-year agreement for the proposed 250 MW Oneida Battery Storage facility. The Minister's letter asked the IESO to submit the final contract, for the Minister to consider in deciding whether to recommend that a government Directive be issued for the IESO to execute.

Lake Erie Connector (government policy - under negotiation): ENERGY has asked the IESO to enter into contract negotiations with ITC on the Lake Erie Connector project which would establish a new 1,000 MW high voltage bi-directional underwater transmission intertie between

Ontario and PJM. Direct access to the PJM market is expected to reduce Ontario capacity needs through increased non-firm imports (250 MW).

Calstock (35 MW) and Chapleau (5 MW) biomass plants (government policy - under negotiation): ENERGY has asked the IESO to enter in discussions with Atlantic Power (Calstock) and Green First Inc. (Chapleau) on potential options for new five-year contracts to support a longer-term transitional plan for the forestry sector. ENERGY has also signalled that it will continue to engage the IESO on details for contract negotiations with Thunder Bay Resolute, Hornepayne, and Atikokan biomass plants (government policy)

Small Modular Reactors (SMRs): Ontario Power Generation (OPG) has announced it will work with GE Hitachi Nuclear Energy on development and deployment of a 300 MW SMR at the Darlington new nuclear site by the end of 2028.

Small Hydroelectric Facilities program (government policy): Small hydroelectric facilities can contribute to meeting both capacity and energy needs, as well as achieving other non-electricity objectives. ENERGY has asked the IESO to explore ways to allow these facilities to continue operating beyond the expiry of their existing Power Purchase Agreements (PPAs).

Pumped storage project proposals (government policy): ENERGY has asked the IESO to continue its assessment of proposed pumped storage projects at Marmora, Meaford, and Schreiber.

4.4 Provincial Energy Adequacy Outlook

In addition to capacity adequacy, the provincial energy adequacy outlook helps determine Ontario's ability to meet electricity needs and to characterize the nature of those needs. The energy adequacy assessment does not include any economic imports or exports across Ontario's interconnections.

The extent to which an energy adequacy need emerges will depend on the availability and capacity factor (e.g. utilization) of existing resources post-contract expiry. The energy adequacy outlooks with continued availability of existing resources and without are shown in Figure 21 and Figure 22, respectively.

Figure 21 | Energy Adequacy Outlook, with Continued Availability of Existing Resources

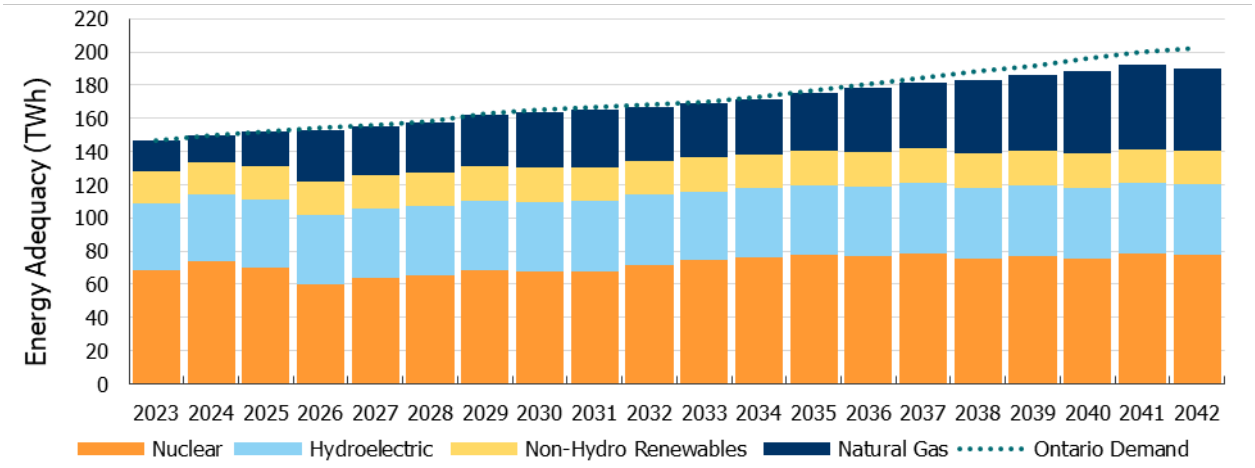
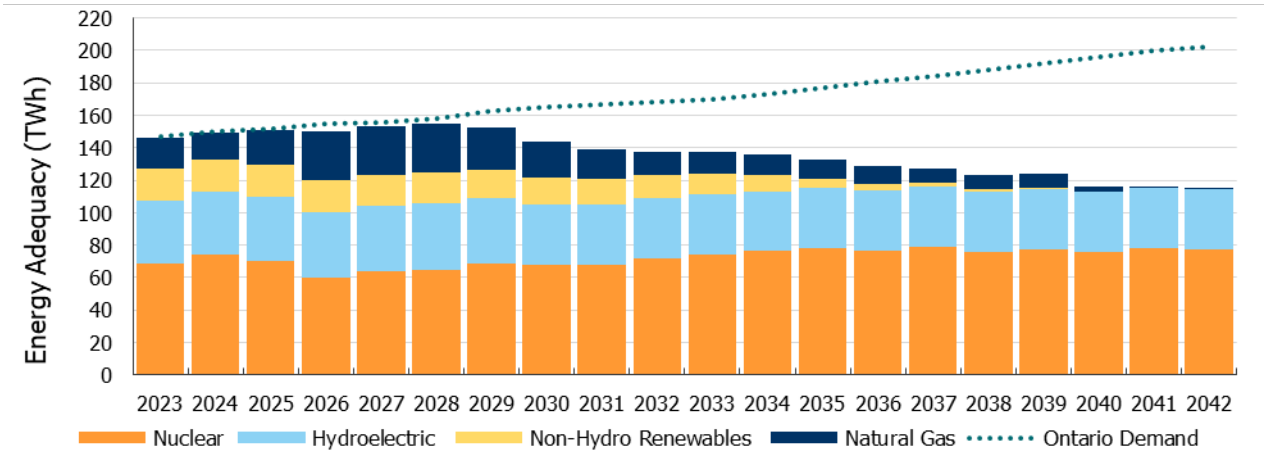


Figure 22 | Energy Adequacy Outlook, without Continued Availability of Existing Resources

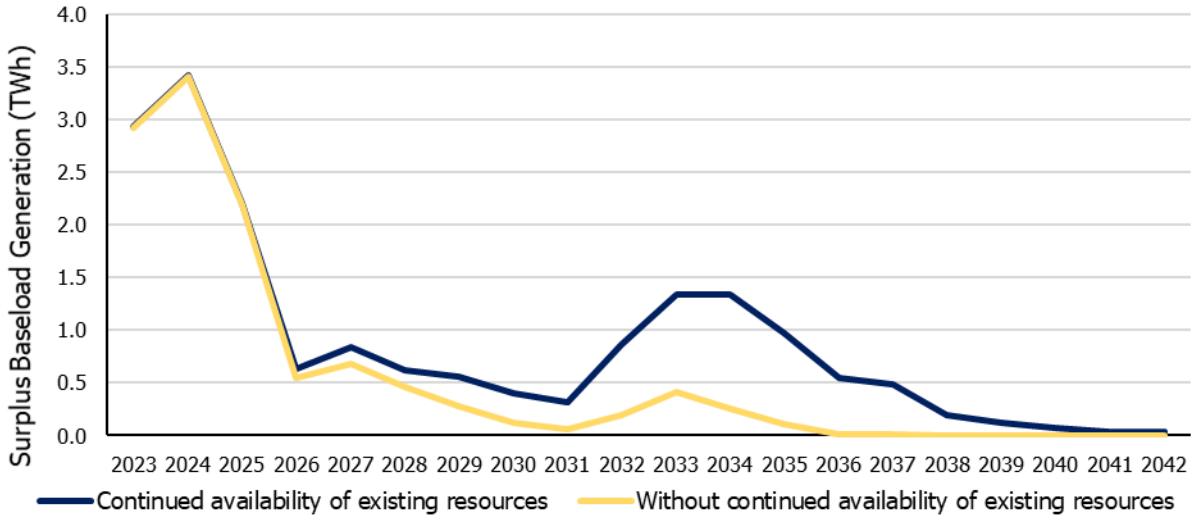


Existing resources can meet energy demands in most circumstances until the mid-2030s. An energy shortfall begins to emerge near the end of the planning horizon largely driven by increases in demand. An energy shortfall begins in 2026, and increases sharply starting in 2029, without continued availability of existing resources post contract expiry.

Surplus baseload generation (SBG), as shown in Figure 23, occurs when output from baseload resources exceeds demand and is normal in electricity markets with high portions of non-dispatchable (i.e., baseload and intermittent) resources (e.g. nuclear, must-run hydroelectric, wind and solar). Periods of SBG require the IESO to use market mechanisms, such as exports, variable generation curtailment, and nuclear manoeuvers/curtailment, to correct the imbalance.

By the mid-2020s, SBG begins to fall as more nuclear units undergo refurbishment and Pickering NGS retires.

Figure 23 | Surplus Baseload Generation



4.5 Provincial Energy Production Outlook

The IESO-administered energy markets are linked to Ontario's neighbours through interconnections. Imports and exports are scheduled in the real-time energy market to take advantage of price differences between jurisdictions. In 2020, Ontario imported 5.2 TWh of energy and exported 20.4 TWh.

The energy production outlook includes interconnections with Ontario's trading partners to more closely represent expected conditions and market outcomes. Trade with our neighbours will allow us to meet energy requirements toward the end of the outlook period, assuming continued availability of existing resources post-contract expiry, as shown in Figure 24. Ontario becomes energy inadequate without existing resources, as shown in Figure 25.

Figure 24 | Energy Production Outlook, with Continued Availability of Existing Resources

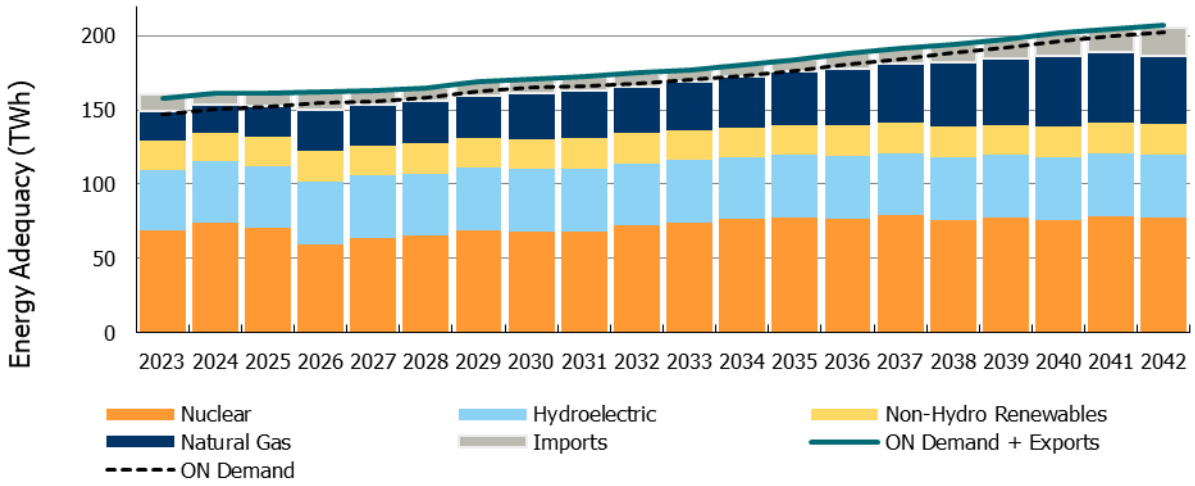
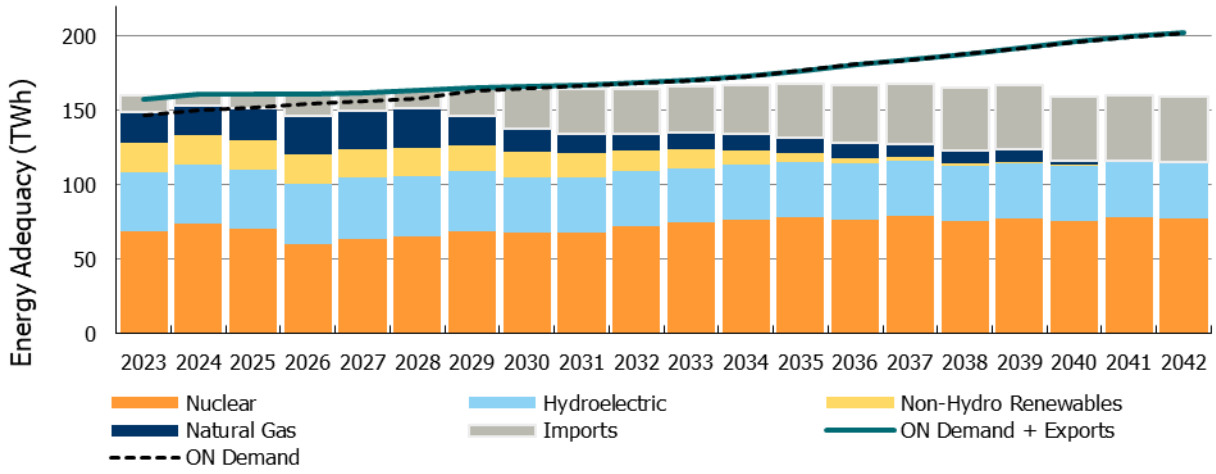


Figure 25 | Energy Production Outlook, without Continued Availability of Existing Resources

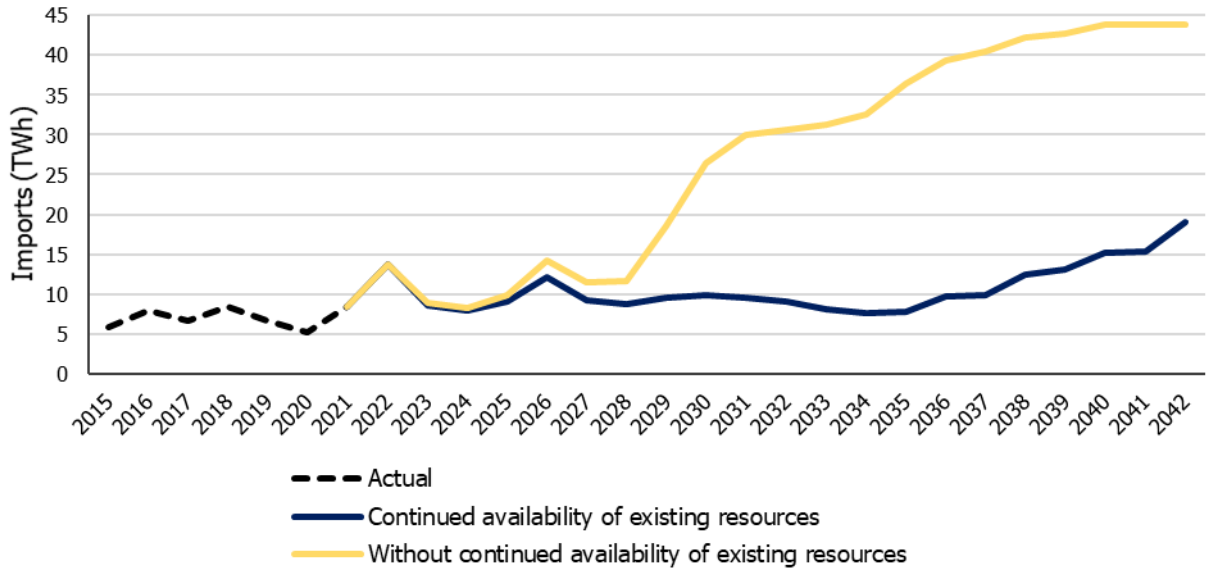


Energy production of baseload resources is similar to the energy adequacy outlook because production from baseload resources is generally insensitive to market prices. Gas production, which is often used to ensure power during times of higher demand and can provide needed flexibility in response to system conditions, can vary depending on when and if these resources are more economic than imports in the real-time market. In addition, where opportunities exist, energy from Ontario's electricity fleet can be exported. Evolving decarbonization policies are expected to change supply mixes and, therefore, energy production outlook, in both Ontario and its neighbouring jurisdictions; the impacts of these changes will be reflected in future work as more information becomes available.

In Figure 26, imports increase from historic levels (about 6 to 8 TWh) in both scenarios. Historically, Ontario has been a net energy exporter. In the scenario assuming continued availability of resources, Ontario becomes a net energy importer starting in the mid-2020s as the demand forecast increases. In the scenario without existing resources, imports reach about 44 TWh by the end of the planning period as demand increases, existing resources retire, and imports reach the intertie limits.

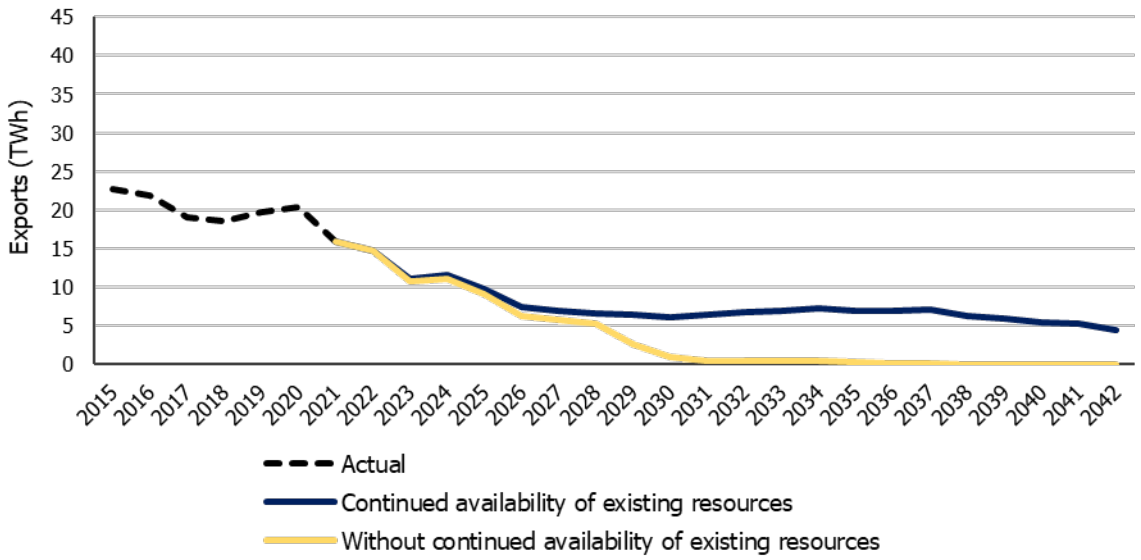
In Figure 27, energy exports decrease in the early and mid-2020s with nuclear retirements and refurbishments. Exports become minimal as demand in the 2030s increases. While the assumptions underpinning this outlook point to Ontario becoming a net importer of energy, there are many factors that could change this outcome, including the nature of any new capacity that may be built in Ontario, and developments in the electricity sectors of neighboring jurisdictions as they pursue their own decarbonization policies.

Figure 26 | Energy Production Outlook, Imports[19]



[19] For 2021, the 2019 APO forecast values are shown. For 2022, the 2020 APO forecast values are shown

Figure 27 | Energy Production Outlook, Exports[20]



[20] For 2021, the 2019 APO forecast values are shown. For 2022, the 2020 APO forecast values are shown

5. Locational Considerations Based on Transmission System Limitations

Limitations on the planned transmission system will impose requirements on where capacity must, or should not, be located to meet reliability standards. These are referred to as locational requirements and they, in effect, dictate where the capacity needed to fill the gap described in Chapter 4 must be placed within the province. In some of these cases it will be more cost-effective to reinforce the transmission system rather than siting resources in more expensive locations in Ontario.

This section describes these locational requirements based on the planned transmission system described in Section 3.7 and indicates where transmission reinforcements are being explored to lessen the requirement.

Future procurements for the capacity needed to meet provincial supply requirements will take into account the locational requirements described in this section.

The resource capacity requirements described in Chapter 4 lay out what is needed to reliably supply forecasted electricity demand in the province. This chapter discusses the locational requirements for that capacity. Section 5.1 discusses the locational requirements to meet resource adequacy criteria, and section 5.2 discusses the requirements to meet transmission security criteria. Section 5.3 ties these concepts together.

5.1 Locational Requirements for Resource Adequacy

Locational requirements exist due to limitations on the transmission system, typically specified through "transmission transfer capability limits" over transmission interfaces.

To account for transmission transfer capabilities across Ontario's interfaces, the IESO specifies the minimum and maximum incremental capacity amounts required in certain regions of the province. These minima and maxima are typically presented at the zonal level, and in some cases are reported for groups of zones that share a common limiting interface.

The methodology for establishing the transmission transfer capabilities is provided in the Transmission Outlook Methodology, while the transfer capability limits themselves are provided

in the Transmission System Interface Data Tables. A description of the interfaces included is provided in the APO modules.[21]

The zonal minima and maxima for select future years are shown for the summer season demand in Table 4 and for winter in Table 5.[22] A zonal minimum represents the minimum required capacity necessary to meet the provincial resource adequacy criterion. A zonal maximum represents the maximum amount of capacity in a Zone that can contribute to provincial resource adequacy. In other words, the zonal minimum is a capacity requirement; capacity exceeding the zonal maximum does not provide further value from a resource adequacy perspective.

These constraints reflect the planned transmission projects listed in Table 2 (in Chapter 3), with the exception of the West of London reinforcements due to the timing of the West of London bulk study outcomes. Furthermore, plans to re-acquire existing generation are not accounted for in the zonal constraints, including the generation need that was identified in the West of London plan and the planned reacquisition of Lennox Generating Station (GS).

Under these assumptions, location-specific capacity needs emerge in the mid-2020s, mainly in the Zones east of the FETT interface (Toronto, Essa, East, Ottawa, Northeast and Northwest Zones).[23] This need is driven by the scheduled retirement of Pickering NGS and the planned refurbishments at Darlington NGS, coupled with increasing demand. The plan to re-acquire Lennox GS for operation until 2029 will address most of this need in 2026 (see Section 5.4).

The results also show an emerging need for capacity in the West Zone towards the end of the decade. This, however, does not reflect resource and transmission system reinforcements recommended in the West of London bulk study. If implemented, they will address this gap.

The limited transfer capability on the Flow South interface restricts the amount of new capacity in northern Ontario (Northwest and Northeast Zones) that can contribute to resource adequacy. There are also limits on the amount of capacity that can be accommodated in southwest Ontario (Bruce, West, Niagara and Southwest Zones). These limits are reflected by the zonal maxima, and are present in both summer and winter.

[21] The 2021 APO Resource Adequacy and Energy Assessment Methodology provides a description on the methodology on how the zonal limits have been calculated. Also refer to the 2021 APO Supply, Adequacy and Energy Outlook Module for additional information on the zonal capacity adequacy assessments.

[22] A maximum limit of "N/A" shown in Table 4 and Table 5 indicates the actual maximum is not expected to be practically limiting.

[23] These zones were grouped together as the constraints do not bind for the individual zones.

Table 4 Incremental Summer Zonal Constraints, without Continued Availability of Existing Resources

Zone	2023 Min	2023 Max	2026 Min	2026 Max	2029 Min	2029 Max
Bruce	0	N/A	0	5,350	0	4,500
East	0	N/A	0	N/A	0	N/A
Essa	0	N/A	0	N/A	0	N/A
Niagara	0	900	0	950	0	850
Northeast	0	250	0	700	500	950
Northwest	0	50	0	400	0	200
Ottawa	0	N/A	0	N/A	0	N/A
Southwest	0	N/A	0	N/A	0	N/A
Toronto	0	N/A	0	N/A	0	N/A
West	0	850	0	1650	700	3,300
Toronto+Essa+East+Ottawa[24]	0	N/A	1,300	N/A	0	N/A
Toronto+Essa+East+Ottawa+ Northeast					2,200	N/A
Northeast+Northwest	0	250	0	700	500	950

[24] Starting in 2029, a minimum emerges in the Northeast Zone and it is observed that the minimum for Toronto+Essa+East+Ottawa becomes dependent on the amount of capacity located in the Northeast and can no longer be calculated in isolation. For example, at least 500 MW is needed in the Northeast in addition to at least 1,700 MW in Toronto+Essa+East+Ottawa to reach the 2,200 MW total reliability target).

Zone	2023 Min	2023 Max	2026 Min	2026 Max	2029 Min	2029 Max
Bruce+West+Niagara+Southwest	0	2,050	0	6,250	700	4,500

Table 5 | Incremental Winter Zonal Constraints, without Continued Availability of Existing Resources (MW)

Zone	2023/2024 Min	2023/2024 Max	2026/2027 Min	2026/2027 Max	2029/2030 Min	2029/2030 Max
Bruce	0	N/A	0	N/A	0	4,700
East	0	N/A	0	N/A	0	N/A
Essa	0	N/A	0	N/A	0	N/A
Niagara	0	750	0	850	0	900
Northeast	0	850	0	1,200	0	2,200
Northwest	0	150	0	450	0	450
Ottawa	0	N/A	0	N/A	0	N/A
Southwest	0	N/A	0	N/A	0	N/A
Toronto	0	N/A	0	N/A	0	N/A
West	0	600	0	800	950	3,150
Toronto+Essa+East+Ottawa	0	N/A	0	N/A	1,950	N/A
Northeast+Northwest	0	850	0	1,200	0	2,200
Bruce+West+Niagara+Southwest	0	1,300	0	4,950	950	5,700

5.2 Additional Locational Requirements for Transmission Security

Transmission security criteria, which are distinct from the resource adequacy criteria addressed in Section 5.1, can also introduce locational requirements. Resulting from the IESO's obligation to ensure the bulk transmission system meets NPCC and NERC reliability standards and criteria, transmission security criteria are concerned with the system's ability to withstand sudden disturbances, such as the loss of system components.

Transmission security studies determine locational capacity needs by comparing forecasted demand to the total amount of resources and interface transfer capability within a given Zone. In these assessments, the transfer capability accounts for contingencies or the loss of various system elements. Where the zonal demand exceeds the internal resources and transfer capability, there will be an additional locational requirement for capacity. In most cases, transmission security needs are more onerous than the resource adequacy need, as reflected by the zonal minima and maxima in Table 4 and Table 5.[25]

Locational considerations resulting from the transmission security outlook are present in the West of London area, FETT interface, Ottawa, and Northeast Ontario. These issues are summarized in the subsections below.

5.2.1 West of London / Buchanan Longwood Input Interface (BLIP)

Transmission security assessments for the West of London area and BLIP transmission interface identified local capacity needs in the West of London area. Both regional and bulk plans focusing on the Windsor-Essex and West of London areas have looked to address these localized capacity needs in the near, medium and long term, which are being driven by the rapid expansion of agricultural greenhouses. The most recent study, "Need for Bulk System Reinforcements West of London" was published in September 2021.

To address a localized capacity need from 2024 to 2028, the IESO intends to begin bilateral negotiations for continued operation of Brighton Beach GS (as outlined in the 2021 AAR), which will be required to support local needs until a transmission solution is in service. Brighton Beach GS was selected to address the near-term need as it represents the only supplier in the local area with requisite scale to address this immediate need, offering 588 MW of capacity to support the growing loads in the area. Further details are available in the study referenced above.

The rest of the multi-pronged solution consists of a new 230 kV line, a new 500 kV line, and a local capacity requirement in the West of London area, starting in 2030 and progressively increasing to 1,975 MW by 2035. 550 MW of this capacity should be located in the Windsor-Essex and/or Chatham-Kent area. This capacity need assumes existing resources are not re-

[25] This is not universally the case, due to differences in methodological approaches and assumptions between the probabilistic resource adequacy assessments and deterministic transmission security studies.

acquired, but as there is currently sufficient capacity in the area, re-acquiring existing generation after contract expiry could meet this need.

Beyond what was recommended by the IESO in the plans for West of London, as summarized in this section, there is no additional locational requirement for capacity in the West Zone.[26]

5.2.2 Eastern Ontario / Flow East Towards Toronto Interface

Over the next few years, supply capacity east of the FETT interface will decrease due to the retirement of Pickering NGS, expected by the end of 2025, and refurbishments at Darlington NGS. Both of these resources are located east of the FETT interface. In addition, more generation contracts will reach the end of their terms toward the end of this decade, all creating a need for additional capacity in the region.

This need will be addressed through the medium-term with a plan to reacquire Lennox GS for continued operation until April 2029 (as outlined in the 2021 AAR), and transmission upgrades to the FETT interface by the end of 2025 (described in Section 3.7). These options were chosen based on a combination of project economics, performance advantage, lower environmental impact and lower implementation risk.[27]

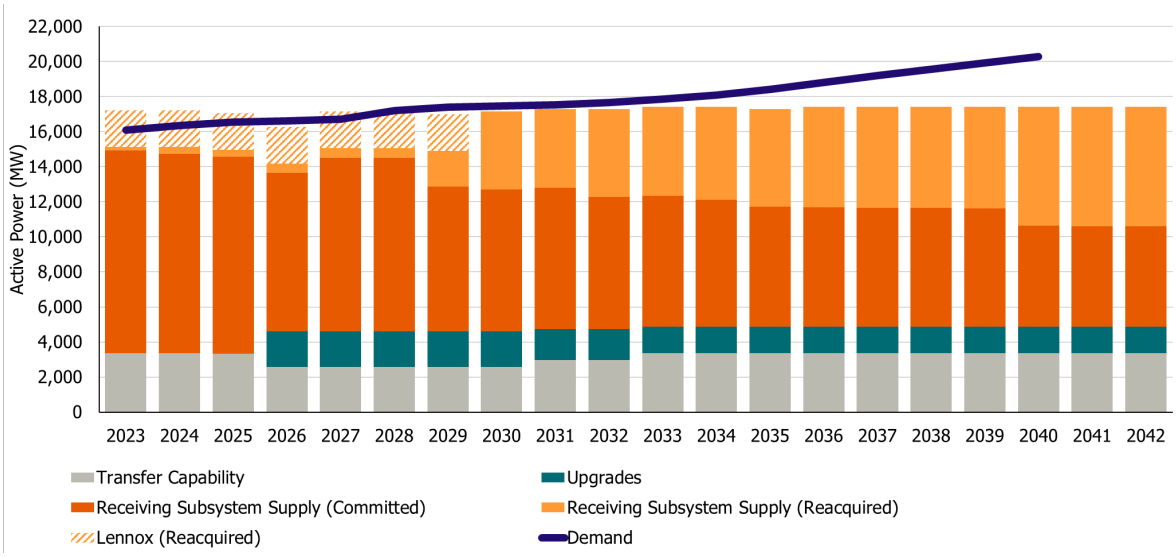
The transmission security outlook for the bulk system east of the FETT interface is illustrated in Figure 28. Assuming that the actions described in the previous paragraph (transmission upgrade and re-acquisiton of Lennox) have been implemented, a small capacity gap emerges in 2026 of just under 300 MW, which is the result of a slightly higher demand forecast for 2021 compared to that of 2020. Should resources acquired to meet the province-wide capacity need in the Long-Term RFP be located east of FETT, this gap would be resolved. If sufficient new resources do not materialize east of FETT by 2026, an alternative could include exercising a 500 MW firm import option from Hydro Quebec.

In the longer term, an additional transmission security need may emerge in the early to mid-2030s driven by demand growth and transfer capability limits across the FETT interface. Any resources situated east of the FETT interface will help to alleviate this issue, including Lennox GS or other, new resources. Also, further improvements of the FETT interface or other approaches as determined through integrated bulk system planning could be considered, while closely monitoring the resource outlook and the demand levels east of FETT.

[26] More information on the projects can be found on the Southwest Ontario Bulk Planning web page. Information on engagement sessions, can be found on the Windsor-Essex Regional Planning web page.

[27] See Hydro One Networks Inc. application to Ontario Energy Board (EB-2021-0136) for further information on the supporting rationale for the transmission upgrades: https://www.rds.oeb.ca/CMWebDrawer/Record/719761/File/document

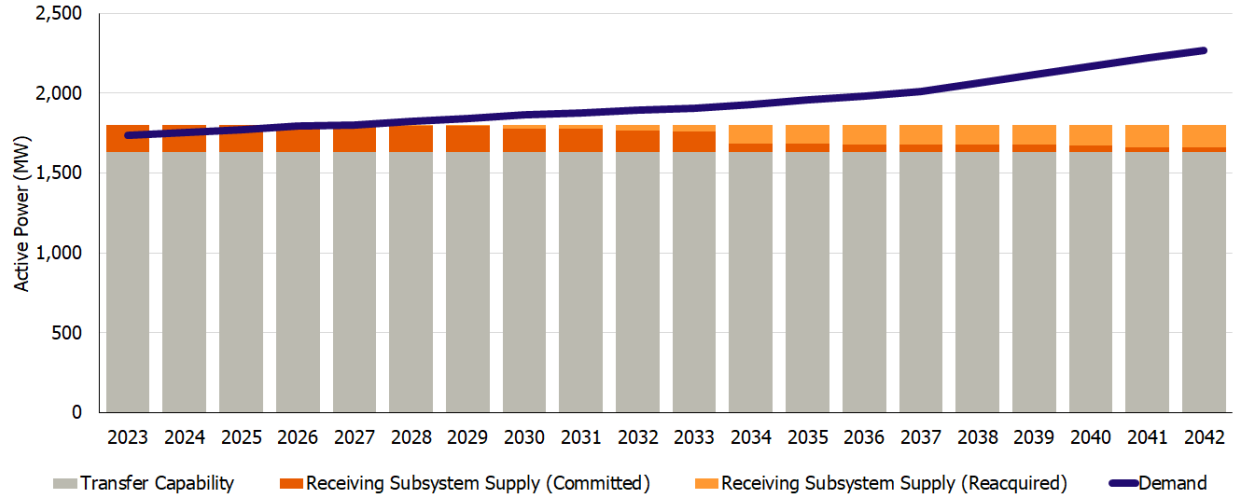
Figure 28 | FETT Security Outlook



5.2.3 Ottawa / Flow into Ottawa Interface

The transmission security outlook for the system east of the FIO Interface (Ottawa Zone) is illustrated in Figure 29. This shows an emerging need in 2027 for additional capacity to supply the Ottawa Zone. Transmission reinforcement to facilitate greater flows into Ottawa could also be an option. This need is highly sensitive to local demand growth over the next several years.

Figure 29 | FIO Security Outlook



The scope of the forthcoming Gatineau Corridor End-of-Life study is examining this need in detail and the result could be transmission enhancements that lessen or eliminate this locational capacity requirement. The Gatineau Corridor is a major transmission corridor between Pickering and Ottawa, consisting of five transmission lines with a combined line length of approximately

1,300 km. This corridor is critical for supporting the transfer capability of the FIO interface into the Ottawa Zone, as well as Flow into Dobbin and Sidney, which supplies the Peterborough to Quinte West area. Large portions of the corridor are over 80 years in age and are expected to reach end of life by the late-2020s.

The Gatineau Corridor study is examining alternative refurbishment options for the transmission facilities at end-of-life, paired with different reinforcement possibilities. Along with needs in the Ottawa Zone, the study is looking to address existing needs for the area of Peterborough to Quinte West. The study is planned to be completed in Q2 2022, and the study outcomes may inform future procurements.

5.2.4 Northeast Ontario (MISSW and FN Interfaces)

The transmission security outlook for the system west of the MISSW and FN interfaces are illustrated in Figure 30 and Figure 31, respectively.

The security outlook for MISSW shows that there is a need for approximately 400 MW of additional capacity starting in 2029, coinciding with the connection of new industrial loads. Substantial government support is being provided for decarbonization initiatives that would promote intensification of electricity use (e.g. electric arc furnaces), resulting in a potentially large increase in industrial electricity use. This additional 300 MW of industrial load is assumed to remain for the duration of the forecast period.

The zonal constraints in Section 5.1 show that to meet resource adequacy standards there are no minimum locational requirements in the Northeast. The security outlook for FN, on the other hand, shows a local capacity need of approximately 500 MW in 2029 to meet transmission security standards. This is being driven by the same connection of new industrial load described above, under the assumption that existing resources are reacquired. Without the reacquisition of existing resources, this gap could start in 2024.

A bulk power system plan is currently being developed for Northeast Ontario to address the supply gap shown in Figure 30. The scope of studies will determine if the transmission infrastructure located west of Sudbury (to Wawa) is sufficient to supply the forecasted demand growth west of Sudbury in Northeast Ontario to the Northwest region.

Finalizing the plan, and considering engagement with affected stakeholders and communities, is expected to be complete by Q2 2022.

Figure 30 | MISSW Security Outlook – All Elements Initially in Service

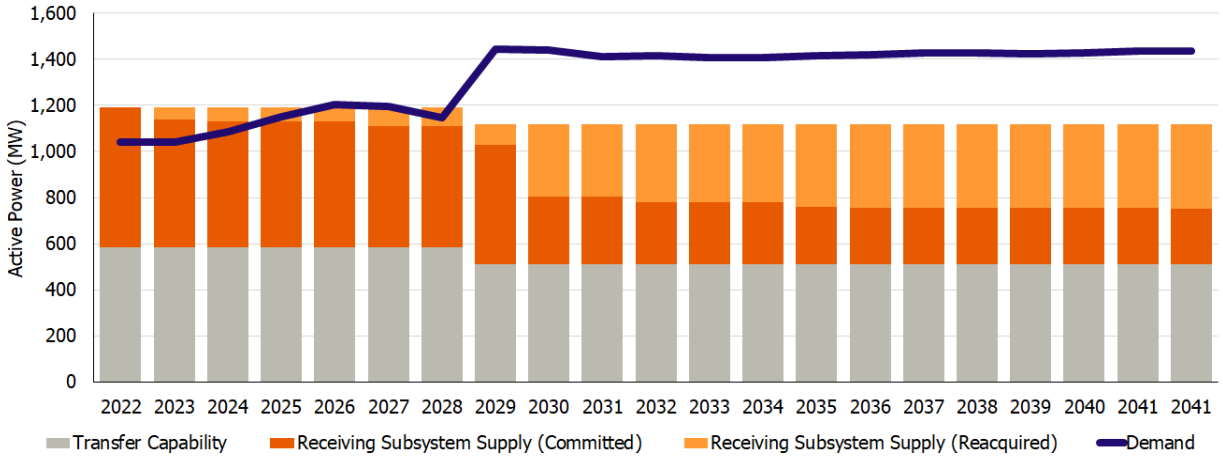
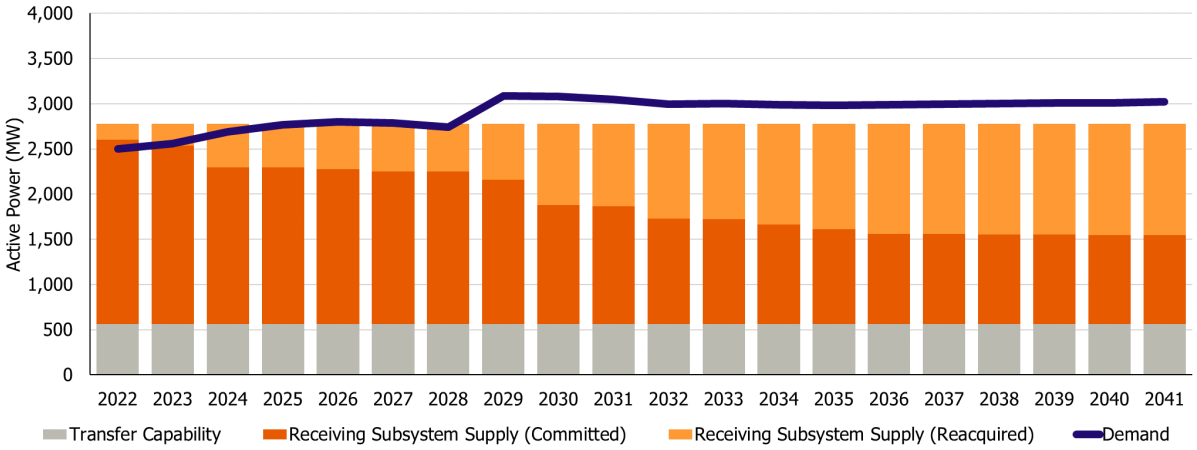


Figure 31 | FN Security Outlook – One Element Initially out of Service



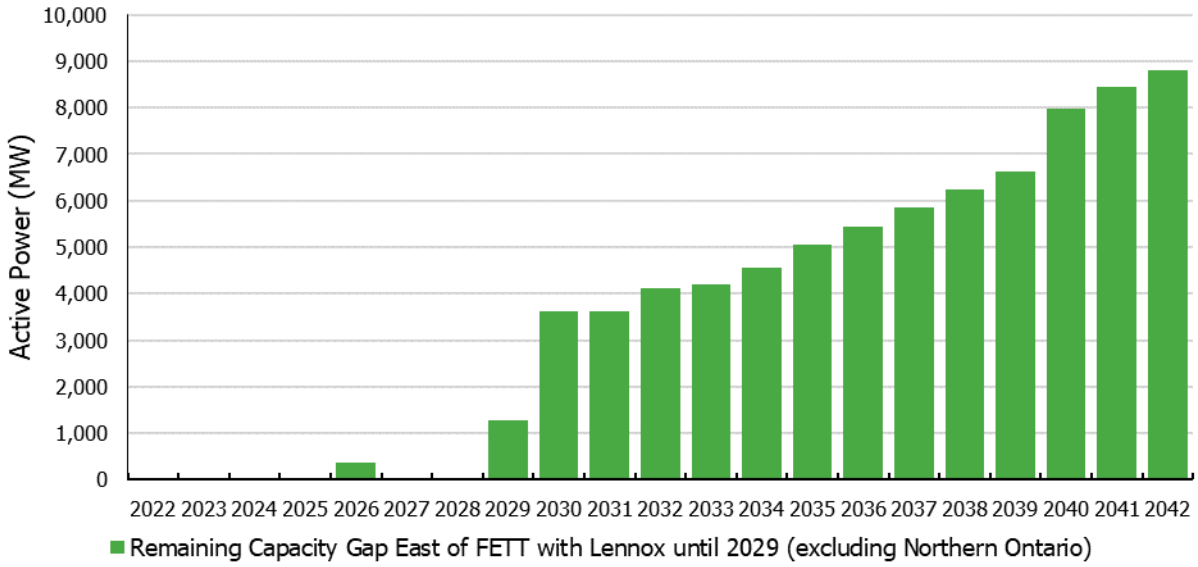
5.3 Combined Locational Requirements for Resource Adequacy and Transmission Security

This section summarizes all of the locational capacity requirements noted in this chapter. This section is intended to serve as an input to the Resource Adequacy Framework, which sets forth the mechanisms for acquiring capacity to meet both province-wide and locational needs. These locational needs, shown in Figure 32 through Figure 34, are the remaining capacity gaps in specific locations in the system, after considering the portion of the need that has been addressed through bulk and/or regional transmission plans that are already in place.

For the West Zone, there are no further requirements to locate capacity in the West of London area beyond what is described in the "Need for Bulk System Reinforcements West of London" study.

For the area east of the FETT interface, a capacity gap emerges starting in the mid to late-2020s, as illustrated in Figure 32. This is being driven by generation retirements and growing demand projections east of the FETT interface, after considering the planned FETT transmission reinforcement and Lennox GS continuing operation until 2029. Without continued availability of the remaining resources east of FETT, compliance with transmission security criteria on the FETT interface will result in the emergence of this capacity gap.

Figure 32 | Capacity Gap East of the FETT Interface (Summer)

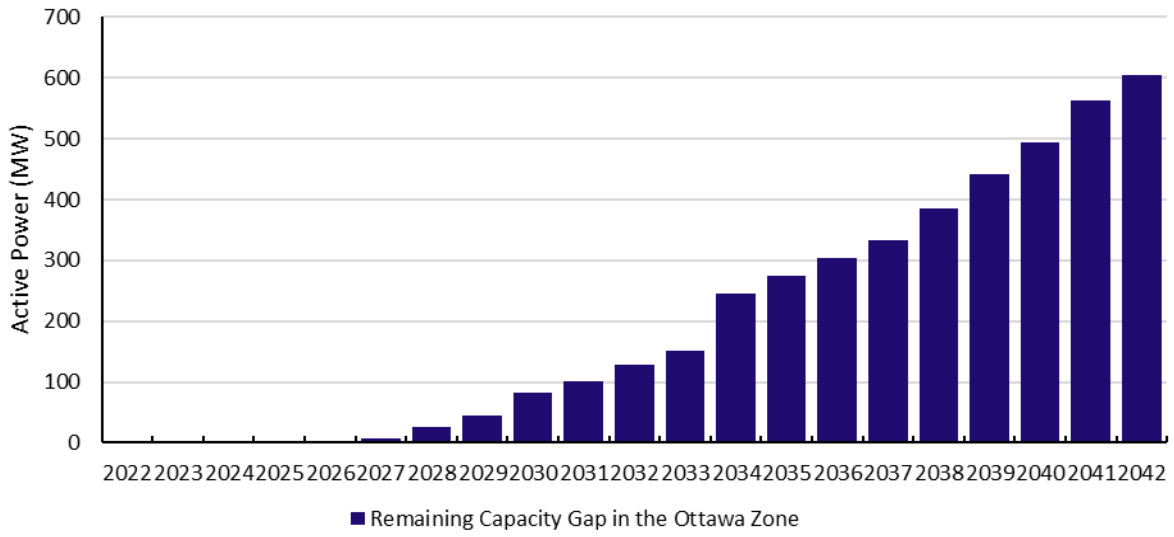


Note: Assumes that existing resources are unavailable after their commitment period ends, with the exception of Lennox GS

This situation will be monitored closely as the IESO acquires supply resources to meet the provincial resource adequacy requirement. Some of these resources are likely to be located east of FETT. Any resources acquired east of FETT, including the re-acquisition of existing resources after their commitment period ends, will contribute to addressing this need.

Growth in the Ottawa area is contributing to a capacity gap in the Ottawa Zone beginning in 2027. This gap, shown in Figure 33, is related to the transmission security outlook for the FIO interface, which will limit the amount of growth in Ottawa that can be supplied by resources from elsewhere in the province. This capacity gap occurs during the summer peak.

Figure 33 | Capacity Gap in the Ottawa Zone (Summer)

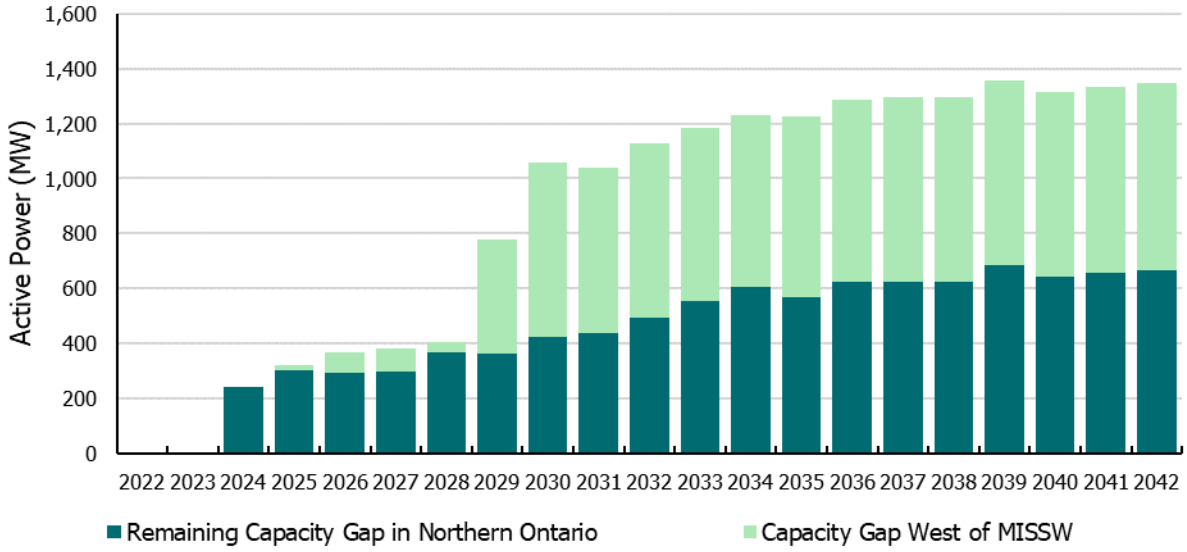


Note: Assumes that existing resources are unavailable after their commitment period ends

The Gatineau Corridor End-of-Life bulk study is looking at options that may defer this locational need into the longer-term period, as discussed in Section 5.5. These options aimed at addressing the existing end-of-life transmission infrastructure that supplies eastern Ontario, including the Ottawa and Peterborough areas, could results in an increase to the transfer capability of the FIO interface.

In the area to the west of the MISSW interface, a capacity gap begins to emerge beginning in 2025, and increases sharply in 2029 as a result of the projected industrial growth in northeast Ontario. This need occurs in the winter and is shown in Figure 34. In addition to the area west of MISSW, there is a broader capacity gap forecast for the rest of northern Ontario, as also shown in Figure 34. The remaining capacity gap in northern Ontario is due to steady industrial growth and expiring contracts of local resources.

Figure 34 | Capacity Gap in Northern Ontario including MISSW (Winter)



Note: Assumes that existing resources are unavailable after their commitment period ends. For clarity the area West of MISSW is part of Northern Ontario

The Northeast bulk system study will evaluate possible options for addressing the gap affected by the transmission security outlook for the MISSW interface. The remaining capacity need, such as that shown for northern Ontario, can be addressed by additional resources strategically located in the north, and/or transmission reinforcement.

6. Integrating Electricity Needs

Determining Ontario's overall capacity needs means integrating provincial needs with locational requirements. Building on the outcomes of Chapters 4 and 5, this chapter summarizes the system needs over the outlook period.

Given the availability of existing resources after contracts expire, Ontario is expected to see unserved energy needs, in the order of 12 TWh, by the end of the planning horizon.

In addition, through the latter part of the planning horizon, existing resources that continue to be available after contract expiry will be required to run at higher capacity factors compared to current operation, in order to meet energy demands.

6.1 Capacity Needs

Some of the province's forecasted needs can be met by the continued availability of existing resources after their contracts expire. However, what remains available depends on a number of factors, including asset age and condition, the need for capital investment, market conditions, and acquisition mechanisms.

The following figures depict locational needs without reacquired resources, and consider the resource adequacy constraints and transmission security needs identified in previous chapters. Only contracted generation, as of publishing, is included as an existing resource.

Figure 35 | Summary of Summer Capacity Needs including Locational Requirements, without Continued Availability of Existing Resources[28]

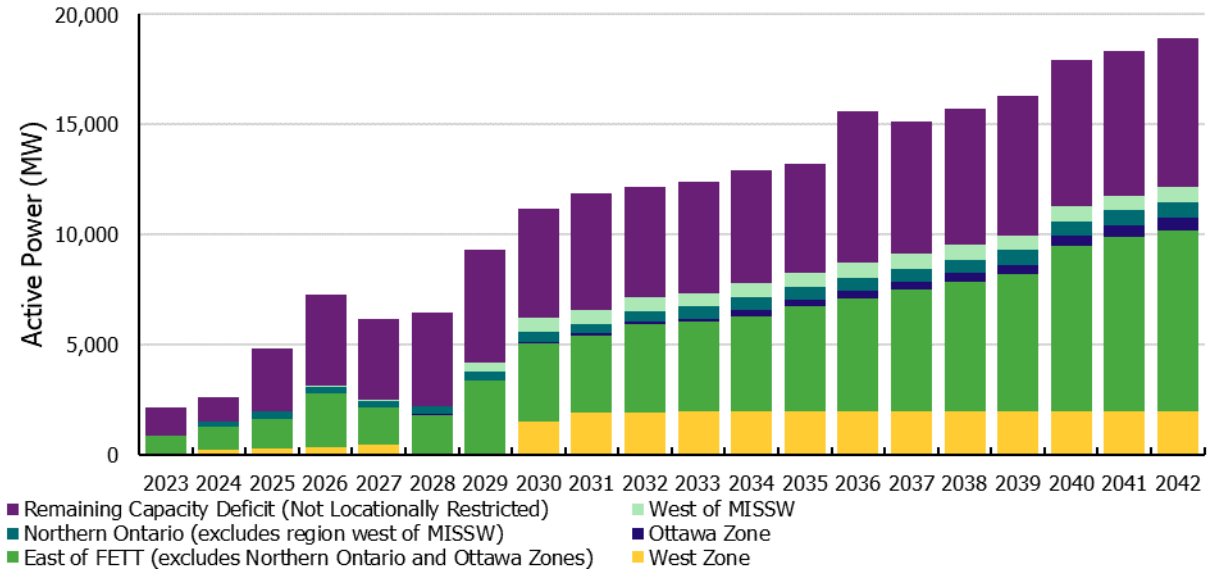
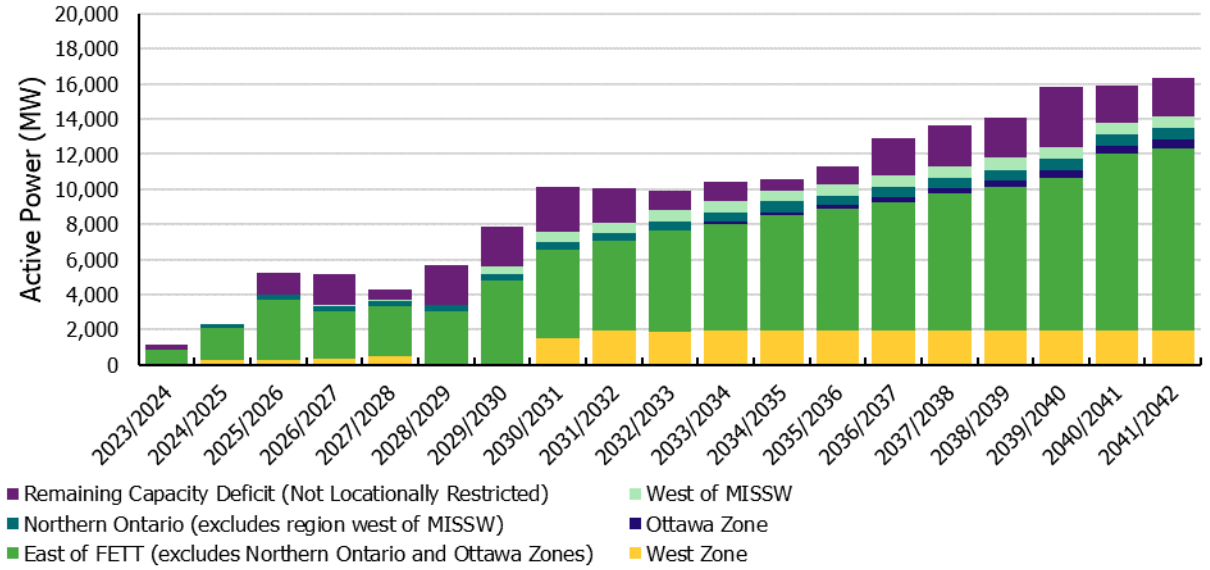


Figure 36 | Summary of Winter Capacity Needs including Locational Requirements, without Continued Availability of Existing Resources[29]



[28] Northwest and Northeast capacity gaps shown are for the winter months. The summer capacity need is expected to be less than the winter capacity need.

[29] The east of FETT (excludes Northwest, Northeast, and Ottawa Zones) capacity gap shown considering summer transfer capabilities. The winter transfer capability of FETT is expected to be larger than the summer transfer capability of FETT, effectively reducing the capacity gap further.

Sources of forecasted capacity needs are listed below.

- The capacity need emerging in 2023 is primarily due to Lennox GS reaching the end of its contract term. This need is concentrated to the East of the FETT interface. Given the geographical significance of Lennox GS, the IESO is expected to extend its contract to 2029, as outlined in the AAR.
- The west Zone need shown in 2024 to 2028 will be addressed by the continued operation of Brighton Beach GS. The IESO intends to enter into bilateral negotiations for continued operation of Brighton Beach GS this need in this period. Other needs in the West Zone emerging in the long-term period will be addressed through implementing the West of London bulk study recommendations pertaining to local resource requirements.
- In the 2024-2025 period, Pickering NGS is expected to retire. Furthermore, the nuclear refurbishment program will continue through the 2020s and into the 2030s, with between two and four nuclear unit refurbishments at Bruce NGS and Darlington NGS taking place concurrently over the summer period for most years until 2030.
- The majority of contracts with natural gas-fired and renewable generation are expected to expire over the next two decades. If capacity from all existing resources is reacquired post contract/commitment, there is no incremental need for new capacity until 2025.
- Most of Ontario's natural gas generation facilities are located in the West Zone and Toronto Zone, contributing to the locational nature of some needs.
- The forecasted demand over the planning horizon is less significant a driver than Ontario's changing supply outlook, but demand is still an important factor contributing to Ontario's capacity needs.

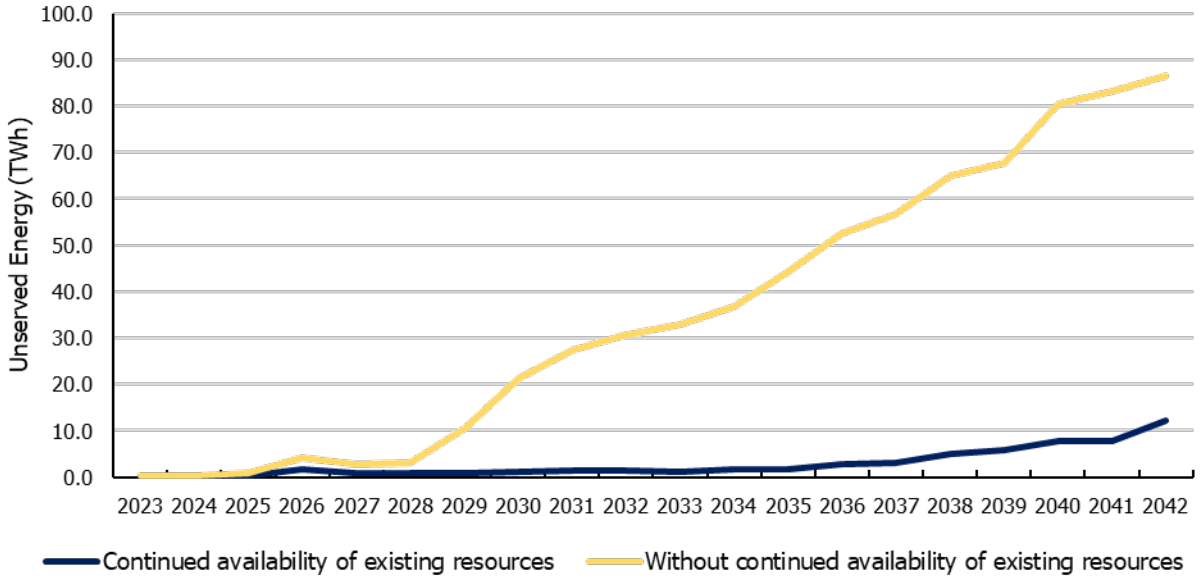
6.2 Energy Needs

Further to capacity requirements, Figure 37 illustrates the potential for unserved energy, demonstrating that capacity needs identified above also eventually lead to an energy need.

Ontario is expected to observe unserved energy needs, in the order of 12 TWh, by the end of the planning horizon should existing resources continue to be available. This suggests that existing resources will not be sufficient to meet energy requirements and Ontario will require new resources and/or imports.

If resources become unavailable or constrained, the potential for unserved energy begins in 2026 and grows substantially, suggesting that the ability to provide energy could be a consideration in the medium-term and/or long-term RFPs. These considerable energy shortfalls are mainly due to expiring contracts from both combined gas cycle generation and renewable energy resources.

Figure 37 | Potentially Unserved Energy



Another way to illustrate the extent of energy adequacy needs is through load duration curves. Assuming continued availability of existing resources in the near term, adequacy needs are primarily for capacity and not energy, as enough energy production capability exists for most periods of time. Energy needs become more prominent in the latter years of the planning horizon.

Figure 38 and Figure 39 show the duration curves of demand, demand net of baseload resources, and demand net of all existing resources (representing the unserved energy) for 2023 and 2042. Demand net of baseload resources refers to demand after the production of nuclear, hydroelectric, solar, wind, combined heat and power, and bioenergy. Demand after all existing resources represents the remaining requirement after baseload and dispatchable resources. Resources beyond what the existing fleet can provide would be required to meet this demand.

By 2042, unserved energy (i.e., demand net of all existing resources) occurs about 60 per cent of the time with continued availability of existing resources and occurs at all hours without continued availability of existing resources.

Figure 38 | Duration Curves, with Continued Availability of Existing Resources

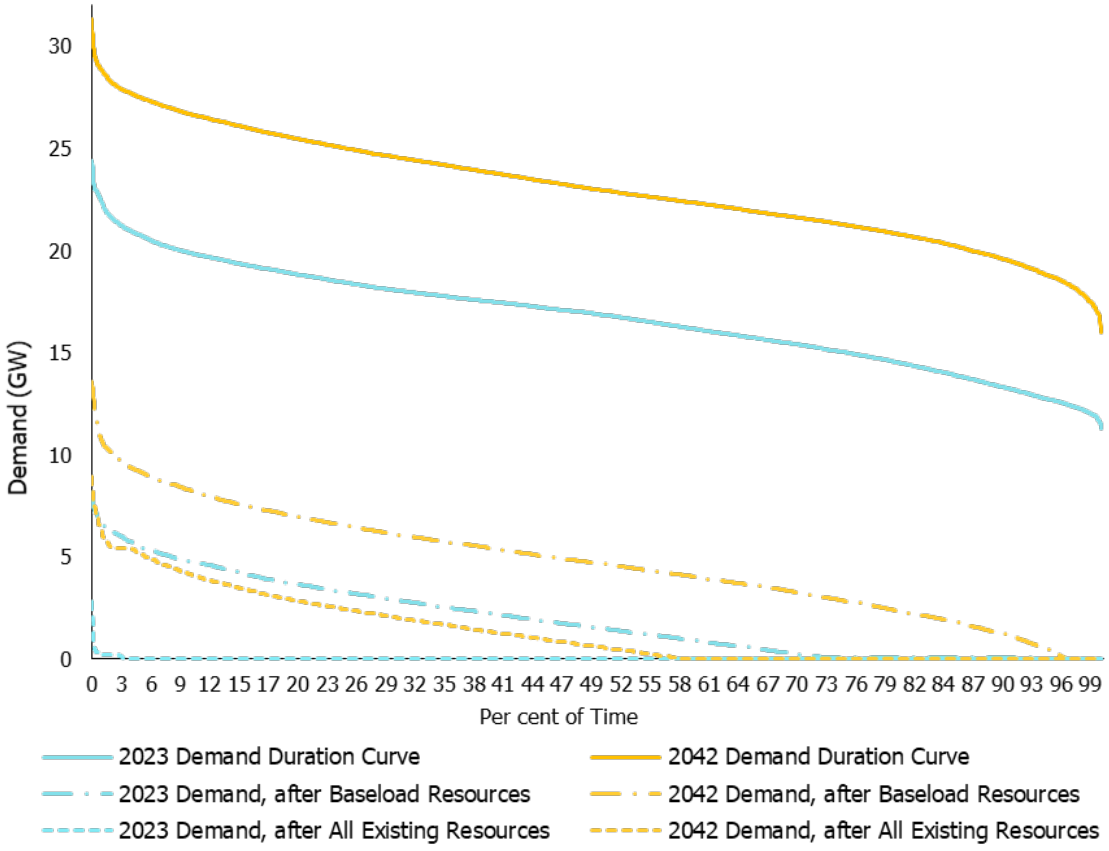
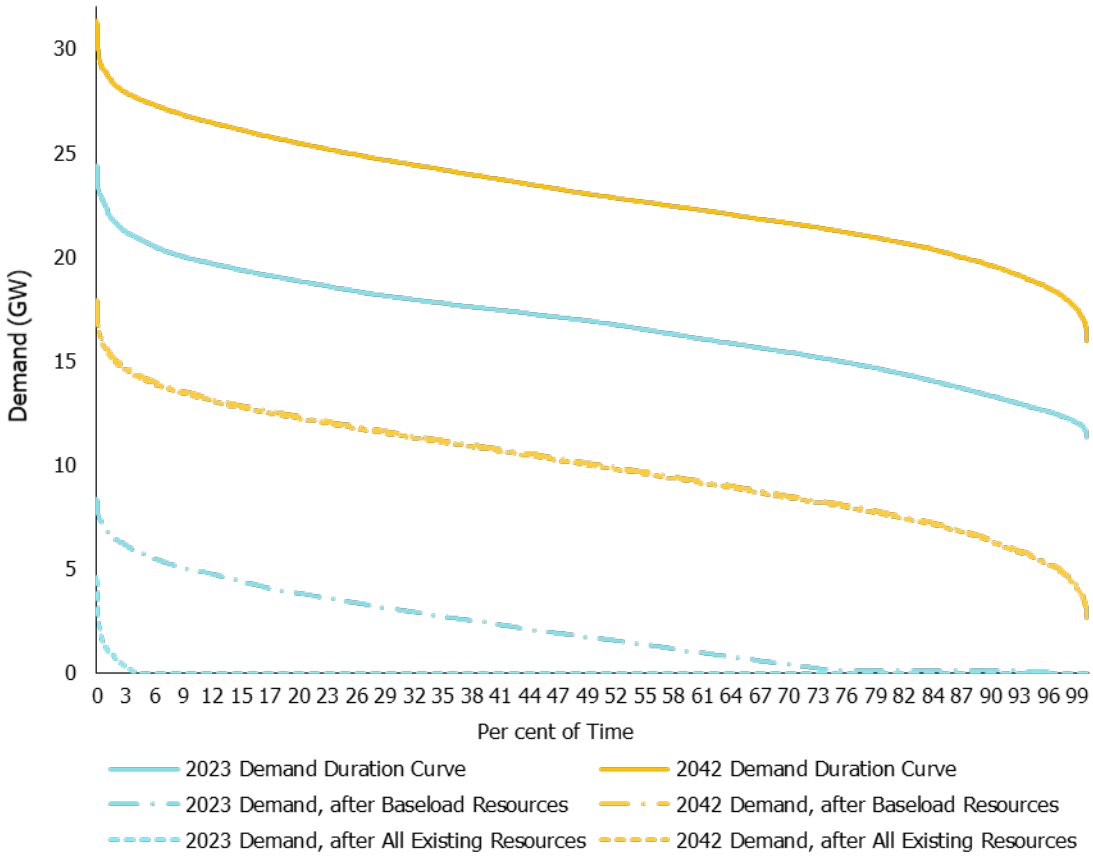


Figure 39 | Duration Curves, without Continued Availability of Existing Resources



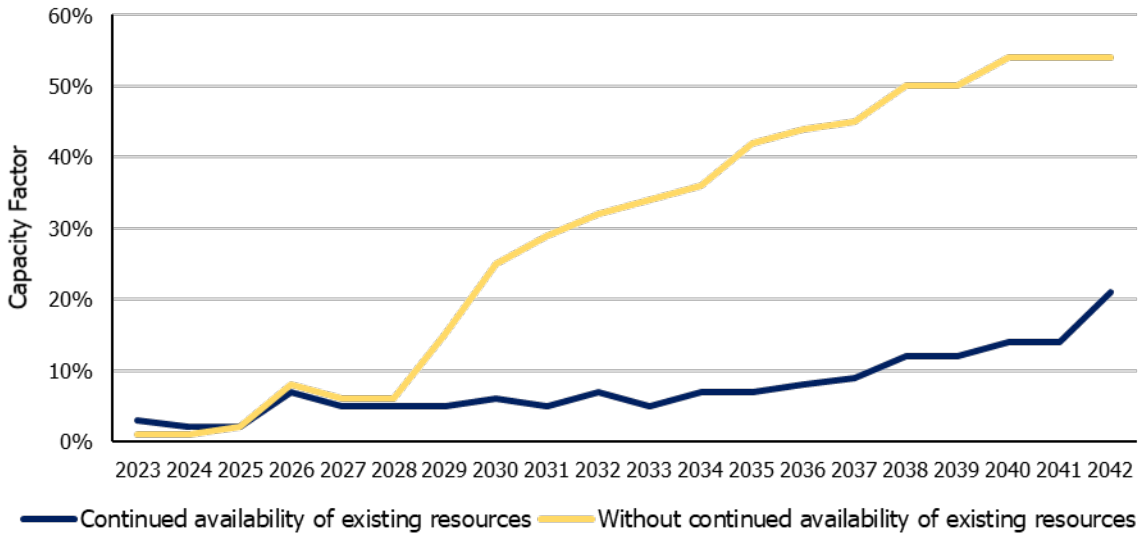
The IESO uses a new proxy resource[30] to demonstrate how to meet the unserved energy need observed above. To illustrate the level of energy requirement, the capacity factor[31] of the new proxy resource used in the energy assessment to fill the gap between load requirements and the existing and committed resource fleet is shown in Figure 40. Existing resources are expected to operate at higher capacity factors should they continue to be available post contract expiry to meet increased demand requirements.

Including existing resources, the proxy resource is expected to operate at a capacity factor of around 5-10 per cent until the late-2030s, and increase to about 10-20 per cent by 2042. The capacity factor increases significantly without existing resources, illustrating system needs are not only for capacity but for energy as well. If resources become unavailable post contract expiry, the capacity factor of the proxy resource grows substantially starting in 2029.

[30] For electricity system modelling, proxy resources are new generation resources that are leveraged last on the supply stack and are assumed to be non-emitting.

[31] A capacity factor is a ratio of a resource's energy output over the maximum possible energy output over a period of time.

Figure 40 | Capacity Factor of New Proxy Resources to Meet Load Requirements



New resources required to meet future energy needs will have the opportunity to compete with existing resources in the energy and capacity markets. Resources can earn revenue in the energy market by offering energy at a lower price than the marginal resource. Flexible, dispatchable resources including dispatchable loads can also quickly react to short-term energy price spikes or provide operating reserve.

7. Outcomes and Other Considerations

The marginal cost of electricity production and electricity sector emissions are both forecast to increase over the outlook period, the first as a result of growing demand, the second due to nuclear refurbishments and retirements resulting in an increased use of Ontario's gas-fired generation fleet. Despite this forecasted increase, electricity remains a source of low-carbon energy in Ontario, and increased electrification of emissions-intensive sectors provides an opportunity to reduce overall province-wide emissions.

The results presented in this chapter are outcomes of the energy production outlook based on the supply mix discussed in Chapters 3 and 4. This mix reflects the continued availability of existing resources following the end of their contract term or commitment, and changes to the supply mix over the outlook period would result in changes to the outcomes described below.

7.1 Marginal Resources

Long-term power system plans use an economic dispatch model that schedules resources to meet system needs based on least cost. This model considers each resource's production or variable costs, which typically include fuel and variable operating and maintenance costs.

Supply resources are categorized as baseload (operating essentially constantly, e.g., nuclear), dispatchable (operating as needed, e.g., gas), or intermittent (operating when fuel is available, e.g., wind or solar). Usually, baseload and intermittent resources have lower marginal energy costs than dispatchable resources.

Resources are generally dispatched from lowest-production-cost baseload to higher-production-cost dispatchable. The marginal resource is the one that provides the last unit of energy needed on the system, and is the most expensive resource scheduled. During the peak demand hours of hot summer days, the marginal resource is usually a natural gas-fired generator; overnight during autumn, gas-fired generation is less likely to be the marginal resource.

7.2 Marginal Costs

The data underpinning this outlook are based on an economic dispatch model that simulates each hour of the outlook period. This model dispatches units in order of their production costs and identifies the marginal resource in each hour. The marginal cost in each hour is the production cost of the marginal resource.

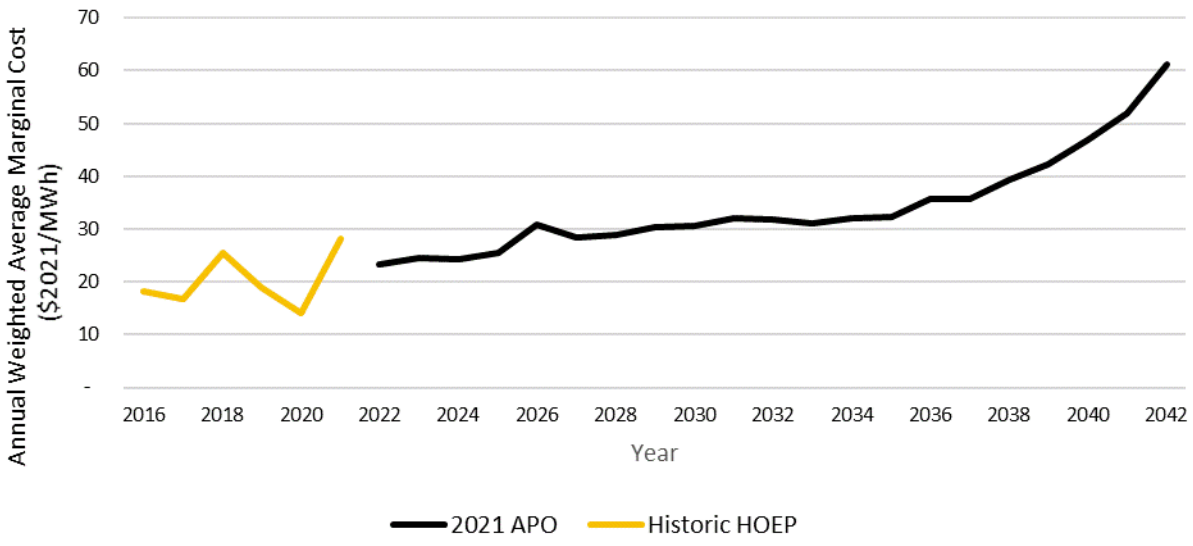
Marginal costs provide the trajectory of market prices, which can differ widely due to market participant behaviour, congestion and other factors. When a fundamental change to the supply

mix occurs – such as the retirement or refurbishment of nuclear units – marginal costs illustrate the expected impact on prices by providing an indication of the change in production costs.

With the refurbishment of nuclear units and demand increases in the long term, marginal costs are expected to increase as gas-fired generation becomes the marginal resource more often. Furthermore, the forecasted demand increase is expected to increase Ontario's reliance on imports which could also put upward pressure on marginal costs in the long term.

Figure 41 illustrates the weighted average marginal costs forecast and the historical Hourly Ontario Energy Price (HOEP). The average marginal costs can also be found in the data tables. Note that there is significant uncertainty pertaining to these values in the later years of this forecast. Substantial use of the proxy resource discussed in Section 6.2 beyond 2035 puts significant upward pressure on marginal costs; should the true resources that this represents turn out to have low marginal cost (e.g. SMRs, hybrid resources), the average marginal cost in these years would be expected to be lower.

Figure 41 | Weighted Average Marginal Costs Forecast, and Historical HOEP[32]



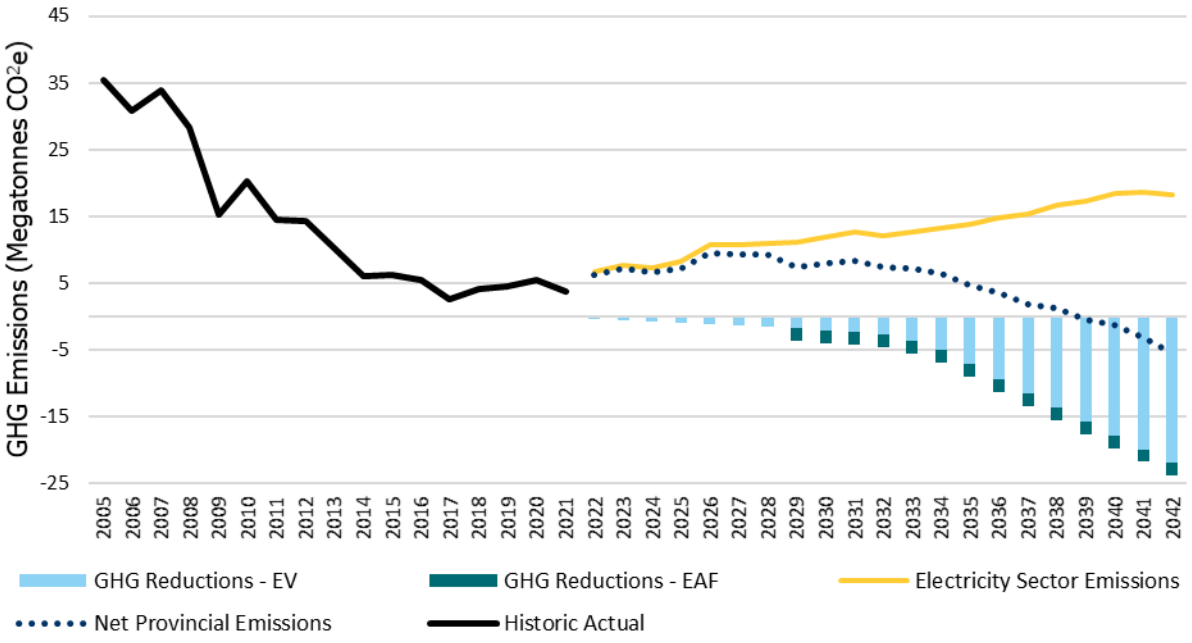
[32] 2021 Actual HOEP is year-to-date as of December 7, 2021

7.3 Greenhouse Gas Emissions

Electricity sector emissions are forecast to increase to 11.9 Mt CO_2e by 2030 due to reduced nuclear production and growing demand, resulting in increased production from gas-fired generation, as shown in Figure 42.

An increase in electricity sector emissions does not necessarily mean an increase in economy-wide emissions. The carbon intensity of electricity remains far below that of other fuels, such as gasoline for automotive transportation or fuel oil for space heating. Switching from higher-emission fuels to low-carbon electricity could increase electricity sector emissions while reducing overall province-wide emissions. As electricity consumption increases, the attendant rise in electricity sector emissions could be reduced by increased energy efficiency, improved management of peak demand, or the entry of non-emitting resources to the Ontario market. Figure 42 shows both historical and forecast electricity sector GHG emissions, as well as estimated GHG emissions reductions in the broader economy due to two major electrification elements in the APO reference demand forecast: electric vehicles (EV) and the electric arc furnace (EAF) at Algoma Steel expected to be in service in 2029. The dotted line in Figure 42 shows Ontario's net emissions resulting from activity in the electricity sector (i.e., electricity sector emissions, less emissions avoided due to electrification). Note that emissions reductions shown here are an estimate only. Further details can be found in the methodology and data tables.

Figure 42 | Electricity Sector Greenhouse Gas Emissions, Historical and Forecast[33]



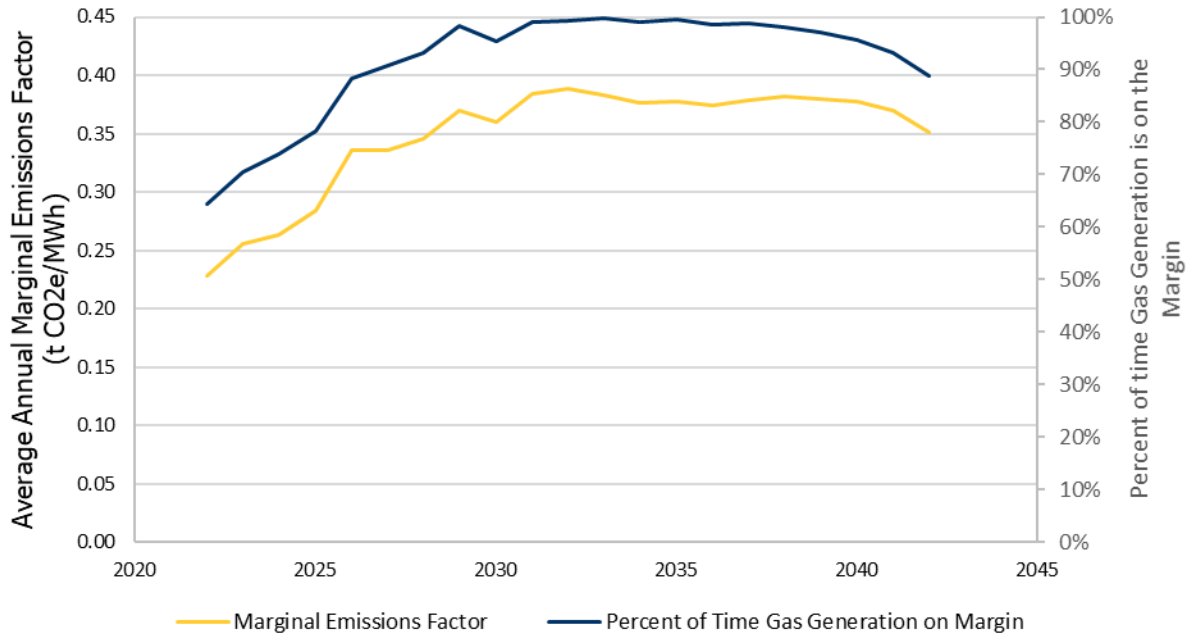
[33] Historical Emissions data for 2006 to 2019 is from Canada's Official Greenhouse Gas Inventory: http://data.ec.gc.ca/data/substances/monitor/canada-s-official-greenhouse-gas-inventory/, emissions data for 2020 was estimated by IESO based on actual natural gas production. Emissions for 2021 and beyond are projected using IESO's detailed energy dispatch model.

7.4 Marginal Emissions

Every five minutes, the IESO matches supply with demand to ensure a stable, reliable power system. Dispatch is based on price. Supply is stacked so that the cheapest resources are selected first until eventually the supply meets the demand. The last resource selected to meet demand is called the marginal resource. If additional capacity is required during this interval, the marginal resource would increase output to serve it. Therefore, the emissions rate associated with the marginal resource is an indicator of the potential GHG impact of increasing demand. The following plot summarizes the projected average annual marginal emissions factors along with the percent of time gas generation is projected to be the marginal unit.

The marginal emissions factor is very closely aligned to how often gas is on the margin since natural gas generation is the only resource type in Ontario's fleet that generates GHG emissions.[34] Note that the marginal emissions factor only applies to the marginal resource (i.e., the last resource selected to meet the demand).

Figure 43 - Marginal Emissions Factors



[34] For the purposes of this forecast, biofuels are considered zero-emission resources.

7.5 Carbon Pricing

Currently, the electricity sectors in Ontario and in neighbouring jurisdictions are subject to carbon pricing. The carbon pricing assumptions used in this outlook are based on the provincial Emissions Performance Standards (EPS) program, which was accepted by the federal government on September 20, 2020. In the 2020 APO, the carbon price was assumed to rise to $50/t CO2e by 2022 and remain at that level indefinitely. In this outlook, the carbon price was increased to align with the federal government's announcement that it intends to increase the carbon price to $170/t CO2e by 2030, and remain at that level for the duration of the planning period.[35] Details on carbon pricing policies currently in effect within the northeastern portion of the Eastern Interconnection, and how carbon pricing was modelled for this outlook can be found in the Carbon Pricing Module.

[35] https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/carbon-pollution-pricing-federal-benchmark-information/federal-benchmark-2023-2030.html

8. Uncertainties

There are a number of growing uncertainties impacting Ontario's electricity grid, ranging from the amount of electricity demand growth to supply constraints. Uncertainties in a demand forecast are not unusual, but what is different this time and relatively unseen in the last decade, is the upward pressure on demand, changing consumer preferences, government policy surrounding decarbonization, and evolving constraints on supply.

If all of the possibilities outlined in this section are realized, by 2042 energy demand could be more than 10 per cent higher than in the reference forecast, while summer and winter peaks could be 8 per cent and 11 per cent higher respectively. The IESO's Resource Adequacy Framework has been designed to flexibly address changing needs; however, the highest demand outcomes presented here will be challenging to meet in the near term.

8.1 Demand Forecast

Prior to the COVID-19 pandemic, electricity demand in Ontario trended downwards for several years. Today, with growing interest in decarbonization policies and increased economic activity, the province is expected to see increases in electricity demand for the foreseeable future. Yet as markets and policy on climate change mitigation and economic development quickly evolve, predicting the timing, location and scale of increases in electricity demand is becoming more challenging.

In light of a number of significant uncertainties, a high demand forecast has been developed to reflect potential, and reasonably probable, increases in electricity demand. This high demand scenario forecast includes: a) current trends towards electrification; and b) potential large industrial sector loads materializing in Ontario as a result of economic growth.

Should all potential drivers materialize, electricity demand could grow to 224 TWh by 2042, with a 33.7 GW summer peak and 33.8 GW winter peak. This represents a total increase of 22 TWh, with a 2.4 GW higher summer peak and 3.3 GW higher winter peak than in the reference scenario demand forecast.

The high demand scenario has an annual growth rate of 2.3 per cent for energy, 1.7 per cent for summer peak and 2.3 per cent for winter peak. Figure 44 and Figure 45 below display the delta between the reference and high demand scenarios. Table 6 illustrates the sectoral difference between the two forecasts.

Figure 44 | Energy Demand by Scenario

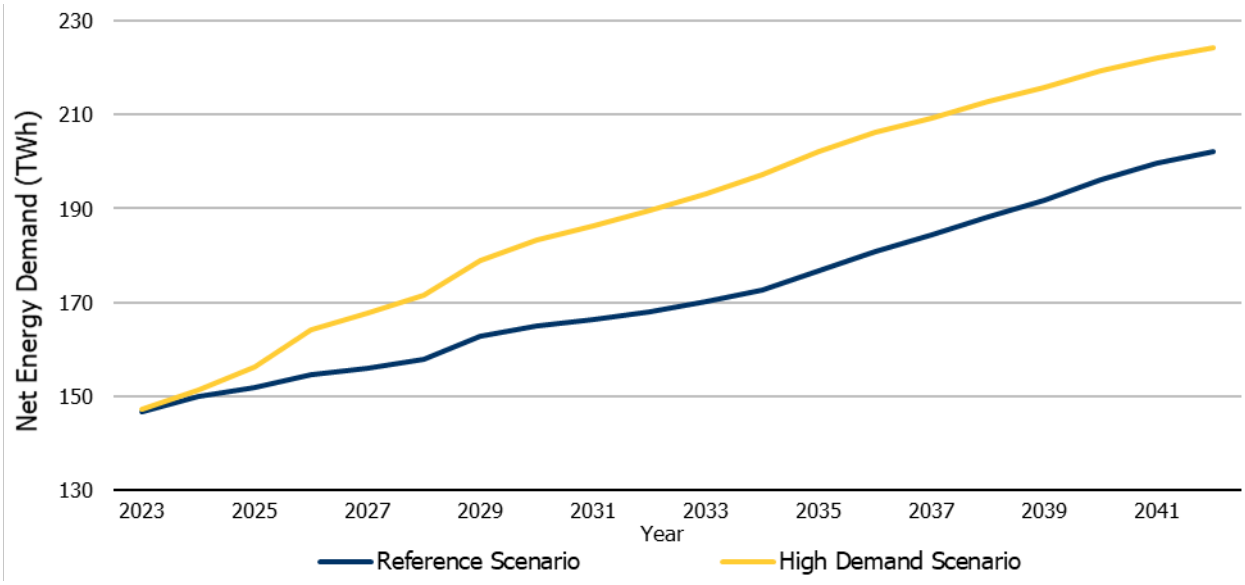


Figure 45 | Season Peak Demand by Scenario

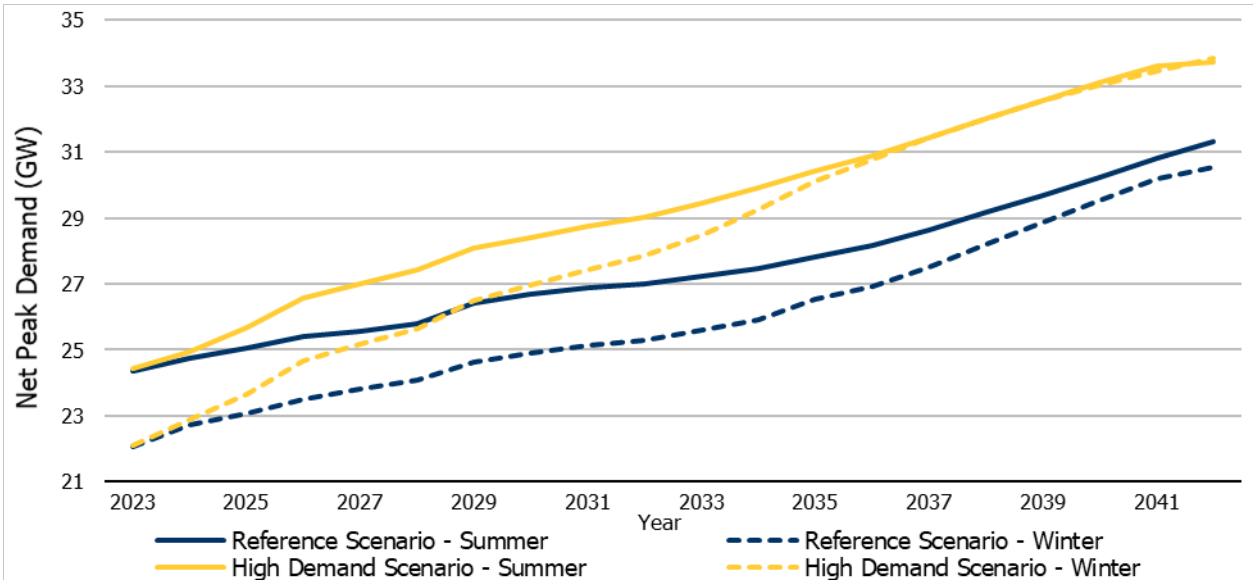


Table 6 | Sector Variance by Scenario

Sector	Reference Scenario	High Demand Scenario
Residential	Work-from-home assumption: 15% of workers for years 2023-2025 Baseline space and water heating heat pump uptake	Work-from-home assumption, 50% of workers for entire outlook period Increased uptake of electric heat pumps for space and water heating, by an incremental 15%. The increase ramps up over the first 10 years and remains constant for the last 10 years of the outlook period
Commercial	Work-from-home assumption: 15% of workers for years 2023-2025 Baseline space heating and water heating heat pump uptake	Work-from-home assumption, 50% of workers for entire outlook period Increased uptake of electric heat pumps for space and water heating, by an incremental 15%. The increase ramps up over the first 10 years and remains constant for the last 10 years of the outlook period
Industrial	Northern Ontario regional planning mining forecast reference scenario No electric vehicle battery manufacturing facilities No ArcelorMittal Dofasco electric arc furnace	Northern Ontario regional planning mining forecast high demand scenario Electric vehicle battery manufacturing facilities ArcelorMittal Dofasco electric arc furnace
Agriculture	Need for Bulk System Reinforcements West of London – reference scenario	Need for Bulk System Reinforcements West of London – high demand scenario
Transportation	Mandatory policy achievement: 100% of new vehicle sales to be GHG emissions free by year 2035	Voluntary policy achievement: 50% of new vehicle sales to be GHG emissions free by year 2030
Industrial Conservation Initiative	Response on top 5 system peak day, system peak hour remains flat at 1,300 MW for outlook period	Response on top 5 system peak day, system peak hour grows to 1,800 MW by 2030

8.1.1 Government Policy

Climate change policy has created an increased demand for clean energy technology and can be assessed by the following categorizations:

Impact on Mining: Renewable energy, storage, and electrification technologies all depend significantly on metals and minerals, many of which are mined in Ontario. Depending on the pace of energy transition, the current global demand for minerals may quadruple by 2040 if the goals of the Paris Agreement are to be met. Ontario's mining industry is well positioned to compete in this area, and the Government of Ontario's Critical Mining Strategy is encouraging growth within the sector. The mining sector in northern Ontario could potentially grow nearly 15 per cent per year through 2026 and then stabilize, as most potential new and/or expansion projects will have materialized, and remaining potential projects are offset by existing mines reaching their end-of-life phase.

Transit Electrification: Increased demand from federal targets for zero-emissions vehicle sales could mean an earlier adoption curve for light duty electric vehicles (a maximum of a 125 per cent increase over the reference scenario, occurring in 2032), and electric buses (a 10 per cent increase over the reference forecast assumptions).

Decarbonization: Several municipal governments have made public announcements either committing to, or in support of, a phase out of natural gas-fueled electricity generation. Furthermore, the Ministry of Energy has directed the IESO to investigate pathways to a zero emissions electricity grid. Future carbon policy, which may be aimed at decarbonization through electrification, therefore has the potential to create additional upward pressures on electricity demand.

The high demand forecast assumes the following:

Residential Sector: for space and water heating end-uses, an assumed incremental 15 per cent increase per year in the uptake of electricity-fueled heat pumps, with a corresponding decrease in natural gas, propane and heating oil-fueled furnaces over the reference scenario.

A greater level of persisting work-from-home practices, representing 50 per cent of office workers and resulting in higher energy and peak demand over the entire outlook period.

Overall, the high demand scenario for the residential sector projects an increase in energy demand of approximately 3 TWh per year over the reference scenario forecast, nearly 5 per cent by 2042.

Commercial Sector: Similar to the residential sector, the commercial sector could experience the impact of space and water heating electrification as a result of new installations and replacement of existing stock. The high demand scenario projects an incremental 15 per cent higher uptake than the reference scenario through an increase in efficient air and ground source heat pumps, as well as a decrease in fossil fueled furnaces.

8.1.2 Economic Activity

Industrial growth is being driven by a rapidly recovering economy and significant government stimulus. A series of large projects are being proposed for Ontario, including production facilities in the emerging vehicle battery cell manufacturing sector. The auto sector is also repositioning to meet increasing demand for electric vehicles, and some investments may be located in Ontario given the province's current auto sector capability and support.

These large industrial projects and expansions are currently in the proposal stage, targeting an in-service date within five to 10 years. Depending on the location, some will require significant transmission system upgrades to connect. Not all proposed projects are expected to materialize in Ontario, but the success of a medium proportion of proposals could increase energy demand by approximately 2.3 TWh per year and approximately 500 MW.

Further, ArcelorMittal Dofasco has announced its intention to implement an electric arc furnace at its steel production facility by 2026, estimated to increase demand by approximately 300 MW.

Agricultural Sector: The higher demand forecast also assumes current connection requests are completed faster (in two years rather than five) than previously assumed, with a 6 per cent growth rate (consistent with the long-term average, rather than flat demand) through 2035 that is unconstrained. This will require a faster buildout of required infrastructure, including electricity transmission system, natural gas, and water supply.

While the above-mentioned uncertainties are likely to increase electricity demand, there are also other uncertainties linked to future government direction that may decrease it. These include the Industrial Conservation Initiative and the provincial energy efficiency programs.

Industrial Conservation Initiative: The program is a form of demand response which allows Class A customers to manage their Global Adjustment costs by reducing demand during Ontario's system peak hours and days.

The reference scenario assumes 1,300 MW and 650 MW on the system peak hour of top five and second top five system peak days respectively; the higher demand forecast assumes 1,800 MW and 900 MW for the same.

This higher reduction values are attributable to associated incremental demand growth in the industrial sector.

The following sectors / drivers have no assumption variances when compared to the reference forecast:

- Conservation Regulations (building codes and equipment standards)
- Fuel Rate Forecast (electricity, natural gas, other)
- Base Year
- Embedded Generation (non-market participant generators; solar, wind, hydro, bio, combined heat and power)

Conservation programs: The assumptions for provincial conservation programs are consistent with the reference scenario demand forecast. However, as supply constraints are increasing, the role of conservation will increase. Based on Scenario B of the joint Ontario Energy Board and IESO 2019 Conservation Achievable Potential Study, conservation has the potential to reduce energy needs by 15 TWh and 2,620 MW of peak demand.

In accordance with the September 30, 2020 Ministerial Directive, in 2022 the IESO will begin the 2021-2024 Conservation and Demand Management Framework Program and Target Mid-Term Review, and will report the findings to the Minister of Energy no later than December 31, 2022, including:

1) The alignment of the demand reduction target, electricity target and the CDM Framework budget with the provincial, regional and/or local electricity system needs as identified by the IESO
2) The alignment of the CDM program offerings with consumer needs in Ontario, and a comparison against programs from other jurisdictions
3) Lessons learned and recommendations from competitive mechanisms for procuring energy efficiency resources, including results to date of the Energy Efficiency Auction Pilot
4) The progress and impact of CDM programs, including for low-income and income-eligible consumers and on-reserve First Nations consumers, and
5) Recommendations on the remainder of the CDM Framework.

8.2 Resource Adequacy

Figure 46 and Figure 47 illustrate the summer and winter capacity deficits under the high demand forecast compared with the reference demand forecast, without continued availability of existing resources post contract expiry/commitment. By the end of the planning horizon, in the summer, capacity needs increase to about 22,000 MW, and in the winter to about 20,000 MW.

Figure 46 | Summer Capacity Surplus/Deficit under High Demand Forecast, without Continued Availability of Existing Resources

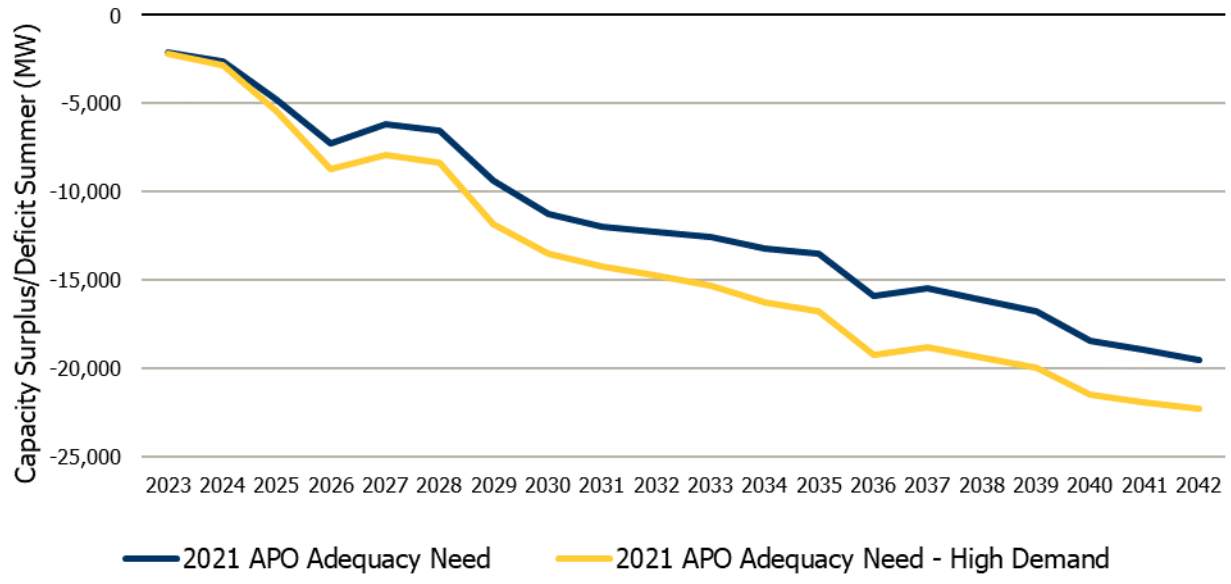
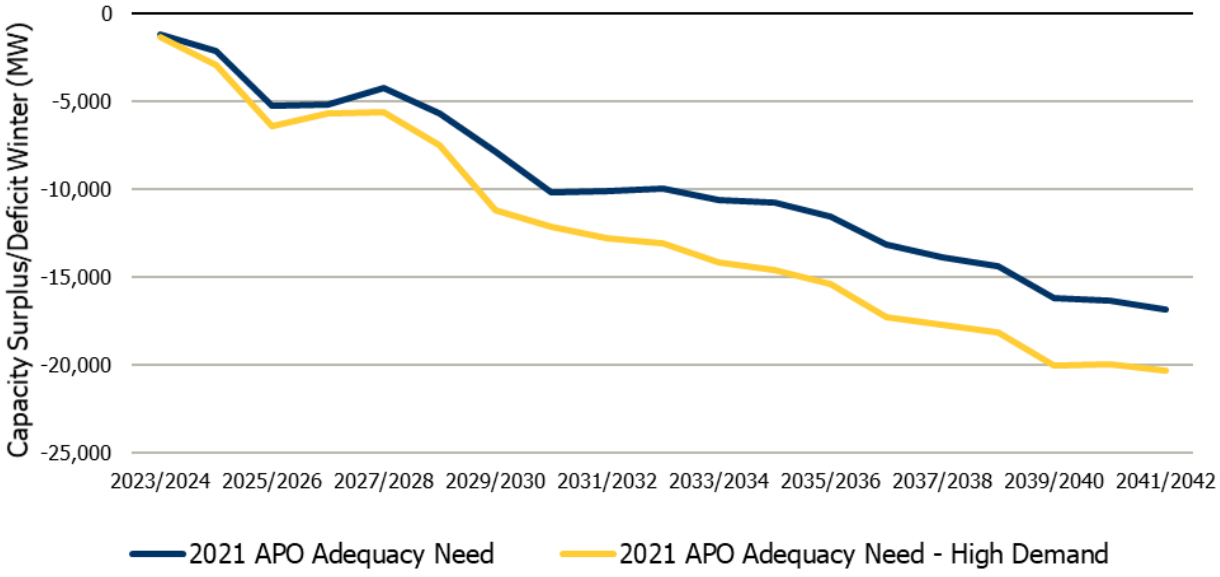


Figure 47 | Winter Capacity Surplus/Deficit under High Demand Forecast, without Continued Availability of Existing Resources



Independent Electricity System Operator
1600-120 Adelaide Street West
Toronto, Ontario M5H 1T1

Phone: 905.403.6900
Toll-free: 1.888.448.7777
E-mail: customer.relations@ieso.ca

ieso.ca

@IESO_Tweets
facebook.com/OntarioIESO
linkedin.com/company/IESO

Connecting Today.
Powering Tomorrow.

O - DISTRIBUTED RESOURCE COALITION INTERROGATORY - 012

Reference:

Exhibit JT-VECC-TCQ-4, Page 3

Preamble:

The load that was added to the forecast in the "Other" column was adjusted downwards relative to the pre-filed evidence in view of a declining optimism regarding the future state of the economy (as compared to optimistic recovery in short run assumed in the pre-filed evidence).

Two factors contributing to this change are discussed.

Interrogatory:

a) Please confirm that no adjustments were made to the "EV" column of the table appearing in part (f) of the undertaking response and discuss Hydro One's approach to determining that the types of impacts that apply to the "Other" column do not apply to the "EV" column.

b) The "Other" column is noted as including "impact of electrification and other considerations". Please discuss Hydro One's understanding of the effects of the broader state of the economy on electrification impacts reflected in the "Other" column and whether these were subject to downward adjustment.

Response:

a) Confirmed. See response to DRC-11.

b) As discussed in the updated Exhibit JT-VECC-TCQ-04, the electrification forecast is not changed and only a small manual upward adjustment, that was added to the original transmission forecast to reflect optimism regarding the future state of economy, was reduced. This was in view of increasing inflation, supply chain constraints, declining consumer confidence, and prospects of increasing interest rate (all aggravated by the Russian invasion of Ukraine and related sanctions) at the time of the forecast update. As noted in response to I-14-D-LPMA 17-18, increase in interest rate reduces investment and other spending and, thereby, economic growth and thus load growth.

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O - ENERGY PROBE INTERROGATORY - 082

Reference:

Exhibit O-1-2, Page 7, Table 2

Preamble:

"Table 2 provides the inflation risk for the Top 10 Material and Service categories."

Interrogatory:

a) Please position these 10 categories in terms of the Revenue Requirement starting with division into Capital Budget and OM&A Budget with a percentage for each category and the total as a percentage of the 2023 revenue requirement. Please provide this separately for Transmission and Distribution.

b) Please confirm that the categories with "CPI risk" include current internal labour costs.

c) Please provide the internal labour costs as a percentage of Total OM&A for each of Transmission and Distribution.

Response:

a) Hydro One does not have this view available for the 2023 revenue requirement.

b) No, the categories with "CPI risk" in Table 2[1] do not include internal labour.

c) Based on compensation costs as filed in Exhibit E-06-01-2A (Appendix 2K) the percent of total OM&A costs for Transmission that are related to internal labour is approximately 47%, and for Distribution, is approximately 66%.

[1] Exhibit O-01-02, Page 7

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O - ENERGY PROBE INTERROGATORY - 083

Reference:

Exhibit O-1-2, Page 9

Preamble:

"Hydro One applied the Proration Factor of 1.0525 to all cost categories, effectively replacing the 2.0% annual inflation assumption with the revised inflation rates."

Interrogatory:

a) Why was one proration factor used for all cost categories instead of using different factors for cost categories that are likely to be impacted differently by inflation such as employee compensation and construction materials?

b) Were other methods of inflation adjustments considered? Please explain your answer.

c) The proration factor is based in a single Scotiabank forecast. Please provide a proration factor based on the Q1 Consensus Forecast.

d) Please provide a projection of the revenue requirements for Transmission and Distribution from 2023 -2027
   i. using the Scotia based proration factor of 1.0525, and
   ii. based on the Consensus Forecast.

   Please provide the Scenarios in Excel Format with explanatory notes

Response:

a) As noted in Exhibit O-01-02, Hydro One applied the originally referenced 2.0% per year inflationary assumption to all costs in the investment plan; in approaching the evidence update based on the accelerating inflation forecasts, Hydro One opted to utilize a similar approach to replace the previous inflation assumption with an updated inflation assumption by way of a proration factor application. Hydro One maintains that the investment plans put forward in the original application provided outcomes valued by customers; by approaching the update in this manner, the bridge between the original application and the application update is provided in a simple and transparent manner. Please refer to further discussion in Interrogatory O-Staff-357.

Witness: JESUS Bruno, JACKSON Alexander, CORNACCHIA Joe, JODOIN Joel, DICKINSON Kevin, LILA Sabrin

b) Please refer to interrogatory response to O-Staff-357 with respect to why other inflation adjustments have not been considered to update for inflation.

Please refer to interrogatory response to O-CME-022 for a discussion of other approaches considered by Hydro One to mitigate the effects of inflation, which were ultimately not pursued.

c) Using the Consensus (Mean) for Canada CPI (average % change on previous calendar year) from the April Consensus Forecasts report (please refer to O-SEC-244 for the April Consensus Forecasts report) for 2022 and 2023, the inflation rates are 5.2% in 2022, and 2.5% in 2023, resulting in a proration factor of 5.14% as shown below:

((1.035)x(1.052)x(1.025))/ (1.02^3)
= 1.0514

d) Please see below projections of the revenue requirements for Transmission and Distribution from 2023 -2027 under the following scenarios:

i. **Scotia based proration factor of 1.0525:** For the revenue requirement projections using the Scotia based proration factor of 1.0525, please refer to Exhibit O-01-02, page 37, Table 26 (for Transmission), and page 39, Table 28 (for Distribution).

ii. **Consensus Forecast:** Please find below the revised estimates utilizing the April Consensus Forecast. Tables 1 and 2 have also been provided in excel format at Energy Probe-083 Attachment 1.

Table 1 - Transmission - JRAP IR - EP 83 Scenario

Line		2023	2024	2025	2026	2027
1	Rate Base	14,611.1	15,515.1	16,582.5	17,598.0	18,528.0
2	Return on Debt	340.0	361.0	385.8	409.5	431.1
3	Return on Equity	487.4	517.6	553.2	587.1	618.1
4	Depreciation (note 1)	531.9	562.6	600.9	634.1	657.7
5	Income Taxes	39.8	70.0	59.1	81.0	81.8
6	**Total Capital Related Revenue Requirement**	**1,399.0**	**1,511.1**	**1,599.0**	**1,711.6**	**1,788.7**
7	Less Working Capital Related Revenue Requirement		2.38	2.37	2.46	2.48
8	**Total Capital Related Revenue Requirement (excluding working capital)**	**1,399.0**	**1,508.8**	**1,596.7**	**1,709.1**	**1,786.2**
9	Less Productivity Factor on Capital (0.00%+0.15%)		(2.3)	(2.4)	(2.6)	(2.7)
10	Less Prior Year Productivity Factor on Capital			(2.3)	(4.7)	(7.2)
11	Less Removing Working Capital from Capital Factor		(0.1)	(0.0)	(0.1)	(0.0)
12	**Total Capital Related Revenue Requirement (excluding working capital and Productivity)**	**1,399.0**	**1,508.8**	**1,594.4**	**1,704.3**	**1,778.8**
13	OM&A (note 1)	449.7	458.7	467.9	477.3	486.8
14	**Total Revenue Requirement**	**1,848.7**	**1,967.5**	**2,062.3**	**2,181.5**	**2,265.6**
15	Increase in Capital Related Revenue Requirement		109.8	85.6	109.9	74.5
16	Increase in Capital Related Revenue Requirement as a percentage of Previous Year Total Revenue Requirement		5.94%	4.35%	5.33%	3.41%
17	Less Capital Related Revenue Requirement in I-X		1.51%	1.53%	1.55%	1.56%
18	**Capital Factor**		**4.43%**	**2.82%**	**3.78%**	**1.85%**

Note 1: The OM&A and Depreciation lines reflect the Proposed PCB Treatment

Table 2 – Distribution - JRAP IR - EP 83 Scenario

Line	Distribution	2023	2024	2025	2026	2027
1	Rate Base	9,394.2	10,029.9	10,761.5	11,474.0	12,099.7
2	Return on Debt	220.0	234.9	252.0	268.7	283.3
3	Return on Equity	313.4	334.6	359.0	382.8	403.6
4	Depreciation (note 1)	465.0	488.1	531.6	569.3	606.8
5	Income Taxes	36.2	53.9	40.5	57.8	67.6
6	**Total Capital Related Revenue Requirement**	**1,034.6**	**1,111.5**	**1,183.1**	**1,278.5**	**1,361.4**
7	Less Working Capital Related Revenue Requirement		17.5	17.7	17.9	18.2
8	**Total Capital Related Revenue Requirement (excluding working capital)**	**1,034.6**	**1,093.9**	**1,165.4**	**1,260.6**	**1,343.2**
9	Less Productivity Factor on Capital (0.30%+0.15%)		(4.9)	(5.2)	(5.7)	(6.0)
10	Less Prior Year Productivity Factor on Capital			(4.9)	(10.2)	(15.8)
11	Less Removing Working Capital from Capital Factor		0.2	0.4	0.6	0.8
12	**Total Capital Related Revenue Requirement (excluding working capital and Productivity)**	**1,034.6**	**1,106.8**	**1,173.3**	**1,263.3**	**1,340.3**
13	OM&A (note 1)	633.7	645.7	658.0	670.5	683.2
14	**Total Revenue Requirement**	**1,668.3**	**1,752.5**	**1,831.3**	**1,933.8**	**2,023.5**
15	Increase in Capital Related Revenue Requirement		72.2	66.6	90.0	77.0
16	Increase in Capital Related Revenue Requirement as a percentage of Previous Year Total Revenue Requirement		4.33%	3.80%	4.91%	3.98%
17	Less Capital Related Revenue Requirement in I-X		1.18%	1.20%	1.22%	1.24%
18	**Capital Factor**		**3.15%**	**2.60%**	**3.70%**	**2.74%**

Note 1: The OM&A and Depreciation lines reflect the Proposed PCB Treatment

ENERGY-PROBE-83 D) ATTACHMENT 1

This exhibit has been filed separately in MS Excel format.

O - ENERGY PROBE INTERROGATORY - 084

Reference:

Exhibit O-1-2, Page 31, Table 20
Exhibit O-1-2, Page 32, Table 21

Interrogatory:

Please explain how why the inflationary increase in rate base for 2023 is being funded by a combination of Short-Term Debt, Deemed Long-Term Debt, and Equity and why the specific amounts of each were selected.

Response:

The inflationary increase in rate base for 2023 is being funded with the capital structure that was approved by the OEB previously, as further described in Exhibit F-01-01, starting on page 1 and reproduced below.

> "Hydro One's Transmission and Distribution deemed capital structures for rate-making purposes are 60% debt and 40% common equity of utility rate base. The 60% debt component is comprised of 4% deemed short-term debt and 56% long-term debt. This capital structure was approved by the Board, most recently as part of its Decision on Hydro One Transmission's 2020 to 2022 Revenue Requirement Application (EB-2019-0082) and as part of its Decision on Hydro One Distribution's 2018-2022 Rate Application (EB-2017-0049). This capital structure is also consistent with the Report of the Board on the Cost of Capital for Ontario's Regulated Utilities, dated December 11, 2009 (EB-2009-0084), and Board Staff's subsequent Review of the Existing Methodology of the Cost of Capital for Ontario's Regulated Utilities, dated January 14, 2016."

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O - ENERGY PROBE INTERROGATORY - 085

Reference:

Exhibit O-1-1
Exhibit O-1-4, Tables 1 and 2

Preamble:

Hydro One is proposing deferring "inflationary" increases in the Revenue Requirement due to Capital and OM&A cost increases until 2028.

Interrogatory:

a) Why is this an appropriate strategy? In responding for each of Transmission and Distribution, please take into account the future potential impacts, including carrying costs rate impacts (with and without amortization), intergenerational equity and retroactive ratemaking.

b) Second reference shows the amount (ranges) of deferred annual revenue requirements from 2023 -2028 and the ending 2028 balance (Transmission and Distribution) based on Hydro One's assumptions. Please provide this projection in Excel format.

c) Please confirm that in O-1-4 Tables 1 and 2, the As-filed revenue requirements correspond to Tables 26-28.

d) Please confirm if Hydro One is proposing that in effect, its overall 1.0525 proration factor replaces the 1.020 and 1.022 I-factors with a true up in 2028? Be clear about what is the RCI formula for the Custom IRM period.

e) Will Clearspring modify its evidence and Benchmarks to include the 1.0525 proration factor? Please clarify.

Response:

a) Please refer to the interrogatory response to O-Staff-391, part b) outlining the rationale for the revenue deferral mechanism applicable to each of Transmission and Distribution.

Please refer to interrogatory response to O-Staff-384 outlining the intergenerational inequity considerations of this proposal.

The proposal does not give rise to concerns with retroactive ratemaking. The revenue requirements would be approved in the current proceeding, and portions of those revenue requirements would be recorded in the proposed deferral accounts which would also be approved. In a future proceeding, the OEB would approve only the disposition approach of the recorded amounts and recovery period of those amounts through rates. As further explained in Staff-384 b), the recovery of carrying costs associated with the deferred revenues is not dissimilar to OPG's Rate Smoothing Deferral Account approved in EB-2016-0152.

b) Please see Attachment 1 to this response provided in Excel format.

c) The "Inflation Update" revenue requirements in Tables 1 and 2 of Exhibit O-01-04 correspond to the Total Revenue Requirement shown in Tables 26 and 28 of Exhibit O-01-02. The "As-Filed Evidence" revenue requirements correspond to the Total Revenue Requirement shown in Table 1 of Exhibit A-04-02 and Table 1 of Exhibit A-04-03, respectively.

d) Not confirmed. As noted in interrogatory response to O-Staff-357, part b), Hydro One is not proposing changes to the inflation factor used for the purposes of its Custom IR framework.

The 1.0525 proration factor referenced in the IR reflects the calculation associated with updating 2023 OM&A and 2023-2027 capital expenses to reflect the updated inflation assumptions as outlined in Exhibit O-01-02, page 9.

e) Please see interrogatory response to O-Staff-361.

TRANSMISSION DEFERRED REVENUE REQUIREMENT FROM INFLATION UPDATE, 2023-2027

This exhibit has been filed separately in MS Excel format.

O - ENERGY PROBE INTERROGATORY - 086

Reference:

Exhibit O-1-2, Page 17

Preamble:

"If the forecast inflation rates for 2022 and 2023 at the time of DRO are higher than the forecasts used in this evidence update (i.e. 4.5% for 2022 and 3.3% for 2023), then the following process is proposed:

- The revenue requirement will be updated to reflect the new inflation rate, but will not *exceed a prescribed inflation cap (the "Inflation Forecast Cap").*
- Hydro One proposes an Inflation Forecast Cap of 10% cumulative inflation over 2022 *and 2023. For clarity, a 10% cumulative inflation means the sum of inflation in 2022 and 2023 equals 10%. For example, inflation of 7.0% in 2022 and 3.0% in 2023 results in cumulative inflation of 10%."*

Interrogatory:

a) Please discuss why Ratepayers should take the risk of inflation exceeding the Hydro One forecast up to the 10% inflation cap.

b) Under Incentive Regulation under RRFE, for Custom IR applications the Inflation Factor I, X factor and other parameters are set by the regulator at the outset of the plan. Please discuss why this should not be the case for Hydro One Transmission and Distribution for 2023-2027?

c) If an RCI formula was to apply for 2023-2027. what would be a realistic I-X factor that shares the risks between ratepayers and shareholders. Please discuss.

Response:

a) Please refer to the interrogatory response to O-VECC-149, part a).

b) Hydro One is not proposing any changes to the Custom IR framework documented in Exhibit A-04-01 as a result of the evidence update. Please refer to the interrogatory response to O-Staff-357(b) for further discussion.

c) Please see part b) above. Hydro One does not believe that any changes are required to the (I) and (X) parameters of its Custom IR framework as a result of the evidence update.

As is typically the case, the test year OM&A and the 5-year capital plan include inflation assumptions and then the Custom IR framework is applied to the resulting revenue requirement based on the approved capital and OM&A. In the current circumstance, Hydro One is only updating the plan's inflation assumption and is not changing the parameters of the Custom IR framework or how it is applied.

O - ENERGY PROBE INTERROGATORY - 087

Reference:

Exhibit O-1-2, Page 30, Cost of Capital
Exhibit 0-1-2, Attachment 7, Table 20

Preamble:

"Hydro One proposes that the 2023 cost of capital parameters established at the time of the Draft Rate Order be used to determine the final revenue requirements for the 2023 to 2027 test years."

Interrogatory:

a) Please confirm that Table 20 includes only the revised amounts from application of the proration factor of 1.0525.

b) Please provide an updated cost of Capital Schedule showing 2022 base year as filed and 2022 -2027 updated Cost of Capital based on the Scotia Forecasts for issuance of Long- term and Short-term debt.

c) Are ratepayers also expected to bear the risk of increases in debt issue costs as well as the increased capital requirements resulting from inflation. Please Discuss.

Response:

a) Confirmed. Please see interrogatory response to O-Staff-397, part a).

b) Hydro One would like to clarify that 2023 is the test year in the current application and not 2022 as indicated in the IR. Furthermore, as proposed in Exhibit F-01-01, the cost of capital parameters will be set for 2023 (Test Year) and will remain in place for 2024-2027.

Scotiabank does not provide an interest rate forecast for Government of Canada bonds in Exhibit O-01-02, Attachment 1. As a result, we are not able to forecast Hydro One's long-term debt interest rates using the information in the attachment.

As stated in Exhibit O-01-02 page 31 and Exhibit F-01-01:
Hydro One anticipates updating the revenue requirements for the 2023 to 2027 test years when the Board releases its 2023 cost of capital parameters, reflecting: (a) the Board-approved 2023 return on equity and deemed short term debt rate; and (b) long-term debt rates based on Hydro One's actual 2021 and 2022 debt issuances to-date and forecasted debt

issues in 2023 with coupon rates based on the September 2022 Consensus Forecast. Hydro One proposes that the 2023 cost of capital parameters established at that time be used to determine the final revenue requirements for 2023 to 2027 test years.

c) As discussed in part a) above, Hydro One is not proposing to update the Cost of Debt from 2024 to 2027 once it is established for 2023 (first test year), which means that ratepayers would not be asked to bear any increases in the debt rate during this time period.

O - ENERGY PROBE INTERROGATORY - 088

Reference:

Exhibit O-1-2, Page 37, Tables 26, 27, 28

Preamble:

"Below are updated tables which set out the calculation of the components of the Custom IR framework for Hydro One consistent with the calculations outlined in Exhibits A-04-02 and A-04-03."

Interrogatory:

a) Please confirm that Table 26 corresponds to Table A-04-02 and Table 28 Corresponds to Table A-04-03.

b) Please indicate the changes/drivers by providing a comparison to the as filed schedules and the basis (calculations and references).

Response:

a) Hydro One confirms that Table 26 is an update to Table 1 of Exhibit A-04-02 and Table 28 is an update of Table 1 of Exhibit A-04-03.

b) Please see Section 5.0 Impact on revenue requirement and related components of Exhibit O-1-2 on page 26 of 42 which sets out the specific sections for the various changes to revenue requirement. To further assist, Hydro One provides below the specific sections and page numbers by Transmission and Distribution from Exhibit 0-1-2 as outlined on page 26 of 42.

   a. Transmission
      i. Impact on OM&A – Section 3.1 page 17 of 42
      ii. Return on Capital – Section 5.3.1 page 31 of 42
      iii. Depreciation and Amortization Expense- Section 5.4.1 page 32 of 42
      iv. Regulatory Taxes - Section 5.5.1 page 35 of 42
   b. Distribution
      i. Impact on OM&A – Section 3.2 page 18 of 42
      ii. Return on Capital – Section 5.3.2 page 32 of 42
      iii. Depreciation and Amortization Expense - Section 5.4.2 page 33 of 42
      iv. Regulatory Taxes - Section 5.5.1 page 36 of 42

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O - ENERGY PROBE INTERROGATORY - 089

Reference:

Exhibit O-1-3, Page 3, Table 1

Preamble:

"The updated CDM forecast from the 2021 APO was reflected in Hydro One's Transmission load forecast, which resulted in a lower net forecast for transmission charge determinants compared to the forecast used in the as-filed evidence as presented in Table 1 below."

Interrogatory:

a) Why did Hydro One only update it Transmission Load forecast for CDM based on the IESO December 2021 Advanced Planning Outlook?

b) The APO projects positive growth in most sectors, that directionally offsets the CDM impacts. Please discuss why selective updating was done.

Response:

a) As detailed in response to CME-023, part c), Hydro One examined many factors affecting the load forecast and determined that the factor materially affecting the forecast was the CDM update by the IESO in the 2021 APO.

b) The CDM update in the 2021 APO was the principal factor affecting the load forecast however, Hydro One updated its forecast regarding that along with other adjustments as detailed in response to CME-023, part c) and detailed in the revised response to JT-VECC-TCQ-04 that was filed with the evidence update. Moreover, there are differences in forecast methodology between Hydro One and the IESO. As an example, in the Hydro One forecast, the load impact of developments in Leamington and surrounding areas are added to transmission peak forecasts since it is the peak figure that determines Hydro One's transmission revenue rather than energy by sector. For a detailed explanation of differences regarding the peak forecast please see Exhibit D-4-1, Appendix F, which notes that after adjusting for differences in forecast methodology, Hydro One's forecast is much higher compared to the IESO's.

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ENERGY PROBE INTERROGATORY #090

Reference:

Exhibit O-1-3, Page 9, Tables 6, 8, 10

Preamble:

"Hydro One's updated distribution load is shown in Table 6. The customer count forecast was not affected by the change in CDM."

Interrogatory:

a) The IESO Update Shows Increased load growth in residential and other sectors. Why is Hydro One distribution not updating its distribution load forecast to account for both CDM (reduction) and growth (increase).

b) If the IESO projection is correct, will Hydro One customers be paying higher rates than needed to recover the revenue requirement? Please discuss in detail.

Response:

a) As detailed in response to CME-023, part c), Hydro One examined many factors affecting the load forecast and determined that the factor materially affecting the forecast was the CDM update by the IESO in the 2021 APO.

b) No. The IESO forecasts cannot be directly compared to Hydro One's forecasts. In particular, the IESO does not have a forecast for distribution load nor a specific forecast for the load of Hydro One's distribution system. The CDM update in the 2021 APO was the principal factor affecting the load forecast however, Hydro One also updated its distribution forecast to increase the forecast for direct customers (i.e. sub-transmission) as detailed in response to CME-023, part c). Moreover, there are differences in forecast methodology between Hydro One and the IESO. As an example, in the Hydro One forecast, the load impact of developments in Leamington and surrounding areas are added to aggregate retail load forecasts. It is the latter figure that determines Hydro One's distribution rates and revenue recovery.

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O - ENERGY PROBE INTERROGATORY - 091

Reference:

Exhibit E-6-1, Attachment 2A (OEB Appendix 2K)

Preamble:

EP wishes to see the impact of the Update on Staffing and Compensation Costs

Interrogatory:

Please update the referenced Schedule and provide a comparison for the 2023-2027 outlook period. Provide the result in pdf and Excel formats.

Response:

Please see interrogatory response to O-Staff-381 part b).

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O - ENERGY PROBE INTERROGATORY - 092

Reference:

Exhibit G-1-2, Page 20
Exhibit G-1-2, Attachment 10, CIVSA

Preamble:

Energy Probe wishes to understand how the Capital In-Service Variation Account will work under the Deferred Revenue Requirement proposal.

Interrogatory:

Please reproduce the illustrative schedule in the second reference under the deferred revenue requirement proposal. Please discuss the result and differences between prior examples.

Response:

In filing the inflation update as part of Exhibit O-01-02, Hydro One is seeking the OEB's approval of capital expenditure and in-service additions, inclusive of the impacts of revised inflation estimates, for the 2023 to 2027 period. As such, the mechanics of the CISVA calculations would not change. The examples use hypothetical in-service additions amounts and revenue requirement components but the actual calculation for the CISVA will use applicable amounts as approved in this proceeding, inclusive of the impacts arising from the deferred revenue requirement proposal. The CISVA calculation would measure Hydro One's actual in-service additions against the approved in-service additions and rate base commitments. As a result, there is no need to reproduce the illustrative examples.

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O – ENVIRONMENTAL DEFENCE INTERROGATORY – 029

Reference:

Various

Interrogatory:

a) Please identify the responses to Environmental Defence interrogatories that would change based on the evidence update and file updated responses to those.

Response:

a) In Exhibit O-01-06 Hydro One provided updated interrogatory responses where the 2023-2027 information changed materially. Below, Hydro One provides updated responses to parts of interrogatories with either 2021 Actuals or non-material 2023-2027 inflation adjustments.

B2-ED-011, part c)

Please see table below for the System Access historical and future forecast costs, broken down by those funded by the connecting customers through capital contributions and those recovered through incremental rate revenue as a result of the load connected.

($ Millions)	Historical				Bridge	Test Years*				
	2018 Actual	2019 Actual	2020 Actual	2021 Actual	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	2027 Forecast
Total Expenditures	95.3	88.7	90.8	126.5	78.3	165.9	162.4	122.7	85.0	88.2
Customer Capital Contributions	61.7	42.7	71.4	56.6	46.9	82.3	87.8	59.8	46.6	35.5
Incremental Rate Revenue	33.7	46.1	19.4	69.9	31.5	83.6	74.6	63.0	38.4	52.8

** The 2023-2027 forecast reflects updated inflation assumptions calculated using the methodology described in Section 2.3 of Exhibit O-01-02.*

B2-ED-012, part a)

Please see Interrogatory O-AMPCO-123.

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O - LPMA INTERROGATORY - 029

Reference:

Exhibit O-1-2, Page 4

Interrogatory:

Please explain why Hydro One engaged Scotia to forecast Ontario CPI for 2022 and 2023 and is using only one source for the Ontario inflation forecast (January 2022 Scotia forecast) rather than a consensus of other provincial forecast providers?

Response:

Hydro One's rationale for selecting Ontario CPI for the inflationary adjustment is described in interrogatory response to O-Staff-357, part a).

To support its Inflation Update, Hydro One sought an expert who could speak to historical inflation, provide a forecast for Ontario CPI and could provide rationale for that forecast.

The selection of Scotiabank was based on an informal evaluation in which several proponents were evaluated on a number of factors including experience and qualifications of team members, overall approach to the engagement and ability to meet schedule. Scotiabank was determined to be an appropriate expert based on these factors and was engaged to provide expertise related to inflation.

With respect to a consensus forecast of Ontario inflation, Hydro One is not aware of a third-party that publishes a consensus of other provincial forecast providers for Ontario CPI. As such, it would be impractical for Hydro One to develop a methodology and create a consensus of other provincial forecast providers that is consistent with Consensus Forecasts for Canadian CPI, which has eighteen forecasters providing input in the most recent April 2022 Canada CPI report.

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O - LPMA INTERROGATORY - 030

Reference:

Exhibit O-1-2, Page 9

Interrogatory:

a) Please calculate the proration figure assuming an Ontario inflation rate of 4.7% in 2022 and 2.5% in 2023.

b) Please provide a version on Table 3 that reflects the proration factor from part (a).

Response:

a) Based on inflation rates of 4.7% and 2.5% in 2022 and 2023 respectively, the proration factor would be 1.0463.

b) Based on a proration factor of 1.0463, Table 3 would be revised as follows:

	2023 Test Year As-Filed ($M) (A)	2023 Test Year Inflation Update* ($M) (B)	Increase ($M)	Relative Increase (B/A)
Transmission	420.5	440.0	19.5	1.0463
Distribution	597.5	625.2	27.7	1.0463

**based on proration factor calculated in part a) above*

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O - LPMA INTERROGATORY - 031

Reference:

Exhibit O-1-2, Page 16

Interrogatory:

a) Based on the illustrative timelines attached to Procedural Order No. 5, a decision would be released by March 28, 2023, regardless of whether no settlement or a partial settlement was achieved. The draft rate order would then be filed in mid April, 2023. What is the latest date that Hydro One expects the final inflation rate for 2022 to be available to be incorporated into the draft rate order?

b) Please explain fully why Hydro One believes it should be protected against forecast error for 2022 inflation and why an updated inflation rate at the time the DRO should be used for 2023?

Response:

a) Statistics Canada released the Ontario Consumer Price Index annual average inflation rate for 2021 on January 19, 2022. Over the past three years, the Consumer Price Index annual average inflation rate has been released by Statistics Canada on the third Wednesday that is a business day in January. If Statistics Canada continues with the same release schedule as past practice, then the Consumer Price Index annual average inflation rate for 2022 would be available on January 18, 2023. However, Statistics Canada has not yet published a release schedule for January 2023.

b) As outlined in interrogatory response to O-Staff-358 part c), rates are established on a forecast basis based on the best information available at the time the OEB approves them. As described under Section 2.5.2 Confirmation and Adjustment of Inflation Forecast in Exhibit O-01-02, Hydro One is proposing a mechanism to update the inflation rates for 2022 and 2023 based on the most recent forecast available at the time of the DRO.

Hydro One disagrees with the notion of protection for forecast error, as characterized by the question posed. The current economic environment is uncertain. This includes the inflationary trend over the 2022 and 2023 period. The actual inflation rate relative to the forecast inflation rate used in the 2022 bridge year forecast could be higher or lower. Updating at the time of the DRO for the actual 2022 inflation will provide for an accurate 2022 inflation. Since the 2023 inflationary impact is premised on the cumulative inflationary impacts in the previous years of the bridge plan, having an actual inflation rate for 2022 and an updated rate for 2023

would provide the most accurate inflation assumption for the approved plan based on known economic circumstances at that time.

This is analogous to the approach the OEB utilizes for annual applications of utilities under IRM frameworks. Applicants file an application using a placeholder value for the inflation factor which is then updated at the time of the rate order process using a mechanistic approach so that final rates are set based on the latest information available regarding inflation. In those circumstances, the update is symmetrical, similar to Hydro One's proposal.

O - LPMA INTERROGATORY - 032

Reference:

Exhibit O-1-2, Pages 36-40, Attachment 1

Interrogatory:

As part of the updated evidence, Hydro One proposes to update the inflation rate for 2022 and 2023 to reflect information available as part of the draft rate order process. This would change the OM&A and in-service capital additions (and rate base) for 2023, as well as impact the 2023 total capital revenue requirement and the total revenue requirement shown in tables 26 and 28.

a) Does Hydro propose to update the calculation of the capital factors for both transmission and distribution as a result of any update to the inflation rates for 2022 and 2023 used in the draft rate order process? If not, please explain fully why not.

b) Please provide versions of Tables 26 through 29 that reflect an inflation rate of 6.3% for 2022 and 3.3% for 2023, as forecast in the Scotiabank Global Economics report found in Exhibit O, Tab 1, Schedule 2, Attachment 1.

Response:

a) At the time of the draft rate order process, Hydro One will provide an updated version of the Custom IR tables which reflects the OEB's decision, including revised calculation of the capital factors. As noted in Exhibit A-04-01, the C-factor will be updated annually in subsequent annual update applications to reflect any changes to the Inflation Factor.

b) Please see tables below.

Revised Table 26 – Summary of Revenue Requirement Components for Hydro One Transmission ($M)

Line	Transmission	2023	2024	2025	2026	2027
1	Rate Base	14,618.0	15,539.5	16,632.6	17,674.6	18,630.1
2	Return on Debt	340.1	361.6	387.0	411.2	433.5
3	Return on Equity	487.7	518.4	554.9	589.6	621.5
4	Depreciation (note 1)	533.2	564.4	603.5	637.4	661.6
5	Income Taxes	39.5	69.6	58.3	80.2	80.8
6	**Total Capital Related Revenue Requirement**	**1,400.5**	**1,514.0**	**1,603.7**	**1,718.5**	**1,797.4**
7	Less Working Capital Related Revenue Requirement		2.40	2.38	2.47	2.48
8	**Total Capital Related Revenue Requirement (excluding working capital)**	**1,400.5**	**1,511.6**	**1,601.3**	**1,716.0**	**1,795.0**
9	Less Productivity Factor on Capital (0.00%+0.15%)		(2.267)	(2.402)	(2.574)	(2.692)
10	Less Prior Year Productivity Factor on Capital			(2.267)	(4.669)	(7.243)
11	Less Removing Working Capital from Capital Factor		(0.1)	(0.0)	(0.1)	(0.0)
12	**Total Capital Related Revenue Requirement (excluding working capital and Productivity)**	**1,400.5**	**1,511.7**	**1,599.0**	**1,711.2**	**1,787.5**
13	OM&A (note 1)	457.8	467.0	476.3	485.9	495.6
14	**Total Revenue Requirement**	**1,858.3**	**1,978.7**	**2,075.3**	**2,197.0**	**2,283.1**
15	Increase in Capital Related Revenue Requirement		111.2	87.3	112.2	76.3
16	Increase in Capital Related Revenue Requirement as a percentage of Previous Year Total Revenue Requirement		5.98%	4.41%	5.41%	3.47%
17	Less Capital Related Revenue Requirement in I-X		1.51%	1.53%	1.54%	1.56%
18	**Capital Factor**		**4.48%**	**2.88%**	**3.87%**	**1.92%**

Note 1: The OM&A and Depreciation lines reflect the Proposed PCB Treatment for revenue requirement purposes, as further explained in Section 4 of Exhibit O-01-01.

Revised Table 27 – Customer Revenue Cap Index (RCI) by Component for Hydro One Transmission

Custom Revenue Cap Index by Component (%)	2023	2024	2025	2026	2027
Inflation Factor (I)		2.00	2.00	2.00	2.00
Productivity Factor (X)		-	-	-	-
Capital Factor (C)*		4.48	2.88	3.87	1.92
Custom Revenue Cap Index Total		**6.48**	**4.88**	**5.87**	**3.92**

* Includes a Supplemental Stretch of 0.15% on capital.

Revised Table 28 – Summary of Revenue Requirement for Hydro One Distribution ($M)

Line	Distribution	2023	2024	2025	2026	2027
1	Rate Base	9,402.5	10,055.1	10,806.7	11,538.7	12,182.1
2	Return on Debt	220.2	235.4	253.0	270.2	285.2
3	Return on Equity	313.7	335.4	360.5	384.9	406.4
4	Depreciation (note 1)	466.8	490.6	535.1	573.6	612.0
5	Income Taxes	35.8	53.6	39.7	57.3	67.2
6	**Total Capital Related Revenue Requirement**	**1,036.5**	**1,115.1**	**1,188.4**	**1,286.0**	**1,370.8**
7	Less Working Capital Related Revenue Requirement		17.5	17.6	17.8	17.9
8	**Total Capital Related Revenue Requirement (excluding working capital)**	**1,036.5**	**1,097.6**	**1,170.7**	**1,268.2**	**1,352.9**
9	Less Productivity Factor on Capital (0.30%+0.15%)		(4.9)	(5.3)	(5.7)	(6.1)
10	Less Prior Year Productivity Factor on Capital			(4.9)	(10.2)	(15.9)
11	Less Removing Working Capital from Capital Factor		0.2	0.4	0.6	0.8
12	**Total Capital Related Revenue Requirement (excluding working capital and Productivity)**	**1,036.5**	**1,110.4**	**1,178.6**	**1,270.7**	**1,349.6**
13	OM&A (note 1)	645.2	657.5	670.0	682.7	695.7
14	**Total Revenue Requirement**	**1,681.7**	**1,767.9**	**1,848.5**	**1,953.4**	**2,045.3**
15	Increase in Capital Related Revenue Requirement		73.9	68.2	92.1	78.9
16	Increase in Capital Related Revenue Requirement as a percentage of Previous Year Total Revenue Requirement		4.4%	3.9%	5.0%	4.0%
17	Less Capital Related Revenue Requirement in I-X		1.2%	1.2%	1.2%	1.2%
18	**Capital Factor**		**3.2%**	**2.7%**	**3.8%**	**2.8%**

Note 1: The OM&A and Depreciation lines reflect the Proposed PCB Treatment for revenue requirement purposes, as further explained in Section 4 of Exhibit O-01-01.

Revised Table 29 – Custom Revenue Cap Index (RCI) by Component for Hydro One Distribution

Custom Revenue Cap Index by Component	2023	2024	2025	2026	2027
Inflation Factor (I)		2.20	2.20	2.20	2.20
Productivity Factor (X)		-0.30	-0.30	-0.30	-0.30
Capital Factor (C)*		3.22	2.66	3.77	2.80
Custom Revenue Cap Index Total		**5.12**	**4.56**	**5.67**	**4.70**

* Includes a Supplemental Stretch of 0.15% on capital.

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O - LPMA INTERROGATORY - 033

Reference:

Exhibit O-1-2, Page 36

Interrogatory:

At the bottom of page 36 the following statement is made*: "In light of the unprecedented levels of inflation currently being seen, Hydro One wishes to clarify that the Capital factor would not become negative in the case of exceptionally high inflation."*

a) Is the inflation factor being referred to here the inflation factor adjustments for 2022 and 2023 that are proposed as part of the draft rate order process or the Board approved inflation factor that would be used to adjust the custom revenue cap index for 2024 through 2027?

b) Please provide an example of a situation in which exceptionally high inflation could cause the capital factor to be negative.

Response:

a) The inflation referenced here is in reference to the Inflation Factor underpinning Hydro One's proposed Custom IR framework which would be used to adjust the Custom RCI for 2024-2027.

b) As noted in A-4-1, the C-factor will be updated annually to reflect any changes in the Inflation Factor. As the Inflation Factor rises, the C-factor is reduced and vice versa. The specific level of the Inflation Factor that would trigger a negative C-factor varies in any given year but ranges over the test period between about 7.4% - 4.4% for transmission and about 7.9% - 6.3% for distribution.

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O - LPMA INTERROGATORY - 034

Reference:

Exhibit O-1-2, Attachments 3A, 3B

Interrogatory:

Please updated the tables in Attachments 3A and 3B to reflect actual data for 2021.

Response:

Please see O-LPMA-034, Attachments 1 and 2 (excel files) appended to this interrogatory.

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TRANSMISSION OM&A CHAPTER 2 APPENDICES

This exhibit has been filed separately in MS Excel format.

DISTRIBUTION OM&A CHAPTER 2 APPENDICES

This exhibit has been filed separately in MS Excel format.

O - LPMA INTERROGATORY - 035

Reference:

Exhibit O-1-2, Attachments 4A to 4H
Exhibit O-2-1

Interrogatory:

Please update any tables in Attachments 4A through 4H that have not been updated to include actual data for 2021 in the tables found in Ex. O, Tab 2, Schedule 1.

Response:

All tables have been updated to include actual data for 2021. Please see below for the mapping of the tables in Attachments 4A through 4H to the attachments in Exhibit O-02-01.

Exhibit O-01-02 Attachments	Related Exhibit O-02-01 Attachments with 2021 Actual Data
4A – Appendix 2-AB – Tx (Capital Expenditures Summary Table – Transmission)	**1** – Transmission Capital Expenditure Summary, OEB Appendix 2-AB
4B – Appendix 2-AA – Tx (Capital Projects Table – Transmission)	**2** – Transmission Capital Projects, OEB Appendix 2-AA
4C – Appendix 2-AB – GP (Capital Expenditures Summary Table – General Plant)	**3** – General Plant Capital Expenditure Summary, OEB Appendix 2-AB,
4D – Appendix 2-AA – GP (Capital Projects and Programs Table – General Plant)	**4** – General Plant Capital Projects, OEB Appendix 2-AA
4E – Appendix 2-AB – Dx (Capital Expenditures Summary Table – Distribution)	**7** – Distribution Capital Amounts, OEB Appendix 2-AB
4F – Appendix 2-AA – Dx (Capital Projects Table – Distribution)	**8** – Distribution Capital Projects, OEB Appendix 2-AA
4G – In-Service Additions – Transmission	**5** – Transmission In-Service Additions
4H – In-Service Additions – Distribution	**9** – Distribution In-Service Additions

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O - LPMA INTERROGATORY - 036

Reference:

Exhibit O-1-2, Attachment 5

Interrogatory:

a) Please explain why the distribution revenue at current rates is the same for the application update as it is for the initial application in Attachments 5F, 5G, 5H, 5I and 5J when the distribution load forecast has been decreased.

b) What impact does this lack of a reduction in the distribution revenue at current rates as part of the update have on the calculation of the revenue deficiency in each of 2023 through 2027? Please provide a table that shows the revenue deficiency, as filed that excludes the impact on the load forecast, and the revenue deficiency including the impact of the reduced load forecast.

Response:

a) Given the proposal to defer the collection of revenues related to reduced load forecast, Hydro One acknowledges that the revenue at current rates in the RRWFs should have been updated. See table provided in response to part b) below for updated revenue deficiency based on Hydro One's proposal.

b) The table below provides the revenue deficiency calculated using the as-filed rates and load forecast in Exhibit D-05-01 versus as filed rates and the updated (lower) load forecast in Exhibit O-01-03.

	Revenue at Current Rates (as filed) ($M)*	Revenue at Current Rates (with updated load forecast) ($M)	Revenue at Proposed Rates (per March Update) ($M)	Revenue Deficiency/(Sufficiency) (as filed) $M	Revenue Deficiency/(Sufficiency) (using updated load forecast) $M
2023*	$1,682	$1,674	$1,623	($59)	($51)
2024	$1,594	$1,585	$1,707	$113	$121
2025	$1,673	$1,663	$1,786	$113	$123
2026	$1,747	$1,733	$1,889	$142	$156
2027	$1,843	$1,829	$1,979	$135	$150

** Note that the as filed revenue at current rates for 2023 has been updated to reflect the OEB-approved 2022 rates.*

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O - LPMA INTERROGATORY - 038

Reference:

Exhibit O-1-3, Table 3

Interrogatory:

Does Table 3 include actual or forecast data for 2021? If forecast, please add lines in Table 3 that reflect actual data for 2021.

Response:

For CDM, 2021 data is from the latest (2021) APO. There is no update for embedded generation. For load, it is the forecast value. Please see below for the requested information.

Table 3: Load Forecast Before and After Embedded Generation and CDM
(12-Month Average Peak in MW)

Year	Ontario Demand	Charge Determinant		
		Network Connection	Line Connection	Transformation Connection
Load Forecast before Deducting Impacts of Embedded Generation and CDM				
2019	22,244	22,130	21,339	18,209
2020	21,927	21,703	20,901	17,779
2021	22,171	21,945	21,118	17,964
2021 Actual	22,142	21,938	21,136	17,958
2022	22,393	22,164	21,347	18,159
2023	22,623	22,391	21,566	18,345
2024	22,674	22,442	21,615	18,387
2025	22,734	22,501	21,672	18,435
2026	22,809	22,576	21,744	18,497
2027	22,906	22,671	21,836	18,575
Load Impact of Embedded Generation				
2019	613	610	476	406
2020	634	628	476	405
2021	671	664	493	419
2022	673	666	495	421
2023	673	666	495	421
2024	673	666	495	421
2025	673	666	495	421
2026	673	666	495	421
2027	673	666	495	421
Load Impact of CDM				
2019	2,055	2,045	1,983	1,692
2020	2,073	2,052	1,989	1,692
2021	2,229	2,206	2,123	1,806
2022	2,397	2,373	2,285	1,944
2023	2,534	2,508	2,415	2,055
2024	2,587	2,561	2,466	2,098
2025	2,758	2,730	2,629	2,236
2026	2,946	2,916	2,808	2,389
2027	2,994	2,964	2,855	2,428
Load Forecast after Deducting Embedded Generation and CDM				
2019	19,575	19,475	18,880	16,111
2020	19,219	19,023	18,435	15,682
2021	19,272	19,075	18,502	15,739
2021 Actual	19,242	19,068	18,520	15,733
2022	19,323	19,126	18,567	15,794
2023	19,416	19,218	18,655	15,869
2024	19,414	19,215	18,653	15,868
2025	19,303	19,106	18,548	15,778
2026	19,191	18,995	18,441	15,687
2027	19,238	19,042	18,486	15,725

Note: All figures are weather-normal.

O - LPMA INTERROGATORY - 039

Reference:

Exhibit O-1-3, Table 6

Interrogatory:

Do the figures in Table 6 for 2021 reflect actual data? If not, please provide the actual GWh delivered and the actual number of distribution customers for 2021. Please also provide the actual normalized weather GWh delivered in 2021.

Response:

The figures for 2021 are forecast values. Hydro One's actual 2021 data includes amounts related to acquired utilities Peterborough Distribution Inc. and Orillia Power Distribution Corp. which were integrated in 2021. Therefore, Hydro One is unable to provide the requested information in a manner consistent with the Application because it is not readily available and cannot be produced in the time set out by the OEB for interrogatory responses.

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O - LPMA INTERROGATORY - 040

Reference:

Exhibit O-1-3, Table 14

Interrogatory:

If not already included in Table 14, please provide actual weather corrected data for 2021.

Response:

The 2021 figures are forecast values. Hydro One's actual 2021 data includes amounts related to acquired utilities Peterborough Distribution Inc. and Orillia Power Distribution Corp. which were integrated in 2021. Therefore, Hydro One is unable to provide the requested information in a manner consistent with the Application because it is not readily available and cannot be produced in the time set out by the OEB for interrogatory responses.

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O - LPMA INTERROGATORY - 041

Reference:

Exhibit O-1-3
Exhibit O-1-6 (Exhibit JT-VECC-TCQ-04)
Exhibit D-3-1

Interrogatory:

The evidence in the update to JT_VECC_TCQ-04 (part (f), states that the "Other" column has been adjusted downwards relative to the pre-filed evidence in view of a declining optimism regarding the future state of the economy (as compared to optimistic recovery in short run assumed in the pre-filed evidence). The response also indicates that higher inflation and supply constraints would lead to an increase in interest rates, leading to slower economic growth than expected in the pre-filed evidence.

a) Please provide the reduction by year in the "Other" column noted in the updated response to JT_VECC_TCQ_04.

b) Please explain why Hydro One made the above noted adjustment related to the change in economic growth while not updating the transmission or distribution load forecasts to reflect changes in the economy from the as-filed evidence, which according to Appendix A in Exhibit D, Tab 3, Schedule 1, is not more than a full year out of date as it was updated on Feb. 3, 2021.

c) Please provide an update to Appendix A of Exhibit D, Tab 3, Schedule 1 to reflect the most recent forecasts currently available.

d) Please add a line to both the GDP forecast and the Ontario housing starts forecast that reflects the April 28, 2022 Ontario government budget forecasts (including historical data for 2019 through 2021).

e) Please provide updated Tables 1 & 16 (and any other relevant tables) if the transmission forecast is updated to reflect both historical and forecast changes:
   i. the updated average forecast in Appendix A as requested above in part (c);
   ii. the updated forecast from the Ontario government budget as requested in part (d) above.

f) Please confirm that based on the Ontario government budget forecast and actuals for 2020 through 2023, the level of economic activity is higher than that forecast by Hydro One in the as-filed evidence. If this cannot be confirmed, please show the calculations that support this claim.

Response:

a) Please see below the requested information.

Year	Reduction in "Other" (MW)
2021	122
2022	37
2023	11
2024	44
2025	40
2026	55
2027	49

b) For the transmission forecast, please see response to Energy Probe-89 parts A) and B). For the Distribution forecast, please see response to Energy Probe-90 parts A) and B).

c) Please see below the requested information.

Survey of Ontario GDP Forecast (annual growth rate in %)

	2019	2020	2021	2022	2023	2024	2025	2026	2027
Global Insight (Apr 2022)	2.0	-5.1	4.3	3.1	3.1	3.0	2.1	1.9	1.9
Conference Board (Feb 2022)	2.0	-5.1	4.3	3.8	3.4	1.3	1.5	1.7	
U of T (Feb 2022)	2.0	-5.1	4.4	4.8	3.8	2.8	2.5	2.3	2.3
C4SE (Feb 2022)	2.0	-5.1	4.2	4.4	2.9	2	1.9	1.8	1.8
CIBC (Dec 2021)	2.1	-5.1	3.9	4.3	2.9				
BMO (Feb 2022)	1.9	-5.6	4.4	3.4	3.0				
RBC (Dec 2021)	2.0	-5.1	4.4	4.4	2.4				
Scotia (Jan 2022)	2.0	-5.1	4.3	3.8	3.4				
TD (Mar 2022)	1.6	-6.2	4.3	4.2	3.0				
Desjardins (Apr 2022)	2.0	-5.1	4.3	3.9	1.8				
Central 1 (Nov 2021)	2.1	-5.1	4.5	4.9	3.0				
National Bank (Apr 2022)	2.0	-5.1	4.0	3.9	2.5				
Laurentian Bank (Jul 2021)	2.1	-5.0	6.0	4.4	2.5				
Average	**2.0**	**-5.2**	**4.4**	**4.1**	**2.9**	**2.3**	**2.0**	**1.9**	**2.0**

Survey of Ontario Housing Starts Forecast (in 000's)

	2019	2020	2021	2022	2023	2024	2025	2026	2027
Global Insight (Apr 2022)	68.7	81.2	99.8	86.6	73.0	66.4	60.4	58.5	57.3
Conference Board (Feb 2022)	69.0	81.3	99.6	95.4	92.6	92.1	92.0	91.9	
U of T (Feb 2022)	69.0	81.3	99.6	74.3	76.9	77.6	78.4	79.0	79.6
C4SE (Feb 2022)	69.0	81.3	100.1	91.6	89.4	85.5	85.8	84.2	84.5
CIBC (Apr 2020)	69.0	43.0	68.0						
BMO (Feb 2022)	69.0	81.0	101.2	90.0	84.0				
RBC (Dec 2021)	69.0	80.8	102.1	88.3	82.0				
Scotia (Jan 2022)	69.0	81.0	101.0	75.0	68.0				
TD (Mar 2022)	70.1	81.1	101.2	84.0	84.3				
Desjardins (Apr 2022)	69.0	81.3	101.2	85.0	76.5				
Central 1 (Nov 2021)	69.0	81.3	97.9	88.2	92.3				
National Bank (Apr 2022)	69.0	81.3	101.2	88.0	80.0				
Laurentian Bank (Jul 2021)	69.0	80.8	93.0	79.0	76.0				
Average	**69.1**	**78.2**	**97.4**	**85.4**	**81.2**	**80.4**	**79.1**	**78.4**	**73.8**

Forecast updated on May 7, 2022

It can be observed that there are mixed results in relation to the consensus forecast of GDP growth in the as-filed evidence in early 2021. The housing starts are higher compared to the as-filed forecast as they do not fully reflect the impact of rising interest rates, in addition to affordability issues. In response to LPMA-17 and 18, it was predicted that rising inflation would lead to increases in interest rates leading to a reduction of demand for housing and, thereby, housing starts. The impact of rising interest rates on housing starts has already started to be factored into forecasts made after the interest rate hikes started in March 2022. The average of housing starts in forecasts made in April 2022 is presented in the following table and is far below the average shown above for all forecasts. It is also lower than the consensus forecast in early 2021 over all the forecast years (2021-2027) on average, as it averages 72,300 compared to 74,300 for the latter forecast. It is expected that, as interest

rates continue to rise, the forecast of housing starts would decrease further as suggested by the economic theory.

2019	2020	2021	2022	2023	2024	2025	2026	2027
68.9	81.3	100.7	86.5	76.5	66.4	60.4	58.5	57.3

The latest actual data also reflects the negative impact of interest rates on housing starts. According to the latest (April 2022) Altus Group Backpage Statistics housing starts in Ontario in March 2022, seasonally adjusted at annual rates, fell by 33% compared to March 2021.

d) Please see below the requested information.

Extract from Ontario Budget Table 2.5 *

	2019	2020	2021	2022	2023	2024	2025
GDP Growth (%)	n.a.	-5.1	4.3	3.7	3.1	2.0	1.9
Housing Starts (000s)	n.a.	81.3	99.6	86.9	84	87.3	87.8

* As noted in the footnote to the table, this information is as of March 8, 2022.

The table is based on information as of March 8 so it does not reflect the full impact of interest rates on housing starts. Please see response to C) above for further discussion in this regard.

e) Hydro One is unable to provide the requested information because it is not readily available and cannot be produced in the time set out by the OEB for interrogatory responses.

f) The GDP in the original forecast in the as-filed evidence is higher compared to the Ontario budget in the years 2021 and 2022. Housing starts in the Ontario budget is higher compared to the as-filed evidence, but see responses to parts C) and D) above for further discussion in this regard.

O - LPMA INTERROGATORY - 042

Reference:

Exhibit O-1-4

Interrogatory:

If the OEB were to determine that the revenue requirement should be reduced relative to the application originally filed, how does Hydro One propose to deal with the incremental revenue requirement associated with the increase in inflation and the decrease in the load forecast? In particular, would all of the associated increases be deferred, or would a portion of the increase in revenue requirement be recovered in proposed rates (i.e. up to the original level) and any excess in revenue requirement from inflation and load adjustments be deferred?

Response:

As outlined in Exhibit O-01-04, Hydro One provided the specific steps required for approval by the OEB in relation to the deferred recovery.

As part of its decision in this proceeding, the OEB will approve total revenue requirements, as well as billing determinants (load forecasts) for each of Hydro One's Transmission and Distribution businesses. In filing the Draft Rate Order (DRO), Hydro One will recalculate and provide:

1. an updated derivation of the as-filed revenue requirement (based on 2% inflation rates) which will reflect any changes arising from the OEB's decision and other typical updates normally done at the DRO stage (e.g. cost of capital parameters); and
2. the total revenue requirement, which will reflect any changes arising from the OEB's decision and other typical updates normally done at the DRO stage (e.g. cost of capital parameters), as well as final inflationary assumptions that will underpin Hydro One's cost forecasts at the time of the DRO.

The final deferred Transmission and Distribution revenue requirements will be the differences between the amounts described in 1 and 2 above, which will be approved by the OEB and tracked through the Transmission Approved Revenue Requirement Deferral Account and the Distribution Approved Revenue Requirement Deferral Account, as applicable. The following elaborates on the methods for calculating these differences in relation to each of the inflation update and the load forecast update. See also O-SUP-019(b).

Regarding the portion of the deferred revenue requirement arising from the inflation update, as noted in Exhibit O-01-04 this will be calculated as the difference between the total revenue requirement approved by the OEB and the updated as-filed revenue requirement. For the purposes of determining the final balance for each year in the deferred revenue requirement associated with the inflation update, this calculation will be based on the updated total revenue requirement and updated as-filed revenue requirement amounts that will be provided at the DRO stage, as noted above.

Regarding the portion of the deferred revenue requirement associated with revenue deficiencies arising from the revised load forecasts, this will be calculated using the final approved charge/billing determinants relative to the as-filed charge/billing determinants using the methodology outlined in Section 2 of Exhibit O-01-03. At the time of the DRO, Hydro One will provide final charge/billing determinants which reflect any necessary changes arising from the OEB's decision. The as-filed charge/billing determinants used in the calculation will not change at the time of the DRO. The calculations in Exhibit O-01-03 will be updated to reflect the revised as-filed revenue requirement that is noted in the paragraph above.

O - LPMA INTERROGATORY - 043

Reference:

Exhibit O-1-4

Interrogatory:

Is Hydro One requesting that the Board approve the transmission and distribution revenue requirements associated with the as-filed evidence, the updated evidence, or both? Please explain fully.

Response:

As described in Exhibit O-01-01, page 1, Hydro One has revised its evidence to reflect a customer-centric approach to update the inflation assumptions and load forecasts. As a result, the revenue requirement for this Application has been updated. As detailed in Exhibit O-01-04, Section 2.2, Hydro One is seeking the OEB's approval of the inflation adjusted revenue requirement associated with the updated evidence as set out in Exhibit O-01-02.

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O - LPMA INTERROGATORY - 044

Reference:

Exhibit O-1-4

Interrogatory:

Please provide versions of Tables 1 & 2 that would reflect Board decisions of a reduction of $10 million in revenue requirement (for both transmission and distribution) assuming that the reduction in the approved revenue requirement is based on:

a) the as-filed evidence;

b) the updated evidence.

Response:

Please see below for each scenario.

a) Revenue requirement (As-Filed)

Table 1 - Transmission Deferred Revenue Requirement from Inflation Update, 2023-2027 ($M)

Description	Forecast Period				
	2023	2024	2025	2026	2027
Transmission Revenue Requirement (As-Filed Evidence)	1,823.2	1,937.8	2,027.5	2,140.3	2,219.0
Transmission Revenue Requirement (As-Filed Evidence) - $10M reduction	1,813.2	1,927.8	2,017.5	2,130.3	2,209.0

Table 2 - Distribution Deferred Revenue Requirement from Inflation Update, 2023-2027 ($M)

Description	Forecast Period				
	2023	2024	2025	2026	2027
Distribution Revenue Requirement (As-Filed Evidence)	1,632.4	1,711.3	1,785.1	1,881.1	1,965.0
Distribution Revenue Requirement (As-Filed Evidence) - $10M reduction	1,622.4	1,701.3	1,775.1	1,871.1	1,955.0

b) Revenue requirement (Updated Evidence)

Table 1 - Transmission Deferred Revenue Requirement from Inflation Update, 2023-2027 ($M)

Description	Forecast Period				
	2023	2024	2025	2026	2027
Transmission Revenue Requirement (Inflation Update)	1,849.3	1,968.2	2,063.0	2,182.5	2,266.6
Transmission Revenue Requirement (Inflation Update) - $10M reduction	1,839.3	1,958.2	2,053.0	2,172.5	2,256.6

Table 2 - Distribution Deferred Revenue Requirement from Inflation Update, 2023-2027 ($M)

Description	Forecast Period				
	2023	2024	2025	2026	2027
Distribution Revenue Requirement (Inflation Update)	1,669.1	1,753.3	1,832.2	1,934.8	2,024.6
Distribution Revenue Requirement (Inflation Update) - $10M reduction	1,659.1	1,743.3	1,822.2	1,924.8	2,014.6

O - LPMA INTERROGATORY - 045

Reference:

Exhibit O-1-5

Interrogatory:

a) What interest rate was used in 2013 through 2020 in the calculation of the accrued interest shown in Table 1?

b) What interest rate was used for 2021 and 2022 in the calculation of the carrying charges for 2021 and 2022?

c) If any of the interest rates identified in parts (a) and (b) are different than the prescribed interest rates set by the OEB for deferral and variance accounts, please explain the reason for the difference and provide an updated Table 1 that reflects the OEB approved rates (assuming the Q2 2022 rate is applied through to the end of 2022).

d) Please add a column to Table 2 that reflects actual data for 2021.

Response:

a) The quarterly OEB approved deferral and variance accounts prescribed interest rates applicable to 2013 through 2020 were used to determine accrued interest.

b) To align with the initial pre-filed evidence, an interest rate of 0.57% was used in 2021 and 2022 to calculate carrying charges. As the prescribed interest rates may continue to change in the upcoming quarters, Hydro One is open to updating the deferral and variance accounts continuity schedules during the Draft Rate Order process if requested by the OEB.

c) Not applicable. Hydro One uses the prescribed interest rates set by the OEB to calculate carrying charges on the balance recorded in DVAs. Please see the response to part b).

d) Please see the updated table below with 2021 actuals.

1 **Table 1 - Updated Transmission External Revenues ($M)***

	2018 Actual	2019 Actual	2020 Actual	2021 Actual	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	2027 Forecast
Secondary Land Use	25.6	26.9	28.4	49.6	46.5	28.8	28.0	24.3	24.6	24.9	25.1
Station Maintenance	4.6	4.0	4.2	4.2	3.4	3.4	3.4	3.4	3.4	3.2	3.2
Engineering & Construction	0.1	0.1	0.2	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Other External Revenues	10.0	9.5	11.4	7.9	8.7	7.2	8.4	8.2	8.1	7.8	8.6
Total	**40.3**	**40.5**	**44.2**	**62.3**	**59.0**	**39.8**	**40.1**	**36.2**	**36.5**	**36.2**	**37.3**

**Exhibit Reference: D-02-01, Table 1*

O - POLLUTION PROBE INTERROGATORY - 022

Reference:

Exhibit O-1-1, Page 1

Preamble:

"This Exhibit presents an update to Hydro One's evidence to reflect a customer-centric approach…….to deliver on our commitments to customers without impacting the proposed transmission and distribution rates during the 2023 to 2027 period in a material way."

The above statement implies an analysis was undertaken that determined the impact on rates was material as a result of higher inflation assumptions and lower demand forecast.

Interrogatory:

a) Did Hydro One undertake an analysis to determine the impact on transmission and distribution rates as a result of the higher revenue requirements due to higher inflation assumptions and reduced load forecast - assuming no deferral of revenue requirements into the next rate period?

b) If the answer to a) is yes, please provide the results of the analysis for each year from 2023 through 2027.

c) If the answer to a) is no, please explain why an analysis of the impact on rates in the existing rate period was not undertaken and presented prior to recommending the deferral alternative.

d) If not provided in the response to b), please provide an analysis of the impact of the higher inflation assumptions and reduced load forecast on transmission and distribution rates for 2023 through 2027 period. Please provide final results identical to the three tables on page 10 and 11 of Exhibit A-3-1, Attachment 1, Joint Rate Application Business Plan - May 7, 2021.

   Please assume no deferral of revenue requirements into the next rate period. Please provide the variance from originally filed evidence and the variance from the previous rate period.

e) Please explain what materiality criteria Hydro One used to assess its updated request for incremental funding and resulting rate impacts.

Response:

a) Yes.

b) The table below provides the summary of the combined Transmission and Distribution bill impacts for typical residential and general service customers. See response to O-SEC-252 (b) for further details on cost allocation and rate design.

Rate Class	Monthly Consumption (kWh)		2023		2024		2025		2026		2027		5-year average	
			Change in Total Bill ($)	Change in Total Bill (%)	Change in Total Bill ($)	Change in Total Bill (%)	Change in Total Bill ($)	Change in Total Bill (%)	Change in Total Bill ($)	Change in Total Bill (%)	Change in Total Bill ($)	Change in Total Bill (%)	Change in Total Bill ($)	Change in Total Bill (%)
R1 (without DRP)	750	DX Impact	($1.46)	-0.9%	$1.56	1.0%	$2.64	1.7%	$2.95	1.8%	$2.91	1.8%	$1.72	1.1%
		TX Impact	($0.30)	-0.2%	$0.82	0.6%	$0.80	0.6%	$1.00	0.8%	$0.59	0.4%	$0.58	0.4%
		Combined Impact	($1.76)	-1.2%	$2.38	1.6%	$3.44	2.3%	$3.95	2.6%	$3.50	2.2%	$2.30	1.5%
GSe	2,000	DX Impact	($5.76)	-1.4%	$2.18	0.5%	$6.98	1.7%	$9.25	2.2%	$7.79	1.8%	$4.09	1.0%
		TX Impact	($0.64)	-0.2%	$1.74	0.4%	$1.70	0.4%	$2.12	0.5%	$1.26	0.3%	$1.24	0.3%
		Combined Impact	($6.40)	-1.5%	$3.92	0.9%	$8.68	2.1%	$11.37	2.7%	$9.05	2.1%	$5.33	1.3%

c) Not applicable.

d) The requested information is provided in the tables below.

1 **Transmission Revenue Requirement**

Updated Evidence	2022[1]	2023	2024	2025	2026	2027	5-year Avg
OM&A[2]		450	459	468	478	487	
Capital Related Items[3]		1,399	1,509	1,595	1,705	1,779	
Revenue Requirement	**1,816**	**1,849**	**1,968**	**2,063**	**2,182**	**2,267**	
Other[4]	(20)	(87)	(55)	(54)	(53)	(54)	
Rates Revenue Requirement	**$1,796**	**$1,762**	**$1,913**	**$2,009**	**$2,129**	**$2,213**	
Annual Impact, excl. Load		**-1.9%**	**8.6%**	**5.0%**	**6.0%**	**3.9%**	
Estimated Load Impact		2.0%	0.0%	0.6%	0.6%	-0.2%	
Annual Rate Impact		**0.1%**	**8.6%**	**5.5%**	**6.6%**	**3.7%**	**4.9%**
~Total Bill Impact (R1 Customer - 7%)		**0.0%**	**0.6%**	**0.4%**	**0.5%**	**0.3%**	**0.4%**
Variance from Exhibit A-3-1-1							
Annual Impact, excl. Load		**-1.0%**	**1.8%**	**0.2%**	**0.2%**	**0.2%**	
Estimated Load Impact		1.5%	0.4%	0.7%	0.8%	-0.1%	
Annual Rate Impact		**0.5%**	**2.2%**	**0.8%**	**1.0%**	**0.1%**	**0.9%**
Total Bill Impact		**0.0%**	**0.2%**	**0.1%**	**0.1%**	**0.0%**	**0.1%**

[1] The 2022 rates revenue requirement of $1,796 million, which excludes the Deferred Tax Asset ("DTA") amount, was approved in EB-2021-0185 on December 16, 2021.

[2] 2024-27 OM&A escalated by 2.0% (2.0% 2021 OEB approved inflation less 0.0% productivity stretch).

[3] Includes ROE at 8.34%, Return on Debt at 4.04%, depreciation, income taxes, and productivity and supplemental stretch factors of 0.15%.

[4] Other includes Deferral and Variance Accounts, external revenues, export service credit, and Low Voltage Switch Gear as well as a refund of the $27.5M credit for External Revenue Variances to customers in 2023.

Distribution Revenue Requirement and Rate Impacts

	2022[1]	2023	2024	2025	2026	2027	5-year Avg
OM&A[2] ($M)		$622	$646	$659	$671	$684	
Capital Related Items[3] ($M)		$1,017	$1,107	$1,174	$1,264	$1,341	
Revenue Requirement ($M)	**$1,692**	**$1,638**	**$1,753**	**$1,832**	**$1,935**	**$2,025**	
Other[4] ($M)	($45)	($64)	($64)	($64)	($64)	($64)	
Rates Revenue Requirement ($M)	**$1,647**	**$1,574**	**$1,689**	**$1,768**	**$1,871**	**$1,961**	
Annual Impact, excl. Load		**-4.4%**	**5.2%**	**4.7%**	**5.8%**	**4.8%**	
Estimated Load Impact		0.4%	-0.4%	-0.4%	-0.3%	-0.5%	
Annual Rate Impact		**-4.0%**	**4.8%**	**4.3%**	**5.5%**	**4.3%**	**3.0%**
~Total Bill Impact (R1 Customer -31%)		**-1.2%**	**1.5%**	**1.3%**	**1.7%**	**1.3%**	**0.9%**
Acquired LDCs Revenue Requirement ($M)[5]		**$31**					
Variance from Pre-filed (Exhibit A-3-1-1)							
Annual Impact, excl. Load		**0.4%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	
Estimated Load Impact[6]		**0.5%**	**0.2%**	**0.2%**	**0.3%**	**0.0%**	
Annual Rate Impact		**0.9%**	**0.4%**	**0.4%**	**0.5%**	**0.2%**	**0.5%**
Total Bill Impact		**0.3%**	**0.1%**	**0.1%**	**0.1%**	**0.1%**	**0.2%**

[1] The 2022 Rates Revenue Requirement of $1,647M was approved by the OEB in EB-2021-0032 on December 16, 2021.

[2] 2024-27 OM&A escalated by 1.9% (2.2% 2021 OEB approved inflation less 0.3% productivity stretch).

[3] Includes ROE at 8.34%, Return on Debt at 4.07%, depreciation, income taxes, and productivity and supplemental stretch factor of 0.3%+0.15% = 0.45%.

[4] Other includes Deferral and Variance Account balances and External Revenues.

[5] $31M of revenue requirement will be integrated, however, this will be offset by increased load and customer count. Amounts for 2024-27 are fully integrated within the OM&A and capital line items, and 2024 rate impacts are relative to 2023 rates revenue requirement including the acquired LDCs.

[6] The 2023 Distribution Load Impact was incorrectly quoted as -1.4% in the as filed evidence (Exhibit A-3-1, Attachment 1, page 11). The variance shown in this table is based on the corrected as filed Load Impact of -0.1% in 2023.

e) While Hydro One assessed the bill impacts of its evidence updates and proposed a mechanism to defer the incremental impacts of those updates on rates until after the 2023-2027 test period in an effort to help mitigate the near-term economic impacts of the inflationary pressures facing its customers, it did not use specific "materiality criteria" to assess the rate impacts resulting from its updates to the inflation assumptions and load forecasts in its application.

O - POLLUTION PROBE INTERROGATORY - 023

Reference:

Exhibit O-1-1, Page 5

Preamble:

"Overall, the above-described updates to Hydro One's load forecasts result in an average 1.2% reduction over the test period in the case of the transmission load forecast and an average 1.9% reduction over the test period in the case of the distribution load forecast."

Lower throughput would suggest there could be opportunities to reduce OM&A and capital spending plans.

Interrogatory:

a) Did Hydro One assess if there are potential opportunities in transmission and/or distribution to reduce OM&A and/or capital spending plans as a result of the lower load forecasts? If yes, please provide this analysis.

b) If the answer is no, please explain why not.

Response:

Please refer to Interrogatory O-Staff-393, part c).

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O - POLLUTION PROBE INTERROGATORY - 024

Reference:

Exhibit O-1-2, Page 6
Exhibit O-1-2, Attachment 1, Page 7

Preamble:

"Rising fuel costs have led to a 30% to 35% increase in the 2022 forecast for Hydro One's internal fleet."

"Higher oil prices influence Canadian inflation in a variety of ways. The direct effect on CPI is mostly limited to gasoline prices that are adding about 1.2 percentage points to Canada's present 5.1% y/y inflation rate (chart 18)."

An increase in the long-term price forecast for fossil fuels will have a material impact on the business case for purchasing electric vehicles as an alternative to conventional and hybrid fossil fueled vehicles. Investing in electric vehicles can help mitigate the impact on rates of higher and volatile fossil fuel prices.

Interrogatory:

a) Please provide Scotiabank's revised long-term price forecast for gasoline and diesel fuel. If not available, please provide their revised forecast for oil prices that can be used as a proxy to forecast gasoline and diesel prices.

b) Please provide financial analyses for purchasing electric vehicles as an alternative to conventional and hybrid fossil fueled vehicles. Please use Scotiabank's revised price forecast for gasoline and diesel fuel in the analysis.

As in a) if an updated price forecasts for gasoline and diesel are not available, please use oil price forecasts as a proxy. Please complete the following tables 1-6 for representative light, medium and heavy-duty vehicles.

Table 1 - Representative Light Duty Vehicle (After Tax Cost)			
Year	Electric vehicle	Conventional fossil fueled	Plug-in hybrid fossil fueled
1			
2			
.			
15			

1

Table 2 - Representative Light Duty Vehicle		
Description	Electric vs conventional fossil fueled vehicle	Electric vs plug-in hybrid fossil fueled vehicle
Incremental cost		
Simple Payback (years)		
NPV discounted @ WACC*		
IRR		

2

Table 3 - Representative Medium Duty Vehicle (After Tax Cost)			
Year	Electric vehicle	Conventional fossil fueled	Plug-in hybrid fossil fueled
1			
2			
.			
15			

Table 4 - Representative Medium Duty Vehicle		
Description	Electric vs conventional fossil fueled vehicle	Electric vs plug-in hybrid fossil fueled vehicle
Incremental cost		
Simple Payback (years)		
NPV discounted @ WACC*		
IRR		

1

Table 5 - Representative Heavy-Duty Vehicle (After Tax Cost)			
Year	Electric vehicle	Conventional fossil fueled	Plug-in hybrid fossil fueled
1			
2			
.			
15			

2

Table 6 - Representative Heavy-Duty Vehicle		
Description	Electric vs conventional fossil fueled vehicle	Electric vs plug-in hybrid fossil fueled vehicle
Incremental cost		
Simple Payback (years)		
NPV discounted @ WACC*		
IRR		

3 **Net Present Value discounted at the weighted average cost of capital*

Response:

a) *Response from Scotiabank:*
Scotiabank does not forecast gasoline prices. Scotiabank is not able to comment as to the appropriateness of using crude prices as a proxy for gasoline prices.

b) As discussed in part a) above, Hydro One is not able to update the analysis requested by Pollution Probe utilizing Scotiabank's revised price forecast for gasoline and diesel fuel.

To provide an understanding on recent fuel price increases upon the prior analysis, Hydro One revisited its analysis on the costs to replace end of life, light-duty vehicles[1] to assess the impact of utilizing current fuel prices as well as cost pressures on the initial purchase price of both the electric vehicle (EV) and internal combustion engine vehicles.

For the analysis, Hydro One assumed a fuel price of $1.68/L ($1.90 pump price less 13% tax), based on annual average assumption using recent fuel trends highlighted in below tables.

Table 1 – Unleaded Gasoline – Ontario In-Month Average Price[2]

Month	2021	2022	YOY % change
Jan	110.4	145.9	32.2%
Feb	116.9	158.2	35.3%
Mar	124.3	176.9	42.3%
Apr	126.4	174.2	37.8%
May	129.6		
Jun	132.9		
Jul	136.4		
Aug	137.2		
Sep	137.6		
Oct	144.7		
Nov	142.6		
Dec	137.4		

[1]Hydro One's electrification strategy is paced to align with end of life thresholds for internal combustion vehicles, based on varying factors including vehicle age, kilometers driven and maintenance completed, in order to maximize the cost effectiveness of each asset.
[2]Data obtained from: Government of Ontario, Fuels price survey information – (https://data.ontario.ca/dataset/fuels-price-survey-information)

Witness: BERARDI Rob, Scotiabank

Table 2 – Diesel – Ontario In-Month Average Price ($/L)[3]

Month	2021	2022	YOY % change
Jan	110.0	149.8	36.2%
Feb	114.4	160.4	40.2%
Mar	118.8	194.7	63.9%
Apr	121.1	196.5	62.3%
May	123.5		
Jun	126.4		
Jul	128.2		
Aug	128.5		
Sep	130.9		
Oct	141.2		
Nov	144.0		
Dec	141.9		

The maintenance assumptions between the two technologies was not changed. The analysis was not conducted for medium and heavy duty vehicles as the technology is not yet mature enough for field deployment. For plug-in hybrid electric vehicles (PHEV), Hydro One does not have the data available to perform the analysis.

The inflationary pressures on the purchase prices for light-duty EVs and internal combustion engines largely offset each other and have only a minor impact on the analysis. However, the potential increase in EV fuel savings utilizing recent fuel pricing of $1.68/L versus previous fuel pricing of $1.15/L[4] has a material impact upon the analysis in favour of EVs. Based on the revised projection using the current fuel prices, projected fuel cost savings increase from $2.7M[5] to $3.9M. The updated fuel savings offset the increased incremental capital required to purchase an EV vehicle versus an internal combustion vehicle with an internal rate of return (IRR) of 10% on the incremental costs.

While the incremental savings present more favourable financial results, the practical limitations of available supply and the supporting EV infrastructure prevent Hydro One from accelerating its paced electrification strategy to replace end of life assets with suitable EVs. The current availability of suitable EVs and plug-in hybrid EVs (PHEVs) will continue to be a challenge as a result of the global supply chain issues in the near term and technological advancements expected in the coming years. Additionally, the level of investment needed to

[3] Ibid
[4] Exhibit I-07-A-DRC-002, page 3, lines 1-2
[5] Ibid

build the necessary infrastructure to meet the electrification strategy will require collaboration among private industry, utilities, governments, Indigenous groups, and citizens. The current provincial rollout of charging infrastructure, especially in rural Ontario, is in its infancy stage and will take time and funding to provide a sustainable network.

O - POLLUTION PROBE INTERROGATORY - 025

Reference:

Exhibit O-1-2, Page 8
Exhibit O-1-2, Page 11
Exhibit O-1-2, Page 17

Preamble:

"The plan was then re-escalated using the revised inflation rates listed above for each of 2021, 2022, and 2023 for capital and OM&A, and by 2.0% for years 2024 through 2027 for capital."

"If the forecast inflation rates for 2022 and 2023 at the time of DRO are higher than the forecasts used in this evidence update (i.e. 4.5% for 2022 and 3.3% for 2023), then the following process is proposed:

- The revenue requirement will be updated to reflect the new inflation rate, but will not exceed a prescribed inflation cap (the "Inflation Forecast Cap")."

Interrogatory:

a) Please provide a sensitivity analysis of the impact on transmission and distribution rates, assuming an average 3% inflation rate for the years 2024 through 2027. Please provide final results identical to the three tables on page 10 and 11 of Exhibit A-3-1, Attachment 1, Joint Rate Application Business Plan - May 7, 2021.

   Please assume no deferral of revenue requirements into the next rate period. Please provide the variance from originally filed evidence and the variance from the previous rate period.

b) If the OEB does not agree to Hydro One's proposal to defer revenue requirements into the next rate period, what other action does Hydro One propose to mitigate the impact on rates?

c) Hydro One has indicated that cost reductions or deferrals could be undertaken in system renewal and system service budget categories. Please outline the estimated total reductions or deferrals in capital spending (in millions of dollars) that could be implemented for each year of the 2023-2027 period. Please indicate which amounts are reductions and which are deferrals.

Response:

a) As requested, the tables below reflect the updates to the revenue requirements provided in Exhibit O-01-02, with the identified change of including 2024-2027 average inflation of 3% (currently average inflation of 2% has been assumed). Note, the rate impacts identified below assume no deferral.

Transmission Revenue Requirement ($M)	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**5-year Avg**
OM&A		450	459	468	478	487	
Capital Related Items		1399	1510	1597	1710	1787	
Revenue Requirement	**1,816.0**	**1849**	**1969**	**2066**	**2187**	**2274**	
Other	(20)	(87)	(55)	(54)	(53)	(54)	
Rates Revenue Requirement, excl DTA	**$1,796**	**$1,762**	**$1,914**	**$2,011**	**$2,134**	**$2,220**	
Annual Impact, excl. Load		**-1.9%**	**8.7%**	**5.1%**	**6.1%**	**4.0%**	
Estimated Load Impact		2.0%	0.0%	0.6%	0.6%	-0.2%	
Annual Rate Impact		**0.1%**	**8.7%**	**5.7%**	**6.7%**	**3.8%**	**5.0%**
~Total Bill Impact (R1 Customer - 7%)		**0.0%**	**0.6%**	**0.4%**	**0.5%**	**0.3%**	**0.3%**
Rates Revenue Requirement – Inflation update		**$1,762**	**$1,913**	**$2,009**	**$2,129**	**$2,213**	
PP25 vs. Inflation Update		**$0**	**$1**	**$2**	**$5**	**$7**	
Rates Revenue Requirement – Pre-filed		**$1,763**	**$1,883**	**$1,973**	**$2,087**	**$2,166**	
PP25 vs. Pre-filed		**($1)**	**$31**	**$38**	**$47**	**$55**	

Distribution Revenue Requirement ($M)	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**5-year Avg**
OM&A		622	646	659	671	684	
Capital Related Items		1,017	1,108	1,176	1,269	1,349	
Revenue Requirement	**1,692**	**1,638**	**1,754**	**1,835**	**1,940**	**2,033**	
Other	(45)	(64)	(64)	(64)	(64)	(64)	
Rates Revenue Requirement, excl DTA	**$1,647**	**$1,574**	**$1,690**	**$1,771**	**$1,876**	**$1,969**	
Annual Impact, excl. Load		**-4.4%**	**5.3%**	**4.8%**	**6.0%**	**4.9%**	
Estimated Load Impact		0.40%	-0.40%	-0.40%	-0.30%	-0.50%	
Annual Rate Impact		**-4.0%**	**4.9%**	**4.4%**	**5.7%**	**4.4%**	**3.1%**
~Total Bill Impact (R1 Customer)		**-1.2%**	**1.5%**	**1.3%**	**1.7%**	**1.3%**	**0.9%**
Acquired LDCs		**$31**					
Rates Revenue Requirement, including LDCs – Inflation update		**$1,605**	**$1,689**	**$1,768**	**$1,871**	**$1,961**	
PP25 vs. Inflation Update		**$0**	**$1**	**$3**	**$5**	**$8**	
Rates Revenue Requirement, including LDCs – Pre-filed		**$1,568**	**$1,647**	**$1,721**	**$1,818**	**$1,901**	
PP25 vs. Pre-filed		**$37**	**$43**	**$50**	**$59**	**$68**	

b) As stated in Exhibit O, Hydro One is seeking approval of updated 2023-2027 revenue requirements for each of the transmission and distribution businesses, adjusted for the inflation assumptions. If the OEB does not approve the deferred recovery mechanism, then the approved revenue requirements adjusted for inflation would be reflected in rates during the 2023-2027 period.

c) Please see Interrogatory O-PP-026, part e).

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O - POLLUTION PROBE INTERROGATORY - 026

Reference:

Exhibit O-1-2, Page 11

Preamble:

"If the plan is not adjusted for updated inflation assumptions, a range of investments that are not deemed "mandatory" (e.g., driven by regulatory or compliance obligations) would be impacted by deferrals and reductions. The potential impact areas include System Renewal investments that are required to mitigate asset-related risks (e.g., to address a subset of deteriorated system assets based on verified condition, risk-based prioritization, and prudent planning to manage the overall proportion of poor-condition assets) as well as System Service investments that aim to improve service for some of the customers that experience reliability issues. The examples below further highlight the likely areas of impact:"

Interrogatory:

a) Please provide the approximate percentage of transmission and distribution system renewal investments that are deemed "mandatory" (e.g., driven by regulatory or compliance obligations).

b) Please provide the approximate percentage of transmission and distribution system service investments that are deemed "mandatory" (e.g., driven by regulatory or compliance obligations).

c) Please clarify if general plant is also a category that could be impacted by potential reductions and deferrals.

d) Please provide the approximate percentage of general plant investments that are deemed "mandatory" (e.g., driven by regulatory or compliance obligations).

e) Hydro One has indicated that cost reductions or deferrals could be undertaken in system renewal and system service budget categories. Please outline the estimated total reductions or deferrals in capital spending (in millions of dollars) that could be implemented for each year of the 2023-2027 period. Please indicate which amounts are reductions and which are deferrals.

Response:

a) Approximately 10% of transmission and 30% of distribution System Renewal investments are mandatory.

b) Approximately 97% of transmission and 15% of distribution System Service investments are mandatory.

c) Hydro One would review all non-mandatory investments, including those in the General Plant category.

d) Approximately 20% of General Plant investments are mandatory.

e) Hydro One has not identified specific investments that could be reduced, as the System Plans that have been proposed are required and respond to the needs and preferences of customers, address asset and system risks based on verified asset condition, risk-based prioritization, and prudent planning to manage the overall proportion of poor-condition assets, and facilitate system upgrades to respond to growth in the communities served.

O - POLLUTION PROBE INTERROGATORY - 027

Reference:

Exhibit O, Tab 1, Schedule 2, page 17 of 42

Preamble:

"If the cumulative inflation for 2022 and 2023 exceeds 10%, Hydro One will aim to manage its work program to the capped amount through investment reprioritization and redirection and will adjust the outcomes outlined in TSP Section 2.5 and DSP Section 3.5 accordingly."

Hydro One has outlined a plan to manage its work program through investment reprioritize and redirection if inflation exceeds its proposed 10% inflation cap.

Interrogatory:

a) Please explain why Hydro One would not implement a similar plan to reduce rate impacts during the 2023 - 2027 period as a result of higher inflation assumptions and reduced loaded forecast - assuming that no incremental revenue requirements are deferred into the next rate period?

Response:

a) Please refer to Hydro One's response to Interrogatory O-VECC-149, part a), which discusses the desire to balance between customer needs and preferences, asset and system risk, and cost. The need for this balance applies equally to both higher inflation assumptions and the reduced load forecast.

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O - SCHOOL ENERGY COALITION INTERROGATORY - 241

Reference:

Exhibit O-1
Exhibit A-4-1, Attachment 1

Interrogatory:

Please update the results of the Clearspring Energy Advisor's *Benchmarking and Productivity Research for Hydro One Networks' Joint Rate Application* report to reflect the updated evidence (i.e. changes to forecast costs, inflation, load forecast), and 2021 actual information.

Response:

Response from Clearspring:

Please see Clearspring's response to Interrogatory O-Staff-361, parts b) and c).

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O - SCHOOL ENERGY COALITION INTERROGATORY - 242

Reference:

Exhibit O-1-1

Interrogatory:

Please provide a copy of all materials provided to the Hydro One Board of Directors and/or any member of its Executive Leadership Team regarding impacts of inflation in 2021, 2022 and through the rate application period (2023-2027).

Response:

Hydro One's Chief Legal Officer and its Chief Corporate Affairs and Customer Care Officer prepared a presentation for the Board of Directors. Included as Attachment 1 are the slides from that presentation that are not subject to legal privilege.

Hydro One's Finance Group prepared a one-page document for the Executive Leadership Team on the financial impacts of inflation, which is included as Attachment 2.

Hydro One's Chief Legal Officer prepared presentations for the Executive Leadership Team on Hydro One's inflation update and its application in connection with and for purposes of providing legal advice. These are subject to legal privilege and have not been produced.

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Update: 2023-2027 Investment Plan

Board of Directors | March 23, 2022

Prepared by: Jason Fitzsimmons & Paul Harricks

Privileged and Confidential | Prepared in Contemplation of Regulatory Litigation

Context

- In early February, **Hydro One requested an adjournment of the JRAP so we could update the evidence** to reflect changes to:
  - **Inflation rates** (the application used 2.0% to forecast costs for 2023 to 2027); and
  - **Load** to reflect new conservation assumptions published by the IESO in December 2021.
- To reflect current inflationary pressures, Hydro One sought to replace the 2.0%/year inflation assumption with: 2021 – 3.5% actual inflation (Ontario); 2022 – 4.5% forecasted inflation (Scotiabank Capital (Scotia), Feb. 2022); and 2023 – 3.3% forecasted inflation (Scotia, Feb. 2022).
- In the span of 4 weeks, Scotia updated its Ontario inflation forecast for 2022 from 4.5% to 6.3%. Scotia has advised the **current market is quite volatile but is likely to stabilize over the next few months**.
- The **landscape has changed significantly since we originally filed the JRAP**. Inflation volatility and rising cost of living have pushed affordability to the forefront.
- **Updating inflation and load forecast will put an upward pressure on rates**.
- Given our commitment to putting customers first, we worked with the Board Election Readiness Advisory Group (ERAG) to **consider a number of mitigating options**.

Examples: Profit Over Purpose

Quebec / Local News

Quebec budget must help citizens cope with inflation: opposition parties

"We are going to help you pay the increases in the costs of housing, groceries, gas and electricity," Legault told Quebecers over the weekend.

MONTREAL | NEWS

Calls to freeze Hydro-Quebec electricity rates as inflation skyrockets



EDMONTON | News

'Irresponsible and insensitive': Kenney renews call to scrap carbon tax, as inflation costs explode



Financial Impacts: Inflation Update & Sensitivities

CONFIDENTIAL

Filed: 2022-05-16
EB-2021-0110
Exhibit I-22-O-SEC-242
Attachment 2
Page 1 of 1

		2021	2022	2023	2024	2025	2026	2027	TOTAL
(1)	**EPS - December 2021 Plan:**			[redacted]					
	OM&A - Pre-filed Evidence			**$1,018**	**$1,038**	**$1,058**	**$1,078**	**$1,099**	**$5,292**
	Capex - Pre-filed Evidence			**$2,439**	**$2,492**	**$2,571**	**$2,533**	**$2,519**	**$12,555**
(2)	**Application Update**								
	Inflation Rates (apply to all costs)	3.5%	4.5%	3.3%	2.0%	2.0%	2.0%	2.0%	
	OM&A Impact			$53	$55	$56	$56	$58	**$278**
	Capex Impact			$128	$131	$135	$133	$132	**$659**
	Rate base			$41	$135	$260	$385	$502	
	EPS - Additional Rate Base			[redacted]					
(3)	**No Application Update / OEB Denial**								
	EPS - OM&A (Unmitigated)		[redacted]						
	EPS - Rate Base								
(4)	**Delayed Filing**								
	EPS - 3 month lost effective date (Unmitigated)			[redacted]					
(5)	**1% Change to Inflation Rate**								
	OM&A Impact			$10	$10	$10	$11	$11	**$52**
	Capex Impact			$25	$25	$25	$25	$25	**$125**
	Rate base			$8	$26	$49	$73	$95	
	EPS - Rate Base			[redacted]					
(6)	**1% Change to Labour-Only Inflation Rate**								
	OM&A Impact			$6	$6	$6	$6	$6	**$31**
	Capex Impact			$10	$10	$10	$10	$10	**$50**
	Rate base			$3	$10	$20	$29	$38	
	EPS - Rate Base			[redacted]					

Application evidence update for inflation:

- Calculated based on total envelope of spend
- Assumes fully approved by OEB
- Incremental capital increases rate base forecast [redacted]

No inflation relief filed or approved by OEB [redacted]

3-month delay in effective date [redacted] If application of requested OM&A increases are delayed over the same period, impact [redacted]

1% change to inflation assumption in any year, will impact costs by $35M annually

1% change to labour-only inflation assumption in any year, will impact costs by $16M annually

O - SCHOOL ENERGY COALITION INTERROGATORY - 243

Reference:

Exhibit O-1-1
Exhibit A-CCC-1, Attachment 1

Interrogatory:

Considering the impacts noted in the updated evidence, please provide a copy of any changes, revisions, amendments, or updates to the Hydro One business plan.

Response:

Due to the timing of the evidence update filed on March 31, 2022 relative to Hydro One's business planning cycle, Hydro One has not updated its last approved business plan to reflect the inflationary impact. These changes will be incorporated in the next business planning cycle.

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O - SCHOOL ENERGY COALITION INTERROGATORY - 244

Reference:

Exhibit O-1-1

Interrogatory:

Please provide a copy of the most recent version of all third-party economic and price forecasts that Hydro One has in its possession or access to (e.g. Consensus Forecast, etc.).

Response:

Hydro One has reviewed the reports and subscriptions it receives across the organization that include third party economic and price forecasts. These are listed below.

Attachments 1-4 are macroeconomic reports used by Hydro One's pension department for the purposes of risk management with respect to the plan's asset mix. Attachment 5 includes a report used by Hydro One's Treasury department for the purposes of tracking economic indicators. Attachments 6-10 include reports used by Hydro One's load forecasting department for the purposes of forecasting load.

Attachment 1 – Capital Economics
Attachment 2 – Strategas Research Partners
Attachment 3 – Taniscott Capital
Attachment 4 – BCA Research
Attachment 5 – Action Economics
Attachment 6 – Altus Analytics (Back Page Statistics)
Attachment 7 – Conference Board of Canada
Attachment 8 – Consensus Forecasts by Consensus Economics (filed on a confidential basis)
Attachment 9 – University of Toronto (filed on a confidential basis)
Attachment 10 – The Centre for Spatial Economics (filed on a confidential basis)

Hydro One's load forecasting department uses one additional reports which is listed below. Hydro One has reached out to the entity to request consent to disclose the most recent version of these reports in response to this interrogatory but has not yet heard back. As such, Hydro One has not determined whether these reports may be disclosed or on what basis.

- IHS Global Insight – Economic Forecast (April 2022)

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Filed: 2022-05-16
EB-2021-0110
Exhibit I-22-O-SEC-244
Attachment 1

GLOBAL ECONOMIC OUTLOOK

Paying the price of high inflation

Table of Key Forecasts

Global Overview – We have revised our forecast for world growth this year to further below the consensus to reflect the growing ill effects of high inflation. While inflation should ease as the year goes on, the drag on real incomes will hit spending in the meantime. The war in Ukraine will weigh on sentiment and add to supply shortages, particularly in Europe where some economies will dip into recession. And as central bankers focus on stemming inflation rather than supporting activity, aggressive policy tightening will add to the economic headwinds. While policy will be *loosened* in China, this will not offset the effects a weak property sector, slowing exports and renewed lockdowns there, which pose downside risks to activity in the rest of the world.

US – The Fed's hawkish pivot has led us to anticipate a significantly more aggressive pace of policy tightening. This will weigh on economic activity and we expect GDP growth to remain below its 2% potential pace over the coming years. But since private sector debt burdens are relatively low, we do not anticipate a recession.

Euro-zone – The Ukraine war has pushed the euro-zone to the brink of recession and simultaneously pushed up inflation. The ECB is likely to focus on price stability meaning it will end its asset purchases soon and raise rates to positive territory this year.

Japan – With the recovery from the pandemic complete, we expect GDP growth of just 1.0% in 2024. The Bank of Japan won't raise short-term interest rates although it may allow longer-term interest rates to rise a little.

UK – Particularly high and persistent CPI inflation will prompt the Bank of England to raise interest rates to around 3% next year and the risks of recession have increased.

Canada – The overvalued housing market makes the economy particularly vulnerable to higher interest rates.

Australia & New Zealand – Sharp tightening cycles will weigh on activity and housing markets.

The Nordics & Switzerland – Squeeze on incomes less acute than elsewhere due to use of renewable energy.

China – While the economy rebounded sharply from the initial COVID-19 outbreak, there is no quick fix this time. The property sector is fragile, less policy support is planned and exporters face a reversal in fortunes.

India – India will be one of the few economies to outperform thanks to rising vaccinations and fiscal support.

Other Emerging Asia – Weak recoveries and relatively low inflation mean less policy tightening than elsewhere.

Emerging Europe – The Russian economy will collapse and effects of the war will cause recessions elsewhere.

Latin America – High commodity prices bode well for Colombia, Argentina and Brazil but not Chile or Peru.

Middle East & North Africa – The Gulf economies will be major beneficiaries from higher oil prices.

Sub-Saharan Africa – Spillovers from the war in Ukraine will add to debt problems in parts of the region.

Commodities – We now expect commodity prices to remain historically high for the rest of this year.

Long-term Outlook – Inflation is likely to be modestly higher in the next few decades than it was in the last.

GDP Forecasts

Table 1: GDP (% y/y)

	World Share[1]	Average 2010-2018	2019	2020	2021	Forecasts 2022	2023	2024
World (CE China estimate)	100	3.7	2.6	-3.6	6.0	2.7	3.7	3.2
World (Official China data)	100	3.8	3.0	-3.1	6.0	3.4	3.6	3.4
Advanced Economies	37.5	1.9	1.7	-4.9	5.2	2.6	1.7	1.6
US	15.7	2.3	2.3	-3.4	5.7	2.4	1.5	1.5
Euro-zone	12.0	1.4	1.6	-6.5	5.4	1.8	1.8	1.8
- Germany	3.3	2.1	1.1	-4.9	2.9	0.8	1.5	1.8
- France	2.3	1.4	1.8	-8.0	7.0	3.0	1.4	1.5
- Italy	1.9	0.3	0.5	-9.1	6.6	1.5	1.8	2.0
Japan	3.8	1.4	-0.2	-4.5	1.7	2.6	2.6	1.1
UK	2.3	2.1	1.7	-9.3	7.4	3.8	1.2	1.5
Canada	1.4	2.3	1.9	-5.2	4.6	4.2	2.2	1.7
Australia	1.0	2.7	2.0	-2.2	4.7	4.8	2.1	1.6
Emerging Economies[2]	62.5	5.1	3.2	-2.7	6.5	2.7	4.9	4.1
Emerging Asia[2]	36.7	6.5	4.0	-1.9	6.9	4.2	6.1	4.8
- China (CE estimate)	18.6	7.3	3.8	0.0	8.2	2.0	6.0	4.0
- China (Official data)	18.6	7.8	6.0	2.2	8.1	5.3	5.0	4.8
- India	7.0	7.5	4.5	-6.5	8.1	9.2	7.5	7.0
- S. Korea	1.7	3.5	2.2	-0.9	4.0	3.5	3.0	2.5
Emerging Europe	8.3	3.2	2.6	-2.1	6.5	-5.7	2.4	3.8
- Russia	3.1	2.1	2.2	-2.7	4.7	-12.0	-1.5	3.0
- Turkey	2.0	6.4	0.9	1.8	11.0	0.3	2.5	2.5
Latin America[3]	6.7	2.5	0.7	-6.9	6.9	2.5	1.9	1.7
- Brazil	2.4	1.4	1.2	-3.9	4.6	1.3	1.8	1.5
- Mexico	1.8	3.0	-0.2	-8.2	4.8	1.8	2.0	1.8
MENA	3.9	3.6	1.7	-3.9	3.2	7.1	4.8	2.7
- Saudi Arabia	1.2	4.0	0.3	-4.1	3.2	10.0	5.3	2.0
- Egypt	1.0	3.6	5.7	1.5	4.5	5.3	4.8	4.5
Sub-Saharan Africa	2.5	4.0	2.9	-2.2	4.5	3.3	3.2	3.2
- Nigeria	0.8	3.7	2.2	-1.8	3.6	2.3	2.3	2.0
- South Africa	0.6	1.9	0.1	-6.4	5.0	2.0	1.8	1.0

Sources: Refinitiv, CEIC, IMF, Capital Economics.

1) % of world GDP in 2021 PPP terms, 2) We use our own China Activity Proxy (CAP)-derived GDP estimates for China in aggregates for emerging Asia, emerging economies, and the world, 3) CE estimates from 2012 using old accounting methodology, 4) Excluding Venezuela.

Other Key Forecasts

Table 2: Other Key Forecasts

	Latest	Average 2010-2018	2019	2020	2021	Forecasts 2022	2023	2024
CPI Inflation[1]								
World[2]	5.9	3.2	2.6	2.3	3.5	5.9	3.3	2.5
Advanced economies	6.5	1.5	1.4	0.7	3.2	6.0	2.5	1.4
Emerging economies[2]	5.6	4.4	3.3	3.3	3.8	5.9	3.8	3.1
US	8.6	1.8	1.8	1.2	4.7	6.1	2.1	1.6
Euro-zone	7.4	1.4	1.2	0.3	2.6	7.0	3.0	1.5
Japan	1.2	0.5	0.5	0.0	-0.2	1.8	0.9	0.2
UK	7.0	2.3	1.8	0.9	2.6	8.7	4.4	1.2
China	1.5	2.6	2.9	2.5	0.9	2.5	0.8	1.4
World Trade[1,3]	6.5	4.1	-0.3	-5.2	10.3	3.0	2.0	2.5
Exchange Rates[4]								
US$ / €	1.07	1.22	1.12	1.22	1.14	1.00	1.10	1.15
Yen / US$	127	103	109	103	115	140	130	120
US$ / £	1.26	1.48	1.33	1.37	1.35	1.22	1.30	1.35
RMB / US$	6.55	6.47	6.96	6.53	6.36	7.00	7.00	7.00
Interest Rates[4]								
US[5]	0.25-0.50	0.50-0.75	1.50-1.75	0.00-0.25	0.00-0.25	2.50-2.75	3.25-3.50	3.00-3.25
Euro-zone[6]	-0.50	-0.13	-0.50	-0.50	-0.50	0.25	1.50	1.50
Japan[7]	-0.10	0.03	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10
UK[8]	0.75	0.50	0.75	0.10	0.25	2.25	3.00	2.50
Bond Yields[4,9]								
US	2.77	2.42	1.91	0.91	1.50	3.25	3.25	2.75
Germany	0.77	1.25	-0.19	-0.57	-0.18	1.00	1.50	1.50
Japan	0.25	0.54	0.00	-0.02	0.02	0.20	0.20	0.20
UK	1.79	2.12	0.83	0.20	0.97	2.75	2.75	2.25
Equity Index[4]								
S&P 500	4,175	1,856	2,563	3,179	3,696	4,000	4,250	4,500
Commodities[4]								
Oil[10]	105	82	53	66	52	100	80	70
Gold[11]	1,905	1,342	1,281	1,520	1,898	1,000	900	700
Copper[12]	9,864	6,844	6,062	6,087	7,772	9,000	8,000	7,500

Sources: Refinitiv, CEIC, IMF, Capital Economics.

1) % y/y, annual average, 2) Excluding Argentina, Venezuela & Turkey, 3) CPB real goods trade, 2021 = CE est., 4) End-year, 5) Federal Funds target range, 6) ECB deposit rate, 7) Bank of Japan IOER, 8) Bank Rate, 9) 10-year government bond yields, 10) Brent ($ per barrel), 11) $ per ounce, 12) $ per tonne.

Global Overview

Paying the price of high inflation

- We have revised our forecast for world growth this year to further below the consensus to reflect the growing ill effects of high inflation. The risks are still skewed to the downside. Most notably, monetary policy tightening could prompt a more dramatic tightening of financial conditions than we have envisaged or widespread lockdowns in China could have implications well beyond its borders.

- Inflation now looks set to be even higher than we had previously envisaged and above consensus expectations in most places this year. (See Chart 1.) Headline rates will fall as the year goes on due to base effects. But high inflation will drag on real incomes in the meantime and weigh heavily on spending, especially as consumer confidence is now low. (See Chart 2.)

- The war in Ukraine has not only added to pressure on energy prices but also affected confidence and risks adding to supply shortages. Our G7 Shortages Indicators offered some evidence that shortages eased in Q1 (see Chart 3), but they remain acute and now seem even more likely to persist in some form throughout the year. Europe is particularly exposed to the effects of the war via energy and supply chains and we now expect recessions in some economies including Germany.

- Central bankers will focus on stemming inflation rather than supporting activity and we broadly agree with markets' expectations that interest rates will rise sharply. (See Chart 4.) This synchronised and relatively aggressive tightening cycle is bound to depress activity. The compensation is that easing inflation should allow central banks to respond to the fragility of their economies and we see several *cutting* interest rates again by 2024, including the US Fed. This should pave the way for a decline in bond yields from late next year.

- Central banks in most emerging markets have already raised interest rates to tackle above target inflation and in some cases exchange rate risks and this is weighing heavily on activity. China is a notable exception where monetary and fiscal policy will be loosened this year. But this support will not offset the drags from a weak property sector, slowing exports and on-off restrictions related to its zero COVID policy.

- In all, we expect the global economy to grow by 2.8% this year, close to its post-GFC average. But this partly reflects a recovery from Omicron early in the year and the quarterly pace of growth will be too weak to allow world GDP to make up lost ground compared to its pre-virus path. (See Chart 5.) Our forecasts remain below the consensus and IMF projections for most major economies, although we expect China and Emerging Europe to underperform by the most. (See Chart 6.) The major commodity producers will be among the few to outperform as prices stay elevated.

- The risks still seem skewed to the downside and two stand out in particular. First, policy normalisation could be more damaging than we anticipate if stubbornly high inflation forces central banks to hike by more than we expect and/or if markets take fright. While we assume that the recent trend of a gradual tightening of financial conditions (see Chart 7) will continue, there is a risk of a sharper adjustment.

- Second, further large-scale virus outbreaks and lockdowns in China could have major adverse effects. In March, container throughput at Chinese ports was little affected, but domestic freight traffic slumped, which may presage a hit to port activity and trade flows in April. (See Chart 8.) More persistent virus restrictions could further expose vulnerabilities within the Chinese economy and in global supply chains.

Global Charts

Chart 1: CE vs. Consensus 2022 Inflation Forecasts (%)

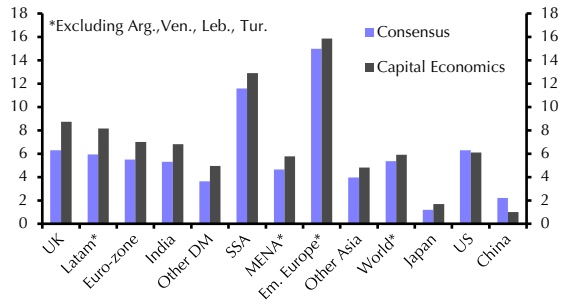


Chart 2: Consumer Confidence (Z-Scores, 2017-19 = 0)

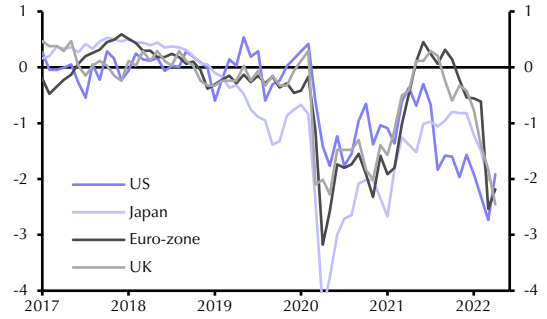


Chart 3: CE G7 Shortages Indicators (Z-Scores)

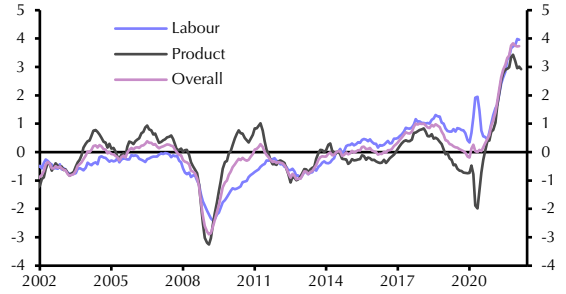


Chart 4: Policy Interest Rates (%)

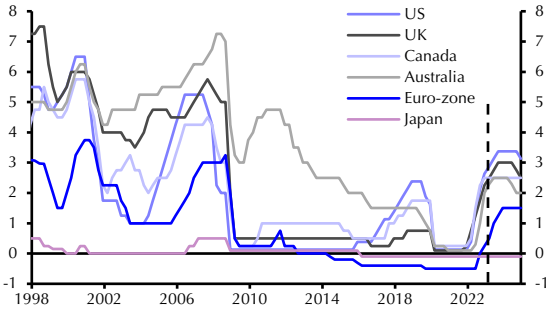


Chart 5: World GDP (International $, Trillions, Not Annualised, 2021 Prices & PPP Exchange Rates)

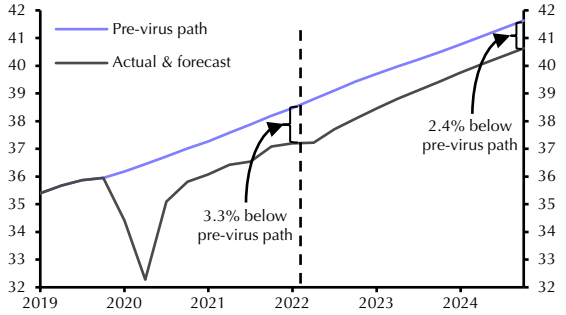


Chart 6: CE vs. Consensus vs. IMF 2022 GDP Growth Forecasts (%)

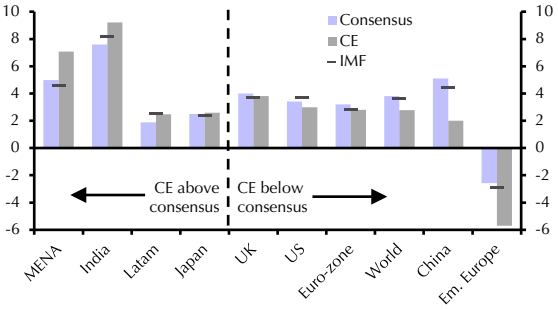


Chart 7: Global Financial Conditions Index (Z-Score)

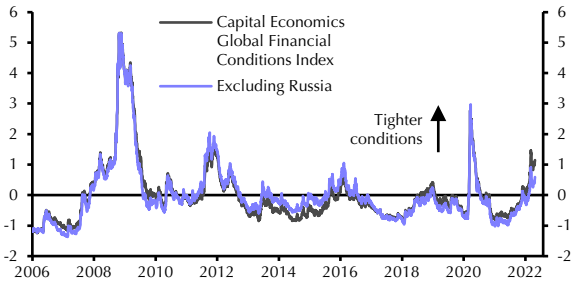
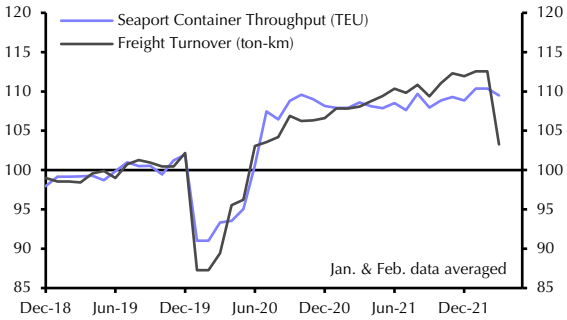


Chart 8: China Domestic Freight & Seaport Traffic (2019 = 100)



Sources: Refinitiv, CEIC, Focus, Capital Economics

United States

Economy will bend not break under higher rates

- We expect economic growth to remain below its 2% potential pace over the coming years, but think that the risks of a recession remain low. As supply shortages gradually improve and commodity prices drop back, lacklustre domestic demand growth will help drive inflation lower too, although core inflation won't return to target until 2024.

- After clinging desperately to its assessment that higher inflation was mostly transitory until late last year, the Fed has now lurched from one extreme to the other. With officials in such a hawkish mood, we expect them to hike the fed funds rate by 50bp at each of the next three FOMC meetings between now and late July.

- By that time, however, it should be obvious that GDP growth is slowing more sharply than Fed officials expect. (See Chart 9.) There are already signs of a global manufacturing slowdown. (See Chart 10.) We expect that weakness will persuade the Fed to revert to 25bp hikes in the second half of this year.

- We now believe that the fed funds rate will peak at between 3.25% and 3.50% in the first half of next year, a marginally more hawkish view than futures pricing or the Fed's own projections. (See Chart 11.) Even that aggressive tightening will only just push real rates back into positive territory, however. (See Chart 12.) Without a more severe tightening in financial conditions, we don't fear a recession, particularly not when private sector debt burdens are relatively low.

- Admittedly, rate-sensitive spending – that is residential investment, durable goods consumption and business equipment investment – rose sharply during the pandemic. (See Chart 13.) But it still accounts for a relatively low share of GDP, suggesting that the economy is well-placed to cope with higher rates. Inventories are also still unusually lean.

- Although price pressures have broadened in the past six months, the surge in energy prices and supply shortages still explain most of the rise in inflation. With crude oil prices dropping back and supply shortages gradually easing, headline inflation should fall back sharply soon. (See Chart 14.) Slower economic growth will add to the disinflationary pressure. We had expected core inflation to remain well above 2%, but the Fed's hawkish pivot means we now think it will return to target by 2024. (See Chart 15.)

Table 3: United States Key Forecasts (%y/y unless stated)

	Ave. 11-20	2021	Forecasts 2022	2023	2024
Private cons'ptn	1.7	8.1	3.1	2.2	2.0
Total fixed investm't	3.6	6.3	4.2	3.4	2.4
Gov't cons'ptn	0.2	1.0	0.4	1.0	0.9
Stockbuilding[1]	0.1	1.1	-0.7	-0.6	-0.4
Dom'stic demand	1.8	7.3	3.8	1.5	1.5
Exports	1.2	5.3	4.3	2.9	2.8
Imports	2.1	14.8	8.4	2.5	2.4
GDP	1.6	5.8	3.0	1.5	1.5
Consumer prices[2]	1.7	4.7	6.1	2.1	1.6
Real disp income	2.8	2.4	-3.6	2.6	2.1
H'hold sav. Ratio[3]	8.3	12.0	6.2	6.6	6.6
Employment	0.6	3.5	4.3	1.6	1.0
Unemp. rate[2,4]	6.1	5.4	3.5	3.2	3.3
Interest rate[4,5]	0.8	0.13	2.63	3.38	3.13
Federal gov't bal.[1]	-5.4	-13.1	-3.6	-3.1	-2.8
Current account[1]	-2.3	-3.6	-4.0	-3.7	-3.4

Sources: Refinitiv, CE. 1) As a % of GDP, 2) Year average, 3) As a % of disposable income, 4) %, 5) Mid-point of fed funds target range, end-year.

United States Charts

Chart 9: Real GDP

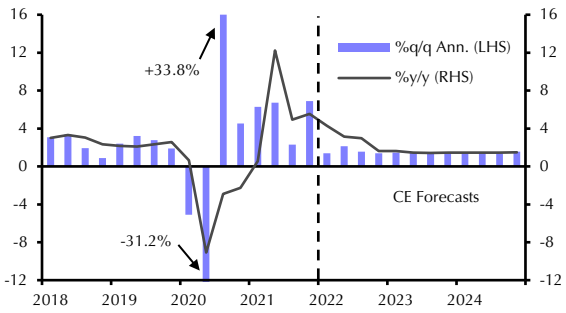


Chart 10: US & China Manufacturing PMIs

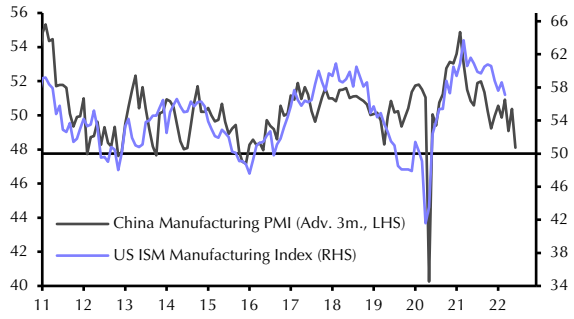


Chart 11: Fed Funds Rate Expectations (%)

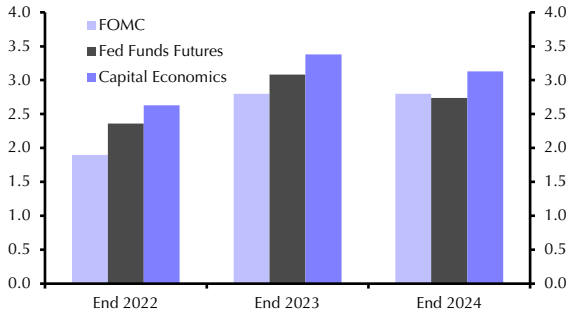


Chart 12: Real Fed Funds Rate (%)

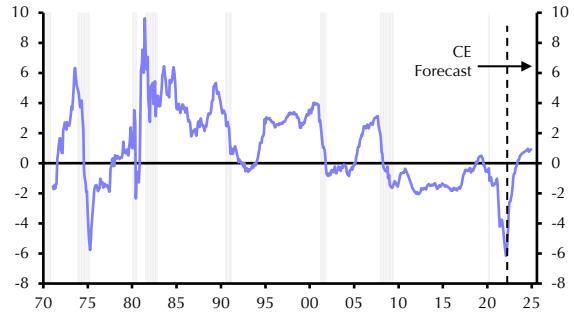


Chart 13: Int.-Rate Sensitive Expenditure (% of GDP)

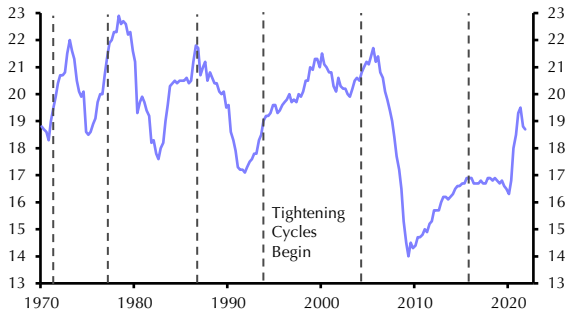


Chart 14: CPI Inflation (%)

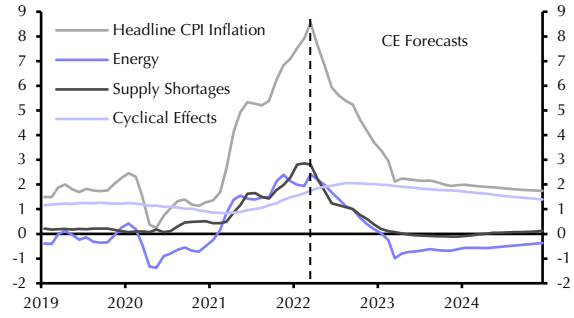


Chart 15: CPI Inflation (%)

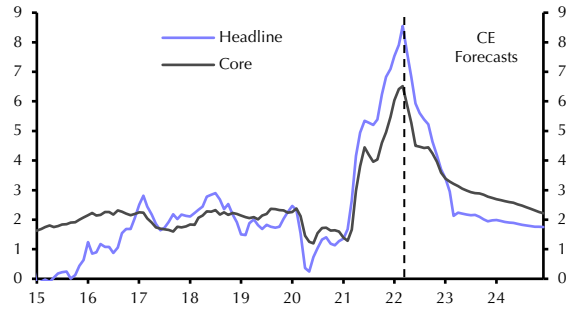
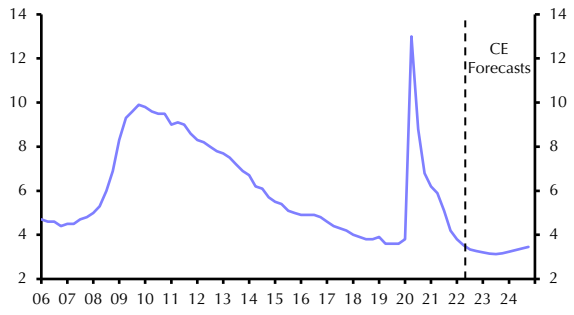


Chart 16: Unemployment Rate (%)



Sources: Refinitiv, S&P Global, CE, Federal Reserve

Euro-zone

A year of stagflation

- The Ukraine war has pushed the euro-zone to the brink of recession and simultaneously pushed up inflation. The ECB is likely to focus on price stability meaning it will end its asset purchases soon and raise rates to positive territory this year.

- Business and investor surveys published since Russia's invasion of Ukraine suggest that economic growth will slow sharply. (See Chart 9.) Russia and Ukraine account for only a small share of euro-zone exports but these sales are set to plummet. The war has also caused new supply-chain problems and damaged business confidence.

- Of course, households will benefit from the end of most Covid restrictions, and are likely to step up spending on travel and hospitality. But higher energy prices have hit real incomes and hit consumer confidence (see Chart 10), meaning that consumption will be weaker than previously anticipated.

- Investment has been recovering strongly from the pandemic-related downturn, and business surveys suggest that it may not be impacted too much by the conflict. (See Chart 11.) Exports, however, will slow due to weaker growth elsewhere. (See Chart 12.)

- Overall, we expect GDP to roughly flat-line for the next six months, which is much weaker than the ECB and economist consensus expects. (See Chart 14.) That said, annual GDP is still likely to increase due to the low base for comparison in 2021.

- The labour market looks set to remain tight. The unemployment rate is at a record low and Eurostat's broad measure of labour market slack, which includes people available for or looking for work, fell to its lowest level on record in 2021. (See Chart 12.) Also, business surveys suggest that employment will continue to rise.

- We now think headline inflation will peak at around 8.5% this year as high natural gas prices continue to feed through to the CPI. Inflation should fall late this year as the previous increases in energy inflation drop out of the year-on-year comparison. (See Chart 15.) Core inflation is also likely to rise further this year but we think it is most likely to settle around the 2% target over the medium term.

- We think the ECB will raise interest rates further than most anticipate this year and next as price pressures continue to build. (See Chart 16.) That said, we think the peak interest rate will be only around 1.5% given that inflation should drop back and the natural real rate is probably negative.

Table 6: Key Forecasts (% y/y, unless stated)

	Ave.		Forecasts		
	11-20	2021	2022	2023	2024
GDP	0.6	5.4	1.8	1.8	1.8
Private cons'ptn	0.0	3.5	2.5	2.2	2.2
Total fixed invest.	1.3	4.3	3.3	2.9	2.2
Gov't. cons'ptn	0.9	3.8	1.2	0.4	0.5
Dom'stic demand	0.4	4.1	1.9	2.0	1.8
Exports	2.8	10.9	4.9	1.3	1.5
Imports	2.6	8.6	5.4	1.6	1.6
Current account[1]	2.1	2.5	1.7	2.0	2.2
Headline Inflation	1.2	2.6	7.0	3.0	1.5
Core Inflation	1.1	1.5	3.5	2.7	2.0
Employment	0.5	1.3	1.3	0.3	1.0
Unemp. rate [2]	10.0	7.7	7.0	6.9	6.4
ECB Deposit Rate[3]	-0.2	-0.5	0.25	1.5	1.5
Gen'l gov't bal.[1]	-2.6	-5.3	-4.8	-3.0	-1.8
Gen'l gov't debt[1]	90	96	93	91	91

Sources: Refinitiv, Capital Economics
1) % of GDP, 2) % year average, 3) % year-end.

Euro-zone Charts

Chart 9: EZ Future Output PMI & GDP

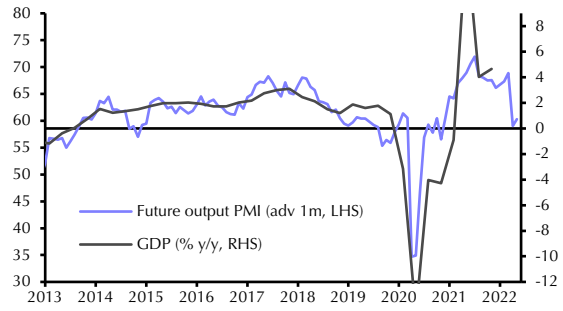


Chart 10: Euro-zone Consumer Confidence and Household Consumption

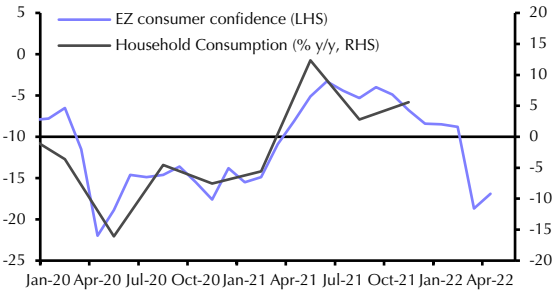


Chart 11: Investment and EC Business Climate Index

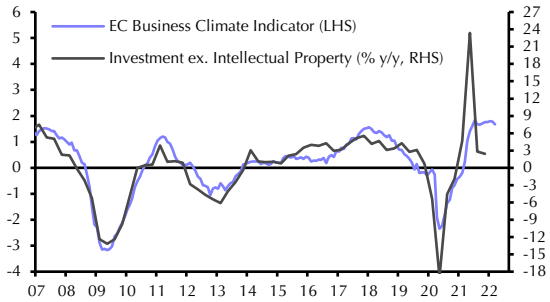


Chart 12: Total Exports & Exports Partners' GDP (% y/y)

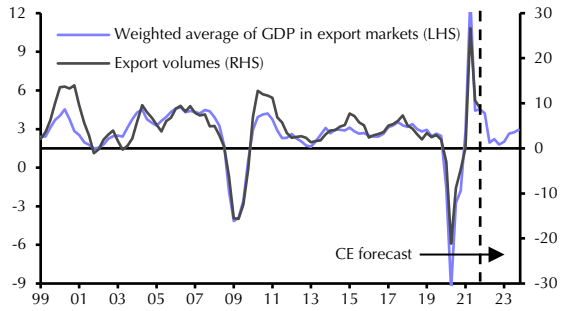


Chart 13: Euro-zone GDP (Q4 2019 = 100)

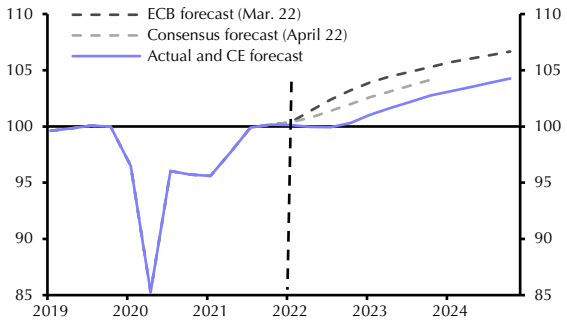


Chart 14: Broad Labour Market "Slack"* (% of Extended Labour Force)

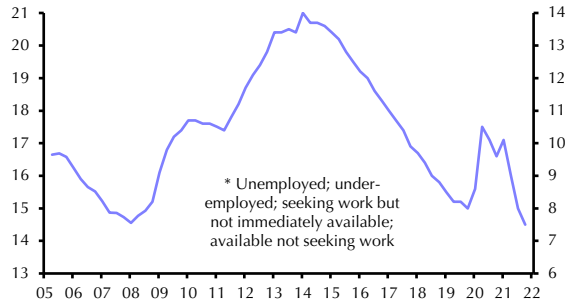


Chart 15: Euro-zone Inflation (%)

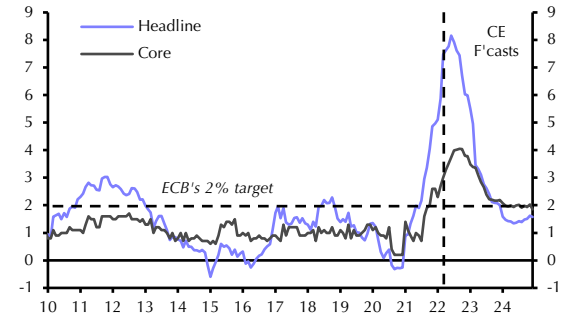
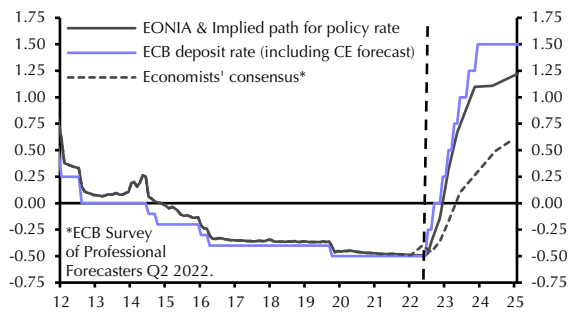


Chart 16: ECB Deposit Rate and Implied Rates (%)



Sources: Refinitiv, Markit, Capital Economics

Japan

BoJ's Yield Curve Control to be tweaked but not abandoned

- We expect Japan's economy to return to its pre-virus path by the end of the year. With the recovery from the pandemic complete, we expect GDP growth to slow from 2.6% this year to just 1.0% in 2024. The Bank of Japan won't respond to inflation rising above its 2% target by raising short-term interest rates. It may allow longer-term interest rates to rise a little but won't give up efforts to control them altogether.

- The Omicron wave resulted in a further decline in consumption in February and we expect a 0.5% q/q fall in Q1 GDP. (See Chart 25.) However, cases have been on the decline since mid-February (see Chart 26) and quasi-states of emergencies ended on 21st March.

- High energy prices and weak employment growth are a headwind to consumers. However, with the savings rates still far higher than it was before the pandemic, we expect consumption to bounce back in Q2 and to surpass its pre-virus level in the second half of the year, putting GDP on its pre-virus path. (See Chart 27.) That said, renewed virus outbreaks, continued consumer caution and persistent supply shortages could all prevent output from recovering as rapidly as we anticipate.

- The Ukraine war does not appear to have resulted in a marked worsening of supply shortages. (See Chart 28.) Even so, we now expect headline inflation to surpass 2% towards the end of the year. (See Chart 29.) That reflects the direct impact of higher energy prices as well as any pass-through of higher input costs.

- Japan's flagship car and machinery industries are less reliant on energy inputs than most other manufacturing sectors and their strong pricing power means that they are usually able to pass on higher energy costs to their clients. (See Chart 30.)

- However, we don't expect the Bank of Japan to respond with tighter monetary policy. For one thing, we expect inflation excluding fresh food and energy to peak at just over 1% later this year, well below the Bank's 2% target. (See Chart 29 again.) What's more, wage growth is unlikely to settle above 1% even if the unemployment rate continues to fall to 2.4% next year as we anticipate. (See Chart 31.)

- The Bank is having to fight to defend its 10-year yield target and has been forced to buy more bonds than usual in recent weeks. We don't think the challenge from bond vigilantes will make Yield Curve Control unsustainable but, as it did in 2018, the BoJ is likely to try to give itself some breathing space by widening the 10-year target band. Widening yield differentials have also weakened the yen. (See Chart 32.) As long-term Treasury yields keep rising, we expect the yen to weaken to 140/$ by the end of this year.

Table 5: Japan Key Forecasts (% y/y unless stated)

	Ave. 11-20	2021	Forecasts 2022	2023	2024
Private cons'ptn	0.3	1.7	2.6	2.6	1.1
Total fixed investm't	1.3	-1.4	1.1	2.4	0.5
Public demand	1.4	0.9	1.9	-0.4	-1.0
Domestic demand	0.5	0.7	2.5	1.7	0.4
Exports	1.3	11.8	5.8	5.6	4.1
Imports	2.3	5.2	5.5	1.0	0.5
GDP	0.3	1.7	2.6	2.6	1.1
Consumer prices	0.5	-0.3	1.8	0.9	0.2
Unempl. (%)[1]	3.6	2.8	2.6	2.4	2.4
Policy rate (%)	0.0	-0.1	-0.1	-0.1	-0.1
10-yr JGB yield target (%)	0.0	0.0	0.0	0.0	0.0
Gen'l gov't bal.[2]	-5.7	-6.8	-4.8	-3.5	-2.9
Current account[2]	2.7	2.8	1.4	2.8	3.9

Sources: Refinitiv, Capital Economics. 1) Yearly Average, 2) % of GDP.

Japan Charts

Chart 25: Consumption Activity Index & Industrial Production (Jan. 2020 = 100)

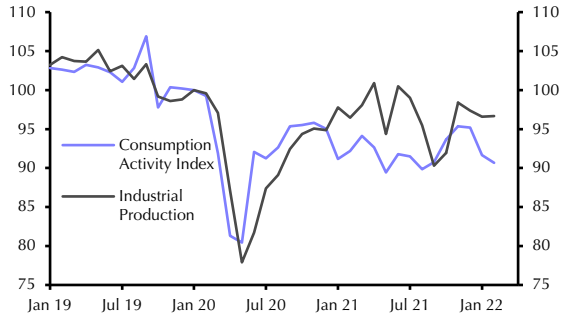


Chart 26: Virus Cases & Hospitalisations ('000)

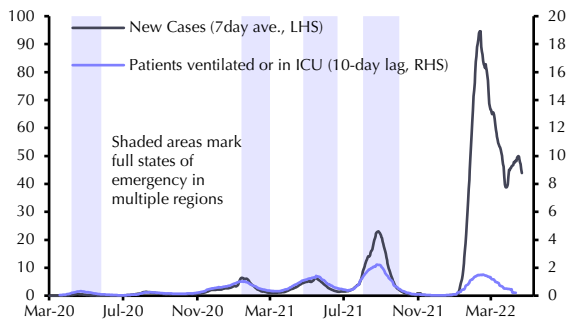


Chart 27: Real GDP (Yen tn)

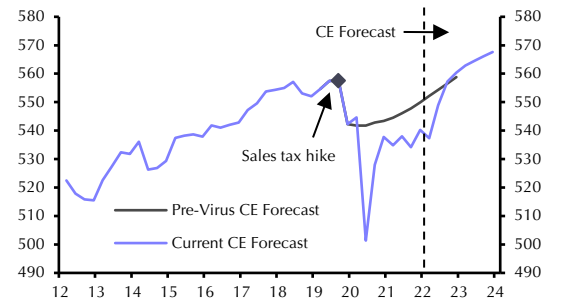


Chart 28: PMI Manufacturing: Suppliers' Delivery Times

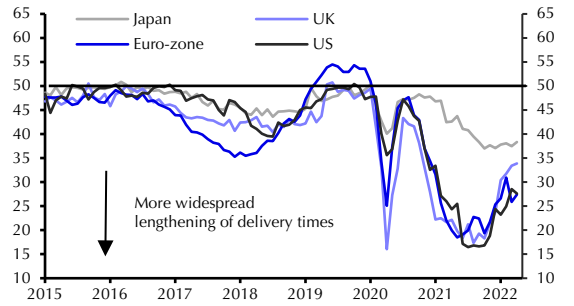


Chart 29: Consumer Prices (% y/y)

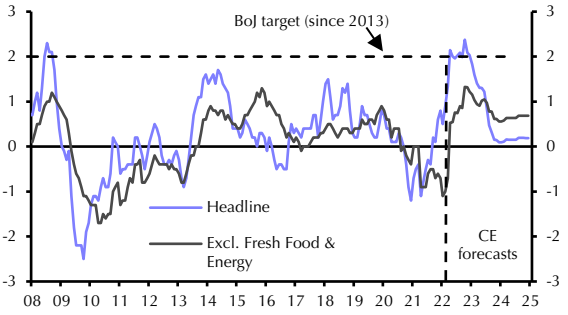


Chart 30: Impact of a 1%-pt rise in Energy Import Prices on Profit Margins (%-pts)

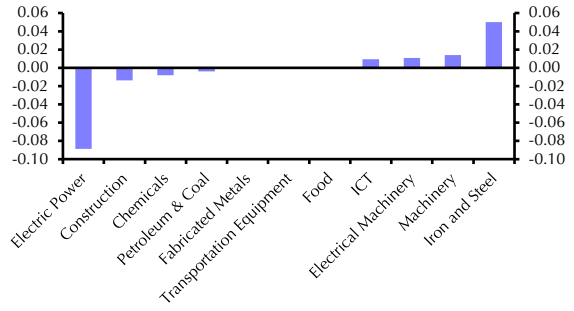


Chart 31: Unemployment Rate & Base Pay

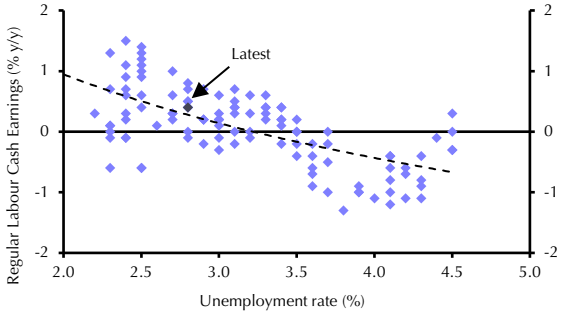
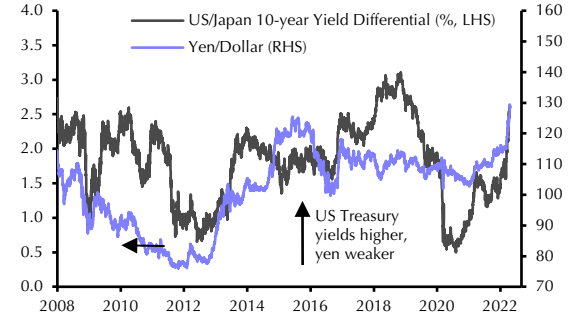


Chart 32: 10-year Treasury Yield & Yen/Dollar



Sources: CEIC, Refinitiv, Capital Economics

United Kingdom

Interest rates to rise to 3% to stamp out higher wage and price expectations

- Even though a further surge in CPI inflation to a peak of 10% will take the economy to the brink of recession, we think the Bank of England will raise interest rates further than most expect, from 0.75% now to a peak of 3.00% next year.

- The terms of trade shock (rise in UK import prices relative to UK export prices) triggered by the war in Ukraine will have a dual effect on the economy. (See Chart 33.) First, inflation will be higher for longer. We have revised up our forecast and now expect CPI inflation to rise from 7.0% in March to a peak of 10.0% in October. (See Chart 34.)

- Second, it will lower real domestic incomes. We have revised down our forecast for real household disposable income so that it falls by 3.3% this year. That would be the largest drop on record. (See Chart 35.)

- This won't lead to a big fall in real consumer spending as there is still scope for households to reduce their saving rate and/or dip into their excess savings to compensate. But with consumer confidence at a record low in March, real consumer spending may well fall in both Q2 and Q3. (See Chart 36.)

- Even so, the economy may avoid a recession, although our forecast that GDP won't rise in Q2 and Q3 means it's going to be close and a decline is possible. Base effects mean annual GDP growth will still be 3.8% this year, but it will slow to 1.2% in 2023 and 1.5% in 2024.

- This will reduce price pressures further ahead. And inflation will probably fall sharply after October when the boost from the surge in global energy prices fades. (See Chart 34 again.)

- But a tight labour market will probably mean that domestic price pressures continue to build this year and next. We think the limited number of workers will mean that even as jobs growth slows the unemployment rate will stay close to 4.0% in both 2022 and 2023. (See Chart 37.)

- This means that the global element of the rise in inflation is more likely to feed into the "second-round" effects that would keep inflation above the 2% target despite a weaker economy. Price expectations have risen sharply and we think that wage growth will rise by more than most forecasters expect. (See Charts 38 & 39.)

- As a result, we have revised up our forecasts for interest rates. We now think that, even as the economy flatlines or briefly contracts, the Bank will raise rates from 0.75% now to 2.25% by December and to a peak of 3.00% next year. That would leave rates higher than investors and other analysts expect. (See Chart 40.)

Table 6: UK Key Forecasts (% y/y unless stated)

	Avg.		Forecasts		
	10-19	2021	2022	2023	2024
Private cons'ptn	2.1	6.2	4.1	0.8	2.1
Total fixed invest.	3.1	5.9	3.2	1.1	-0.5
Gov't cons'ptn	1.1	14.3	3.4	1.2	1.4
Stockbuilding[1]	0.3	0.0	1.4	0.8	0.8
Domestic demand	2.2	8.5	5.2	0.1	1.2
Exports	3.4	-1.3	5.5	4.3	4.1
Imports	3.8	3.8	10.3	0.2	2.6
GDP	2.0	7.4	3.8	1.2	1.5
Consumer prices[2]	2.2	2.6	8.7	4.4	1.2
RPIX[2,3]	3.1	4.2	10.5	5.5	2.1
Real disp income	1.9	1.1	-3.3	1.1	4.3
H'hold sav. ratio[4]	7.3	10.7	3.4	3.7	5.6
Employment	1.2	-0.5	0.1	0.1	0.9
Unemp. rate[2]	6.0	4.5	3.8	4.1	4.5
Interest rate[5]	0.53	0.25	2.25	3.00	2.50
PSNB[1]	4.8	5.5	3.9	1.9	1.8
Current account[1]	-3.9	-2.6	-3.6	-2.8	-2.1

Sources: Refinitiv, Capital Economics. 1) % of GDP, 2) Annual average, 3) Retail Price Index exc. mortgage interest, 4) As a % of disposable income, 5) Bank Rate, end period.

United Kingdom Charts

Chart 33: Terms of Trade Index (Q4 2021 = 100)

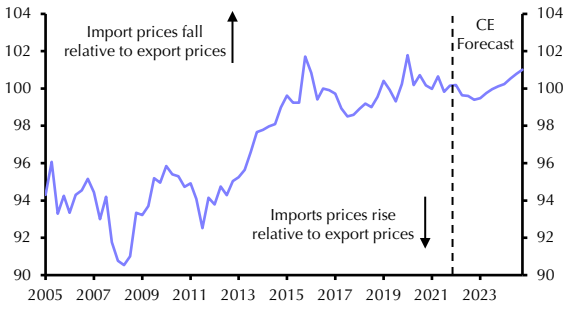


Chart 34: CPI Inflation (%)

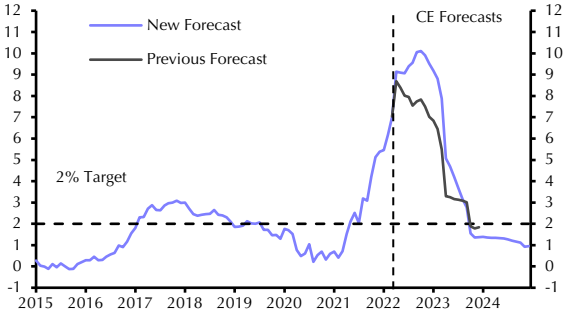


Chart 35: Real Household Disposable Income (%y/y)

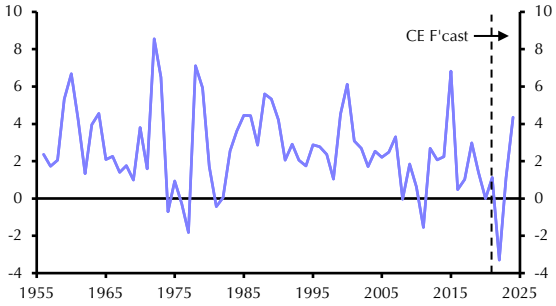


Chart 36: Real Consumer Spending & GDP (%q/q)

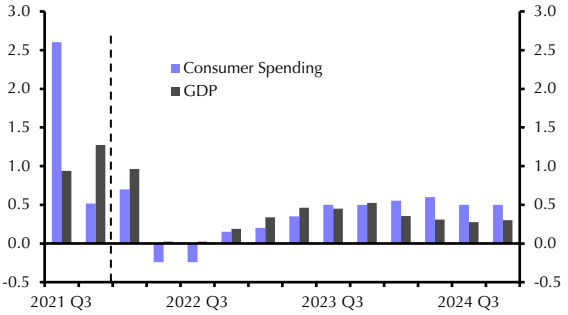


Chart 37: ILO Unemployment Rate (%)

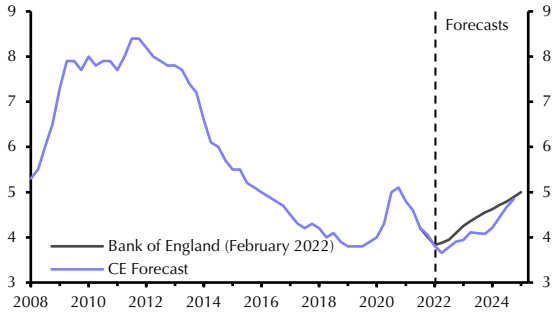


Chart 38: BoE Decision Makers Panel Selling Prices (%)

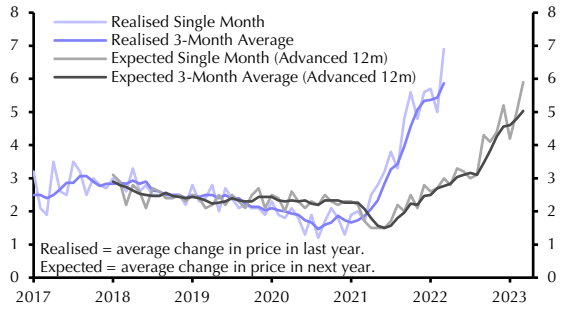


Chart 39: Average Earnings (%3myy)

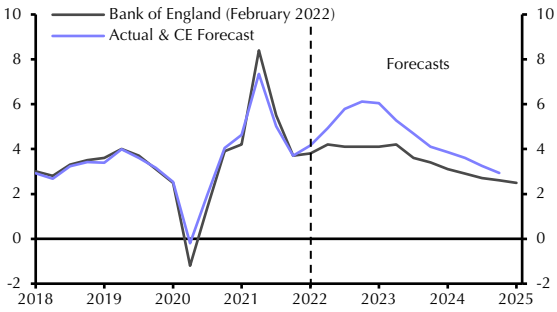
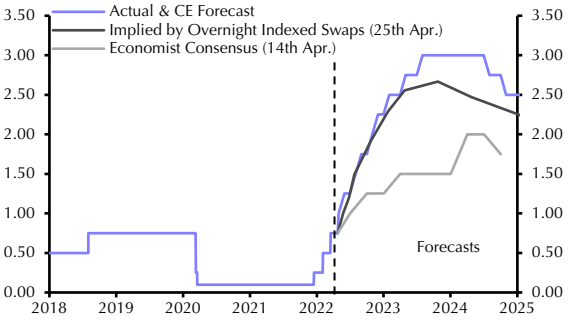


Chart 40: Bank Rate (%)



Sources: Refinitiv, OBR, Bank of England, Capital Economics

Canada

Tighter policy to drive GDP growth below potential

- Canada's economy looks more vulnerable to interest rate hikes than many of its peers. As the Bank of Canada rapidly tightens policy to quell inflation, we expect GDP growth to slow below its long-run potential in 2023.

- The economy will admittedly be firing on all cylinders for the next couple of quarters, benefitting from the return to normalcy following the earlier lifting of the pandemic restrictions, an easing of global supply shortages, and the substantial improvement in the terms of trade thanks to elevated commodity prices. At a time when consumer price inflation is already near 7% and inflationary pressures have broadened (see Chart 41), that solid momentum has prompted a dramatic hawkish shift by the Bank. We are concerned, however, that the Bank could misjudge the sensitivity of the economy to interest rate hikes.

- The Bank's communications lead us to think it will raise its policy rate to 2.5% by as soon as the October policy meeting. If so, it will have hiked rates by 225 bp in just eight months. That would be the most rapid tightening since the mid-1990s (see Chart 42) but, back then, the level of interest rates was much higher. The proportionate impact on borrowing costs will therefore be substantially greater this time. For example, our policy rate forecast implies that there will be a near 20% hit to affordability in the housing market compared to last year, which is three times as large an impact as during the previous tightening cycle in 2017/18.

- With little time to judge the impact of its hikes on the overvalued housing market (see Chart 43) and an economy unusually reliant on the most interest rate sensitive component of GDP, residential investment (see Chart 44), the Bank risks making a policy error.

- Although our forecast for the policy rate to peak at 2.5% is below the market-implied peak of more than 3% (see Chart 45), we still judge it will be enough to cause GDP growth to slow below potential next year, as residential investment declines. (See Chart 46.)

- The slowdown in GDP growth that we forecast should be enough to help inflation fall toward the 2% target. The current elevated rate of inflation is still being driven in large part by elevated goods inflation (see Chart 47), which should reverse as supply shortages ease and commodity prices drop back. And with productivity in Canada still more than 2% below the pre-pandemic level, the rebound in productivity growth that we expect this year will help to keep domestic price pressures at bay even as wage growth picks up. (See Chart 48.)

Table 7: Canada Key Forecasts (% y/y unless stated)

	Avg. 11-20	2021	Forecasts 2022	2023	2024
Private cons'ptn	1.5	5.2	4.6	2.6	2.0
Total fixed investm't	0.7	7.8	3.3	0.1	0.8
Gov't cons'ptn	1.2	4.9	1.2	1.2	1.2
Stockbuilding[1]	0.0	0.6	0.4	-0.2	-0.1
Dom'stic demand	2.2	5.5	3.5	1.8	1.6
Exports	1.9	1.4	4.8	6.3	2.6
Imports	1.2	7.4	5.1	5.1	1.7
GDP	1.4	4.6	4.2	2.2	1.7
Consumer prices[2]	1.7	3.4	6.3	3.0	1.8
Real disp income	2.8	0.4	-3.0	1.8	2.3
H'hold sav. Ratio[3]	4.4	10.9	3.5	2.7	3.0
Employment	1.3	5.0	4.3	0.8	0.6
Unemployment[2]	6.8	7.5	5.1	5.2	5.5
Interest rate[4]	1.8	0.3	2.5	2.5	2.5
Federal gov't bal.[1]	-1.0	-6.0	-2.0	-1.5	-1.5
Current account[1]	-2.8	0.1	1.3	0.8	0.8

Sources: Refinitiv, CE. 1) As a % of GDP, 2) Year average, 3) As a % of disposable income, 4) Bank of Canada overnight target rate (end of period).

Canada Charts

Chart 41: Number of Components Rising by >1% m/m (out of 55, three month rolling average)

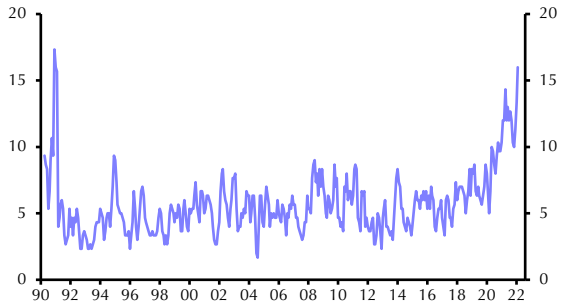


Chart 42: Hikes Per Month During Tightening Cycle (bp)

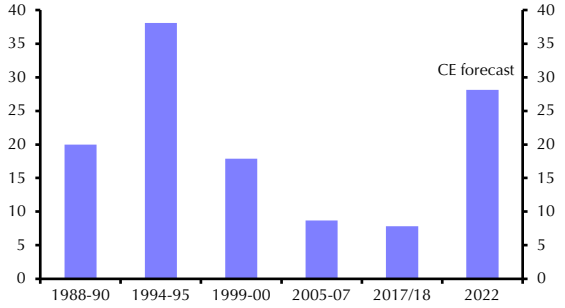


Chart 43: House Price Affordability ($,000)

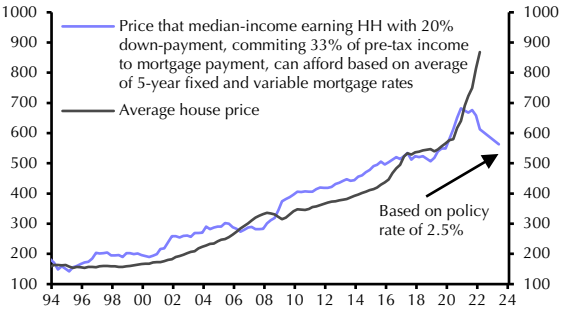


Chart 44: Residential Investment (% of GDP)

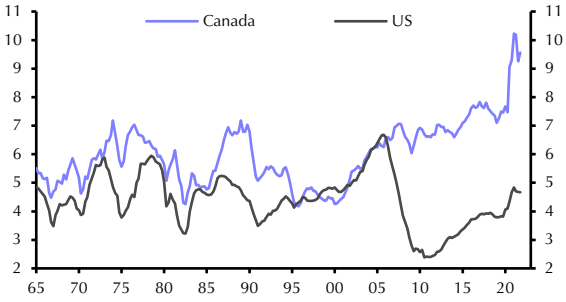


Chart 45: Policy Rate Implied by OIS (%)

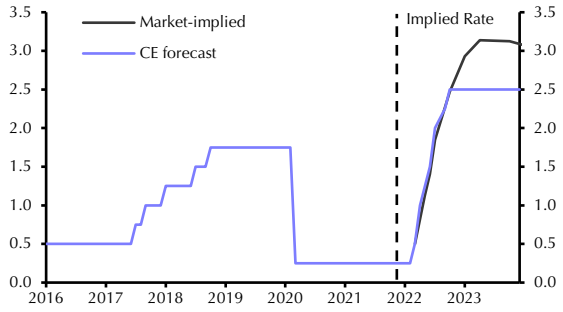


Chart 46: GDP

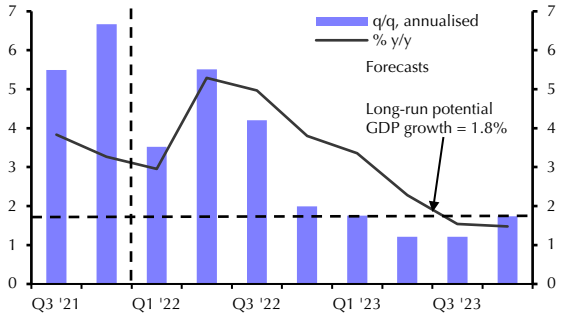


Chart 47: Inflation (%)

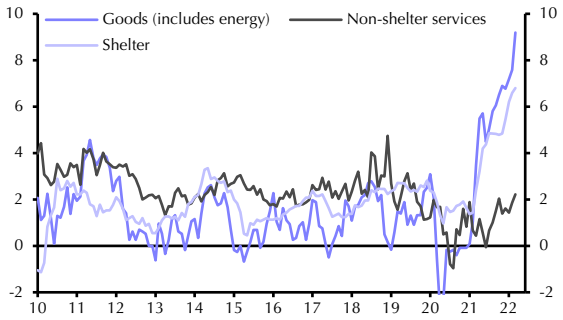
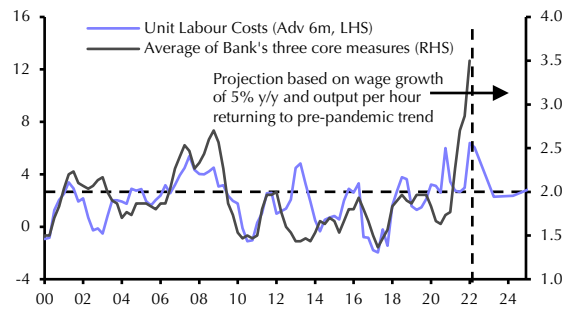


Chart 48: Unit Labour Costs & Core Inflation (% y/y)



Sources: Refinitiv, Bloomberg, Capital Economics

Australia & New Zealand

Sharp policy tightening to weigh on activity and housing markets

- With inflation set to reach multi-year highs, we expect the RBA to start tightening in June and lift rates to 2.5%, while the RBNZ will hike to 3.0%. That tightening cycle will over time weigh on activity and the housing market, prompting central banks to reverse course.

- New Zealand's economy seems to have been hit a bit harder than Australia by the ongoing Omicron wave as card transactions fell in both February and March. (See Chart 1.) But with Auckland's lockdown only ending in mid-December, we've pencilled in a further strong rise in consumption in both countries in Q1.

- Looking ahead, we suspect that Australia's economy will gain some ground relative to New Zealand. (See Chart 2.) For one thing, the household savings rate in New Zealand is now around its pre-virus level and won't fall any further. By contrast, it's still well above pre-pandemic levels in Australia and a further fall should propel continued strong gains in consumption. (See Chart 3.)

- The housing boom is stalling in both countries, and prices have already started to fall in New Zealand. Even so, housing affordability in the latter is the most stretched on record. (See Chart 4.) We expect house prices to fall by 10% in both countries with price declines starting in the first half of next year in Australia.

- On paper, the surge in energy prices in the wake of the Ukraine war is great for Australia as the country's energy exports are nearly three times as large as its imports. (See Chart 5.) Indeed, we expect Australia's terms of trade to rise by double digits yet again this year.

- What matters though is how that money is spent. Miners have not responded to the prolonged rise in commodity prices in recent years with a marked pick-up in capital spending. And soaring petrol prices are a key reason why consumer confidence has soured in recent months. (See Chart 6.)

- Labour markets in both countries are now the tightest in more than a decade and price pressures are building. Business surveys suggest that Australia's trimmed mean inflation will rise at an even faster pace than the 1.0% q/q rise in Q4 and we expect annual trimmed mean inflation to surpass 4% this year, with headline inflation approaching 5%. (See Chart 7.) With the RBA no longer signalling that it will be patient when assessing the outlook for inflation, we expect the Bank to start hiking in June. We expect rates to peak at 2.5% in Australia and at 3.0% in New Zealand.

- However, we expect housing markets to tank in both countries as higher borrowing costs weigh on affordability. We're assuming that inflation will come under control over the coming year, allowing central banks to respond to weaker activity with policy easing. We've pencilled in 75bp of rate cuts by the RBNZ from 2023 and 50bp by the RBA in 2024. (See Chart 8.)

Table 8: Australia & New Zealand (%y/y unless stated)

	Avg. 11-20	2021	Forecasts 2022	2023	2024
Australia					
GDP	2.1	4.7	4.8	2.1	1.6
Unemployment[1]	5.6	5.1	3.9	3.7	4.2
Consumer prices[2]	1.9	2.9	4.5	3.2	2.4
RBA cash rate[3]	2.1	0.10	2.00	2.50	2.00
Gen'l gov't bal[4]	-2.5	-3.7	-2.7	-2.6	-2.1
Current account[4]	-2.3	3.5	3.7	3.5	1.6
New Zealand					
GDP	2.3	5.6	3.6	1.9	1.7
Unemployment[1]	4.4	3.8	3.7	4.3	4.7
Consumer prices[2]	1.7	3.9	6.1	2.8	2.3
RBNZ cash rate[3]	2.4	0.8	3.0	2.5	2.3
Gen'l gov't bal[4]	-0.8	-5.5	-0.2	0.3	1.2
Current account[4]	-2.9	-5.6	-6.5	-4.3	-3.5

Sources: Refinitiv, Capital Economics. 1) Unemployment rate, 2) Year average, 3) End-year, 4) As a % of GDP.

Australia & New Zealand Charts

Chart 1: Consumption (Feb. 2020 = 100)

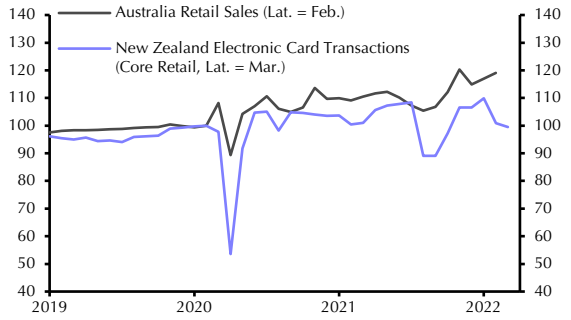


Chart 2: Real GDP (Q4 2019 = 100)

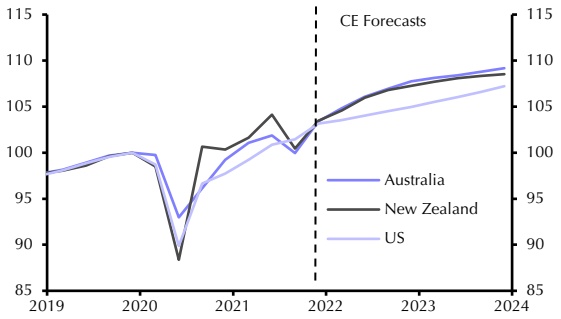


Chart 3: Household Saving Rates (% of Disp. Income)

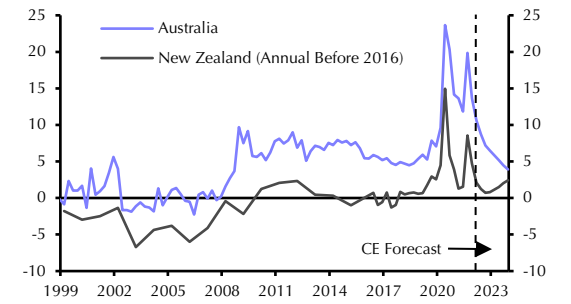


Chart 4: Mortgage Payments Required to Buy Median Priced House (% of Income)

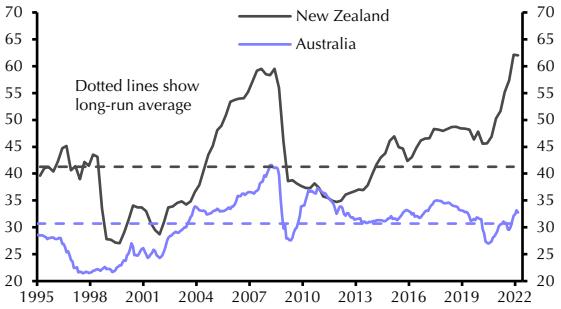


Chart 5: Australia Real Energy Exports & Imports ($bn)

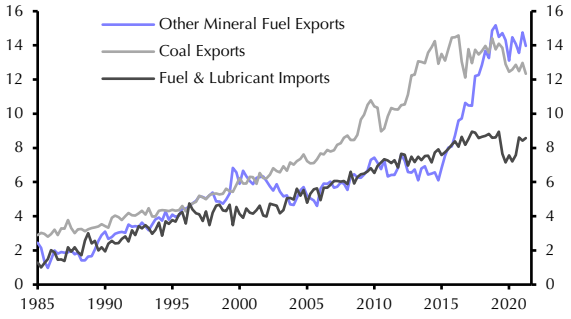


Chart 6: Aus. Consumer Confidence & Real Consumption

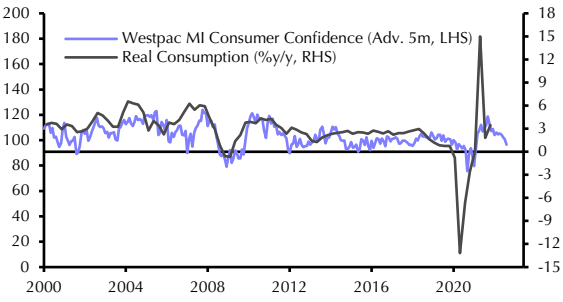


Chart 7: Consumer Prices (% y/y)

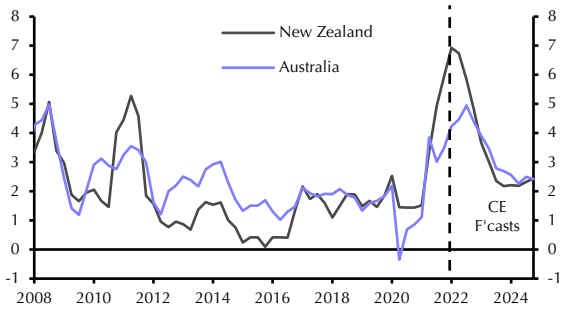
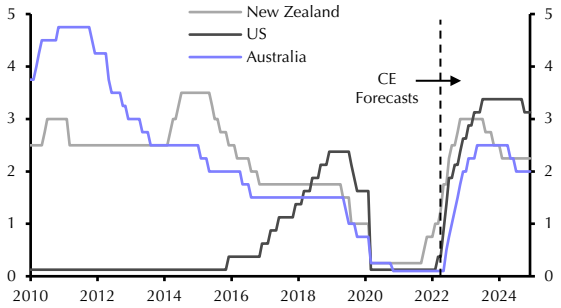


Chart 8: Policy Rates (%)



Sources: Refinitiv, RBA, CoreLogic, CEIC, StatsNZ, Capital Economics

The Nordics & Switzerland

Constrained by weaker euro-zone growth

- Higher energy prices will squeeze household incomes this year, and flat-lining growth in the euro-zone will also weigh on exports. But the higher prevalence of renewables than in most of Europe means the squeeze on incomes will be less acute, and Norway even stands to *benefit*.

- The war in Ukraine has dented consumer confidence, particularly in Sweden (see Chart 57), and has hit Swiss business confidence too. (See Chart 58) We have lowered our already below-consensus 2022 GDP forecasts for both countries. Norway is the exception, with strong demand for its energy exports and high prices set to support activity. (See Chart 59.)

- Headline inflation rates have risen further than expected, but will peak at a lower level than in the euro-zone and will fall back in H2. (See Chart 60.) As elsewhere, though, the broadening out of price pressures has brought policy tightening up the agenda.

- Against this backdrop, the risk is that the Norges Bank hikes rates more than the once-per-quarter pace that has typically been a speed limit in the past. In contrast, the greater sensitivity of households to rate hikes in Sweden means that the Riksbank will tread more cautiously. Meanwhile, the prospect of 75bps of rate hikes by the ECB this year will give the SNB cover to finally start to lift interest rates away from their extreme position below zero (See Chart 61.)

- The combination of a likely measured approach to rate hikes by the Riksbank and wider deterioration in risk sentiment will leave the Swedish krona vulnerable against the euro this year. We forecast it to lose ground against the Norwegian krone, which will be supported by higher oil prices and a hawkish Norges Bank. Conditions will shift in favour of the SEK later in our forecast horizon as commodity prices decline, though, and the NOK will give up the gains in 2023/24. (See Chart 62.)

- Meanwhile, recessionary conditions in Europe will contribute to the Swiss franc drifting back towards parity against the euro this year. But if euro-zone growth and risk appetite improves further out, as we expect, the franc should ease back thereafter. (See Chart 63.)

- Recent rises in long-term government bond yields have mirrored those seen in major markets and we expect further increases over the coming years. The Swiss 10-year government bond yield is likely to move in line with the German bund this year, but normal service of a negative rate differential will be re-stablished next year. (See Chart 64.)

Table 9: The Nordics & Switzerland Key Forecasts

	GDP (% y/y)				CPI Inflation (%)				Policy Rates (%)[3]			
	2021	2022	2023	2024	2021	2022	2023	2024	2021	2022	2023	2024
Switzerland	3.7	2.0	1.8	2.0	0.6	2.3	0.9	0.5	-0.75	-0.25	1.00	1.00
Sweden[1]	3.7	2.0	1.8	2.0	2.4	5.0	2.0	2.0	0.00	1.00	2.00	2.00
Norway[2]	4.2	3.7	2.3	2.0	1.7	2.5	2.3	2.1	0.00	1.50	2.50	2.50
Denmark	4.7	2.8	2.0	2.0	1.9	5.5	2.0	2.3	-0.60	0.00	1.25	1.25

Sources: Refinitiv, Capital Economics. 1) CPIF, 2) Mainland GDP & CPI-ATE, 3) end year.

Nordics & Switzerland Charts

Chart 57: Sweden Consumer Confidence & Household Consumption

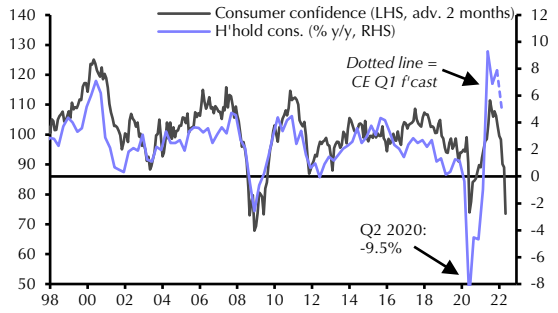


Chart 58: Switzerland KOF & GDP

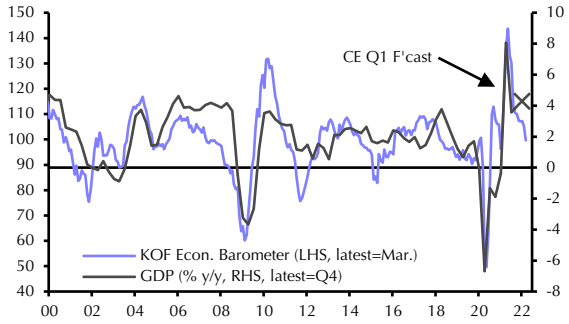


Chart 59: Real GDP (Q4 2019 = 100)

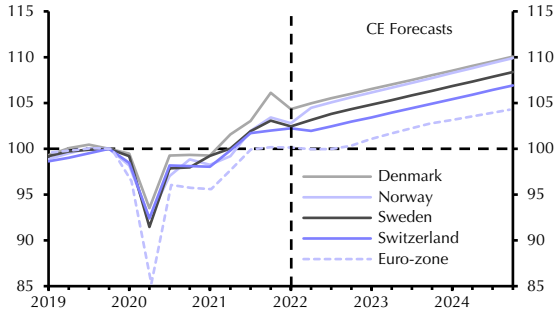


Chart 60: CPI Inflation (%)

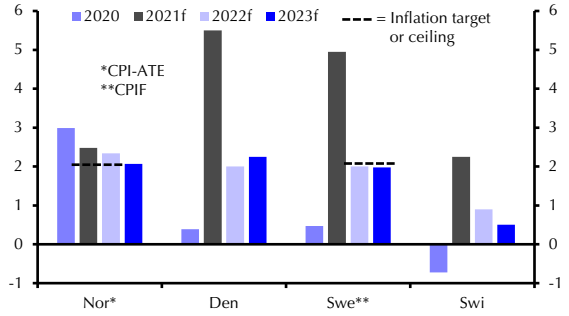


Chart 61: Policy Interest Rates (%)

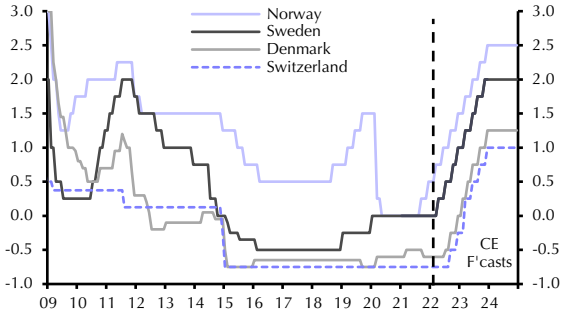


Chart 62: Norwegian Kroner per Swedish Kronor

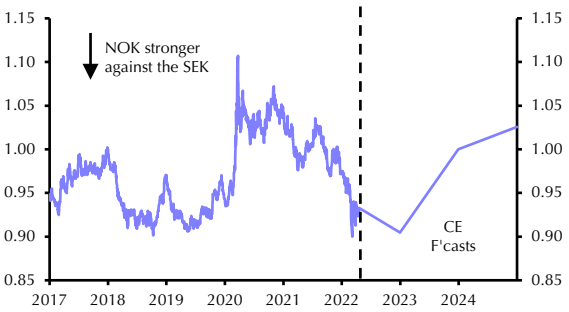


Chart 63: Swiss Franc Exchange Rates

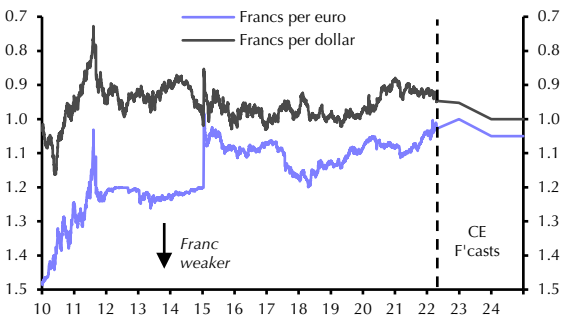
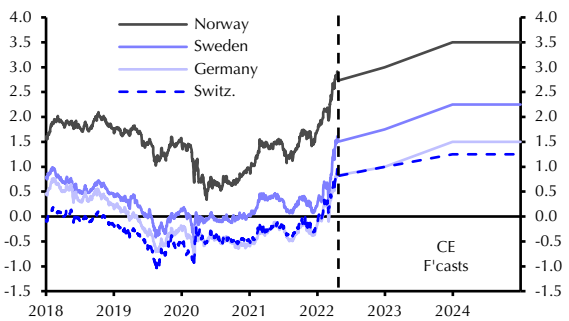


Chart 64: 10-Year Government Bond Yields (%)



Sources: Refinitiv, Capital Economics

China

No quick fix this time

- China's economy rebounded sharply from the initial COVID-19 outbreak. The recovery will be slower and more muted this time, even if the ongoing COVID outbreak is successfully quashed, as less policy support is planned and exporters face a reversal in fortunes.

- The official GDP figures suggest that q/q growth remained robust last quarter. But we don't think this reflects reality. Our China Activity Proxy (CAP) suggests that output fell in Q3 last year and has since been largely stagnant. (See Chart 65.) The main culprits have been the property downturn and disruption from virus outbreaks, which has hit the service sector especially hard. (See Chart 66.) High-frequency data suggest that activity has weakened even further at the start of Q2. (See Chart 67.)

- The virus wave is coming under control in Shanghai. 95% of cases there are now among people in quarantine, suggesting that the authorities are close to eradicating community transmission. The share of economic activity in areas with outbreaks has fallen. (See Chart 68.)

- But there is a great deal of uncertainty over what happens next, with Beijing now appearing on the brink of its own outbreak. Our base case is that officials learn from recent mistakes, refine their strategy, and get back to being able to isolate virus clusters quickly with limited disruption, as they did in Tianjin and Shenzhen.

- If so, there is plenty of scope for in-person services activity to rebound. Home sales have been held back by lockdowns recently, but they had stabilised around the turn of the year as the regulatory stance shifted from headwind to tailwind (see Chart 69) and should also pick up if virus restrictions and concerns ease.

- Overall though, the recovery will be much less impressive than that following the initial outbreak in early 2020. At the time, China benefitted from a surge in foreign demand as the pandemic boosted global appetite for Chinese consumer goods. But with this shift in consumption patterns now reversing and backlogs easing, exports are likely to come back to earth over the coming quarters. (See Chart 70.)

- Policy easing will offer less of tailwind this time too. Officials appear wary about the costs of another round of large-scale stimulus. The fiscal support laid out in this year's budget was modest and monetary easing has so far been restrained. Policymakers have the tools to do more and we expect them to loosen a bit further. But the resulting pick-up in credit is likely to be underwhelming. (See Chart 71.)

- The authorities will most likely publish GDP figures showing them meeting their annual growth target on paper. But the reality will be a lot less rosy – we now expect the economy to expand by only 2.0% this year. (See Chart 72.) And risks remain skewed to the downside given the possibility of further large-scale virus outbreaks and the commitment to COVID zero.

Table 10: China Key Forecasts (% y/y unless stated)

	Ave. 11-20	2021	Forecasts 2022	2023	2024
GDP (CAP-based)[1]	5.6	8.2	2.0	6.0	4.0
GDP (Official) [1]	6.8	8.1	5.3	5.0	4.5
Consumer Prices[1]	2.5	0.9	1.0	1.1	1.3
Policy Rate[2]	2.85	2.20	1.90	1.90	1.90
Exchange Rate[2,3]	6.51	6.37	7.00	7.00	7.00
Gen'l gov't bal [4]	-3.3	-3.8	-4.6	-4.4	-4.9
Current Account[4]	1.7	1.8	1.5	0.5	0.0

Sources: CE.
1) Annual Average, 2) end-period, 3) vs. US Dollar, 4) % of GDP,

China Charts

Chart 65: GDP & CE China Activity Proxy (2019=100, seas. adj.)

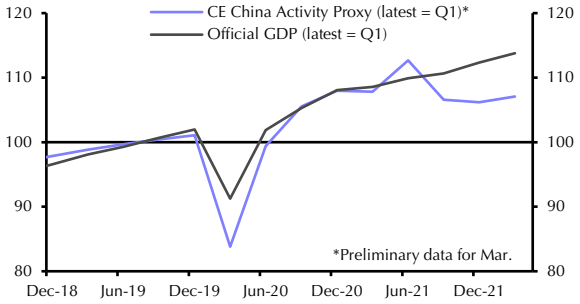


Chart 66: CAP Sector Proxies (2019=100, seas. adj.)

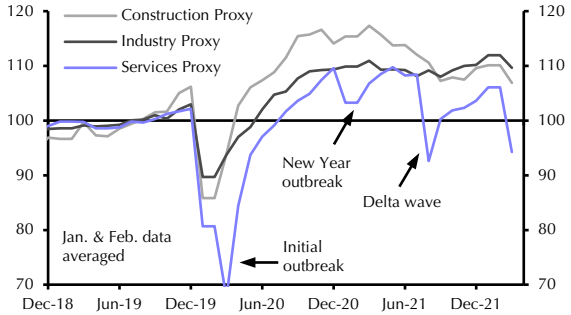


Chart 67: Daily Activity Indicators (% of 2019)

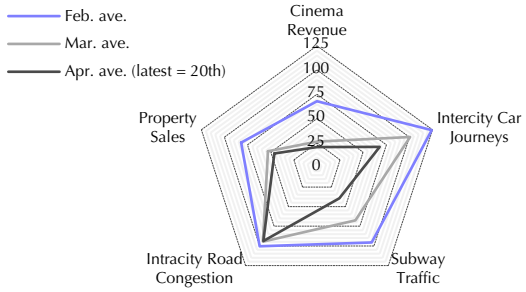


Chart 68: Activity in Areas with Local Outbreaks (%)

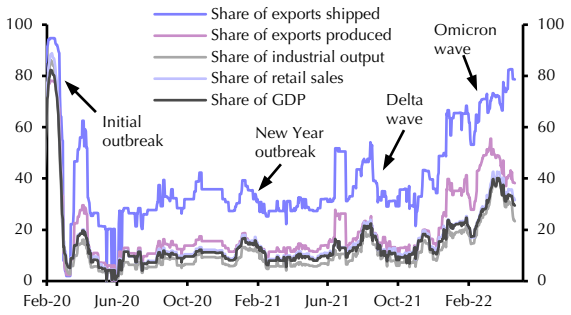


Chart 69: New Home Sales (sqm mn, seas. adj.)

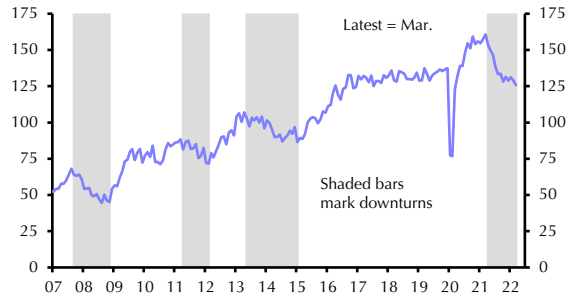


Chart 70: Exports vs Trading Partner GDP (2019 = 100)



Chart 71: Broad Credit (AFRE)

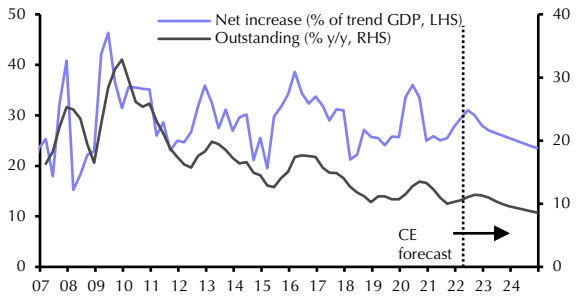
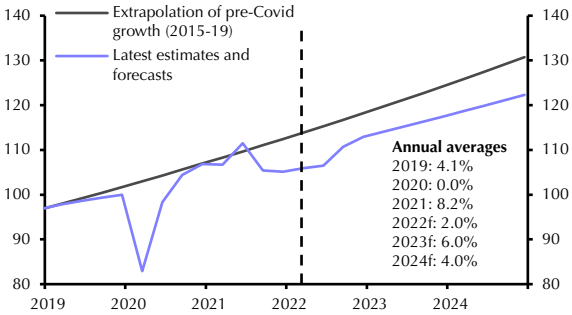


Chart 72: CE China Activity Proxy (Q4 2019 = 100)



Sources: CEIC, Refinitiv, WIND, Capital Economics

India

Inflation will force the RBI's hand

- The surge in global commodity prices will take a little gloss off India's recovery this year but we still expect stronger GDP growth than the consensus. Higher commodity prices will also keep inflation high, which we think will force the RBI to raise rates by more than most expect.

- High frequency data show that activity has been quick to rebound from the Omicron wave at the start of the year. (See Chart 73.) The ongoing vaccination campaign will put India in a better position to deal with future outbreaks. At current rates, almost 75% of the population will be fully vaccinated by end-year. (See Chart 74.) The expansionary budget for FY22/23 should help to boost aggregate demand too.

- However, the surge in commodity prices brought about by the war in Ukraine is a key headwind given India's position as a large net importer. Industry is particularly exposed to higher oil prices. That, along with increases in the prices of industrial metals and other energy commodities, will weigh on firms' profit margins and thus investment intentions.

- We now expect GDP growth of 9.2% this year (previously 10%). But even on our new forecast, growth will be faster this year than last and stronger than the consensus expects. (See Chart 75.) Further ahead, we expect growth to remain slightly above trend in 2023 and 2024.

- Consumer price inflation has soared above the 6% ceiling of the RBI's target range and we expect it to climb further over the coming months. Oil companies have incrementally raised prices in the past couple of weeks. (See Chart 76.) That will keep fuel inflation sticky. With food price inflation also set to rise, there is a risk that household inflation expectations become unmoored. We think inflation will peak at 7.5% this year, higher than the RBI and consensus is expecting. (See Chart 77.)

- Monetary policy support has lessened following the RBI's introduction of the Standing Deposit Facility (SDF), which has raised the floor of the interest rate corridor. Given the inflation threat, we think the central bank will tighten policy more aggressively before long. We've pencilled in 100bps of hikes in both the benchmark repo rate and the SDF rate this year, which is more hawkish than the consensus. (See Chart 78.)

- Higher energy prices will also lead to a deterioration in India's trade balance (see Chart 79), widening the current account deficit to almost 4% of GDP this year. (See Chart 80.) While not as large as it was during the previous period of high commodity prices from 2011 to 2013, a deficit of that size would still leave the rupee vulnerable if risk sentiment deteriorated.

- One of our longstanding concerns through the pandemic has been the damage it would wreak on banks' balance sheets. Extraordinary support measures for struggling borrowers have been scaled back. As a result, we think that non-performing loans, high even before the crisis, will rise later this year and beyond. This could impair the capacity of banks to fund the investment needed for India to fulfil its growth potential over the long term.

Table 11: India Key Forecasts (% y/y unless stated)

	Avg. 10-19	2021	Forecasts 2022	2023	2024
GDP	7.0	8.1	9.2	7.5	7.0
Consumer prices[1]	7.0	5.1	6.8	5.0	4.5
RBI Repo Rate[2]	5.15	4.00	5.00	5.50	5.50
Cent'l gov't bal[3,4]	-4.5	-9.2	-6.9	-6.4	-5.5
Current account[4]	-2.3	-1.1	-3.7	-2.0	-2.0

Sources: Refinitiv, Capital Economics. 1) Annual average, 2) End-year, 3) End of Fiscal Year, Excl. State Deficits 4) % of GDP

India Charts

Chart 73: Selected Activity Indicators (% m/m, seasonally-adjusted)

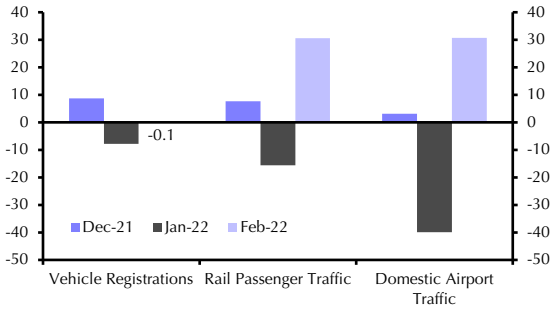


Chart 74: Total Number of Vaccines Administered (% of Population)*

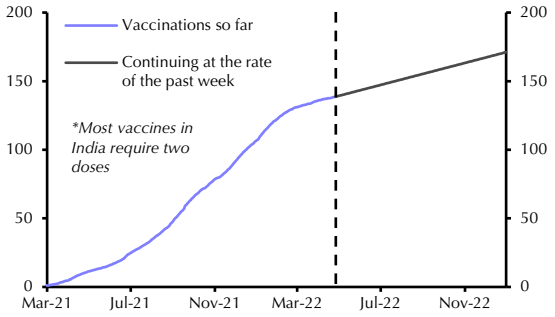


Chart 75: GDP (%y/y)

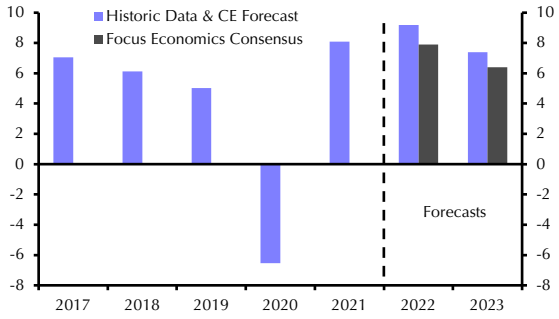


Chart 76: Average Fuel & Brent Crude Oil Prices (INR/litre)

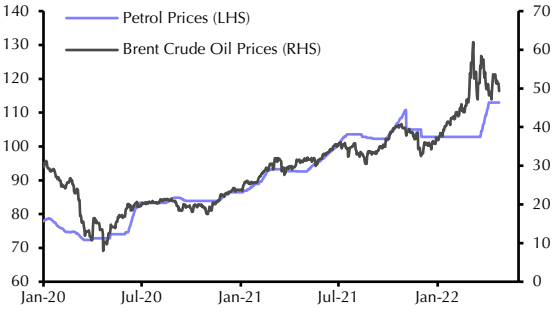


Chart 77: Consumer Prices (% y/y)

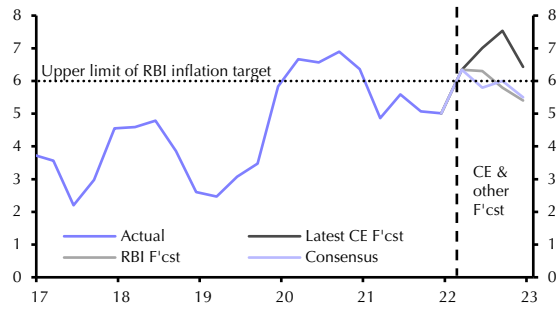


Chart 78: RBI Policy Rates (%)

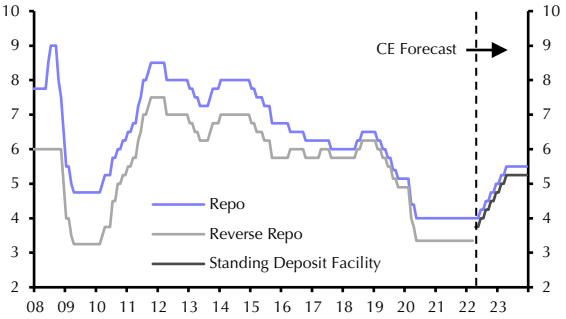


Chart 79: Net Effect of Commodity Prices on Trade Balance (2021-2022, % of GDP, CE Forecasts)

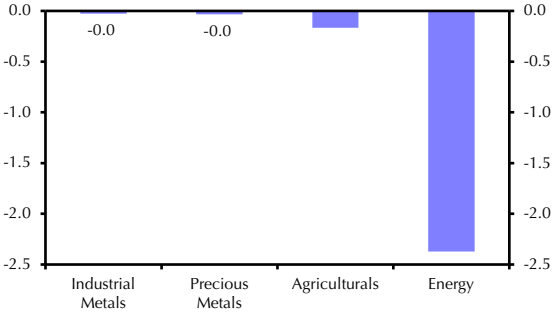
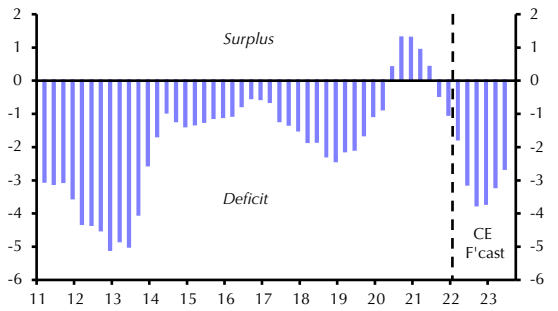


Chart 80: Current Account Balance (4Q Sum, % of GDP)



Sources: CEIC, Focus Economics, Bloomberg, ITC, Capital Economics

Other Emerging Asia

New headwinds emerge, central banks in South East Asia to remain dovish

- The war in Ukraine and the jump in global commodity prices will weigh on economic recoveries this year, even as the drag from the pandemic starts to fade. Weak recoveries and relatively subdued inflation mean Asian central banks will tighten policy less aggressively than those elsewhere.

- Successful vaccination campaigns allowed governments to keep economies open during the recent Omicron waves, and activity appears to have held up well. (See Chart 81.) Meanwhile, international borders are slowly being reopened, which should boost tourism destinations, such as Thailand. (See Chart 82.)

- But new headwinds are emerging. The war in Ukraine and the surge in global oil prices will drag on the purchasing power of consumers, while a slowdown in the global recovery will weigh on regional exports, which have surged since the start of the pandemic. (See Chart 83.)

- So even though headline growth rates are likely to pick up in many countries this year, GDP will typically end the year well below its pre-crisis trend. The key exceptions are Taiwan, Singapore and Korea. (See Chart 84.) A key risk to the outlook is rising virus cases in China, which raise the prospect of further disruption to global supply chains. Vietnam's close integration into Chinese supply chains makes it the most vulnerable country in Asia. (See Chart 85.)

- While price pressures have risen recently, inflation in Asia remains much lower than elsewhere in the world. (See Chart 86.) And although headline rates will rise further over the next couple of months on the back of higher commodity prices (see Chart 87), we expect inflation to fall back to target across most of the region by the end of the year as base effects become more favourable.

- The outlook for monetary policy across the region has started to diverge. Further tightening is likely this year in countries where the recovery from the pandemic has been strongest (Korea and Taiwan) or where inflation worries are greatest (South Asia).

- But central banks in South East Asia, where economic recoveries are less advanced, have so far stayed on the side-lines, and we expect this to remain the case for rest of this year. (See Chart 88.) Our interest rates forecasts are generally more dovish than the consensus, which is for widespread rate hikes this year.

- Finally, the recent default in Sri Lanka and the change of leadership in Pakistan should pave the way for IMF deals in both countries. Over time this should lead to the return of economic stability. But painful periods of austerity are likely to precede that, and growth looks set to weaken sharply this year.

Table 12: Selected Other Emerging Asia (% y/y)

	World Share[1]	GDP				Consumer Prices			
		2021	2022	2023	2024	2021	2022	2023	2024
Emerging Asia[2]	**11.1**	**4.2**	**4.8**	**5.3**	**4.5**	**1.9**	**3.0**	**3.3**	**2.8**
Indonesia	2.4	3.7	6.0	6.0	5.0	1.6	3.0	2.5	3.0
South Korea	1.7	4.0	3.5	3.0	2.5	2.5	4.0	1.4	1.3
Thailand	0.9	1.9	3.5	5.5	4.0	1.2	4.0	1.0	1.0
Philippines	0.7	5.6	7.5	8.5	7.0	4.1	4.3	2.5	3.0

Sources: Refinitiv, Capital Economics. 1) Share of World GDP in 2021 PPP terms. 2) Excluding China and India.

Other Emerging Asia Charts

Chart 81: GDP Estimates/Forecasts (SA, %q/q)

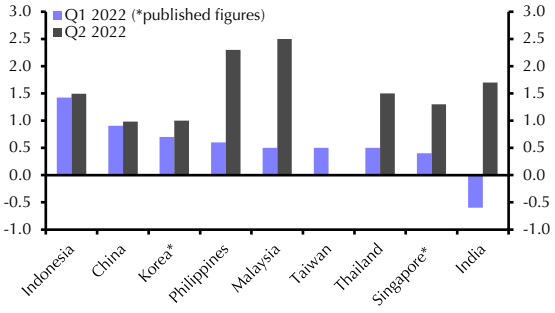


Chart 82: Monthly International Arrivals (% of same month in 2019)

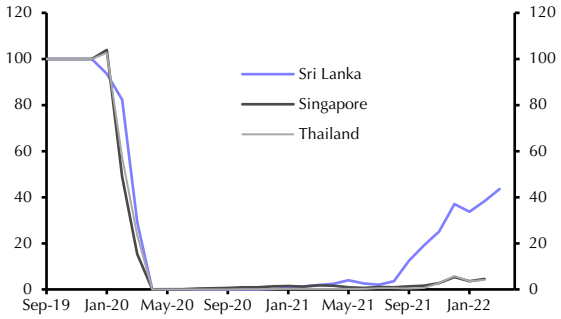


Chart 83: Emerging Asia Merchandise Trade (US$, SA, Dec. 19 = 100)

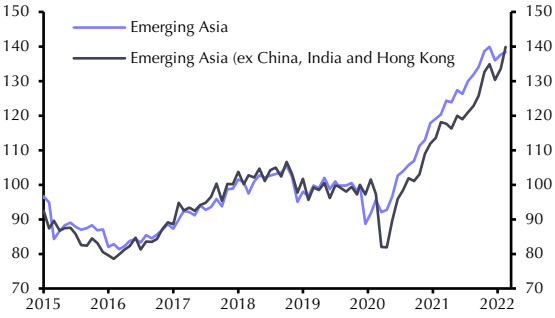


Chart 84: GDP (%-dif. from pre-pandemic trend, end-2022)

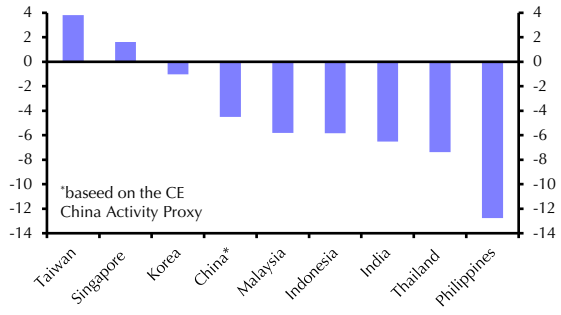


Chart 85: Manufacturing Inputs from China (% of Total GVA, latest)

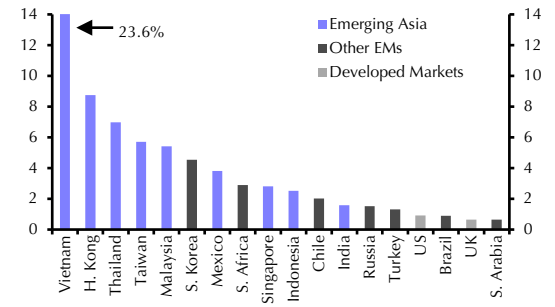


Chart 86: Headline Consumer Prices (% y/y, latest)

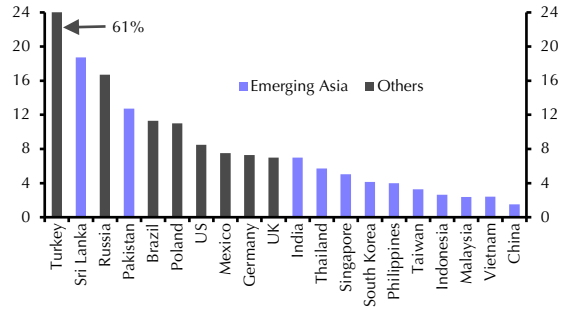


Chart 87: Emerging Asia CPI & Brent Crude Prices (% y/y)

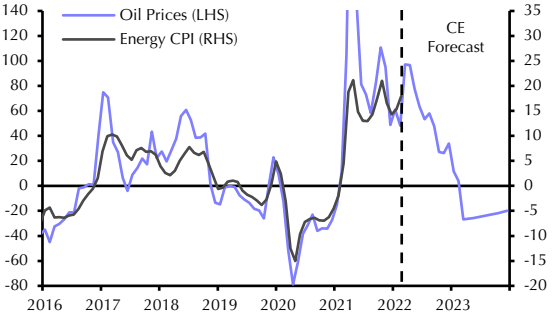
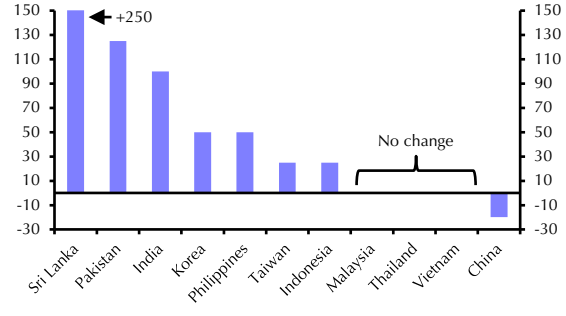


Chart 88: Forecast Change in Policy Rate (Now to end-22, bps)



Sources: Refinitiv, CEIC, OECD, Capital Economics

Emerging Europe

Recession risks take centre stage

- The Russian economy will collapse this year and we expect spillovers from the war in Ukraine to cause a recession in many of the smaller countries in the region. Inflation will end the year stronger and interest rates higher than most expect and we think the economic backdrop will cause currencies to depreciate.

- The region is heavily exposed to the war in Ukraine. The Baltic States and Bulgaria are particularly dependent on Russia for their exports and imported intermediate inputs. (See Chart 89.) And Slovakia, Czechia, Hungary and Poland depend heavily on Russian oil and gas for their imported energy needs. (See Chart 90.)

- Surveys show a collapse in activity in Russia, as well as declining confidence and fresh supply chain problems elsewhere. Firms in Poland and Czechia have reported raw material shortages which will become more widespread, causing industrial production to decline this quarter.

- Higher commodity prices will boost Russia's current account surplus, but will cause increased risks to macro stability and wider external deficits elsewhere. (See Chart 91.) We think higher commodity prices, supply chain disruptions and strong core price pressures, will push headline inflation rates to double-digits in most countries this year. (See Chart 92.) This will weigh on households' real incomes and dampen consumption.

- This will all be compounded by the knock-on impact of the war on the euro-zone economy, weakening external demand, and on monetary policy as central banks continue to fight against inflation. With inflation likely to remain above-target, we expect interest rates to remain higher for longer than most expect. (See Chart 93.)

- We expect GDP in most economies to contract in Q2. We think the Baltic States, Bulgaria and Slovakia will fall into recession, while Turkey's economy will struggle to regain pace following its downturn in Q1. (See Chart 94.) Growth will be strongest in Israel, Poland and Hungary, where labour markets are tight and fiscal policy has been loosened. Even so, this will be a difficult year for the region and we are below consensus on growth. (See Chart 95.)

- Our working assumption is that sanctions on Russia remain in place. But there is a risk that sanctions are tightened further, which would cause a deeper contraction for Russia and result in widespread shortages of raw materials, oil and gas and food products elsewhere.

- Although we are more hawkish on interest rates, we think most currencies will end the year weaker than analysts expect. Recession risks in Europe, widening imbalances, and a hawkish Fed means that the backdrop is unlikely to be favourable. As a result, we expect currencies to fall by year-end. (See Chart 96.)

Table 13: Emerging Europe Key Forecasts (% y/y)

	World Share[1]	GDP				Consumer Prices			
		2021	2022	2023	2024	2021	2022	2023	2024
Emerging Europe[2]	**8.3**	**6.5**	**-5.7**	**2.4**	**3.8**	**5.8**	**15.9**	**8.4**	**4.2**
Russia	3.1	4.7	-12.0	-1.5	3.0	6.7	19.0	9.5	4.8
Turkey	2.0	11.0	0.3	2.5	2.5	19.6	59.0	21.8	15.5
Poland	1.0	5.7	3.5	3.3	3.5	5.2	12.0	8.3	4.3
Czech Republic	0.3	3.3	2.0	2.8	3.5	3.8	12.0	4.8	2.8
Hungary	0.2	7.1	3.3	3.0	3.5	5.1	9.3	5.8	3.8

Sources: Refinitiv, Capital Economics. 1) Share of World GDP in 2021 PPP terms. 2) Inflation measure excluding Turkey

Emerging Europe Charts

Chart 89: Imported Intermediate Inputs from Russia (% of Total Intermediate Inputs Imported, 2018)

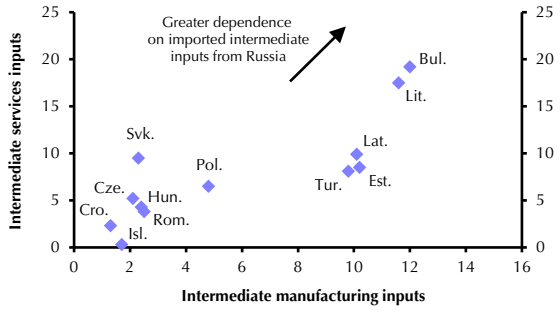


Chart 90: Imports of Oil and Natural Gas from Russia (% of Total Oil and Natural Gas Imported)

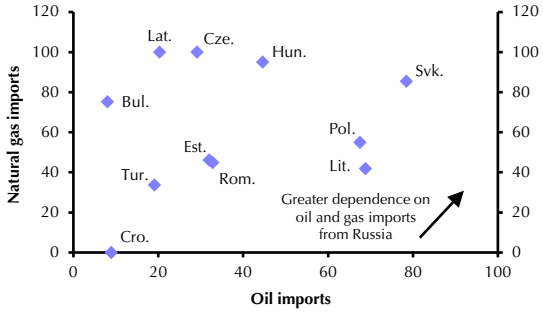


Chart 91: Current Account Balance (% of GDP)

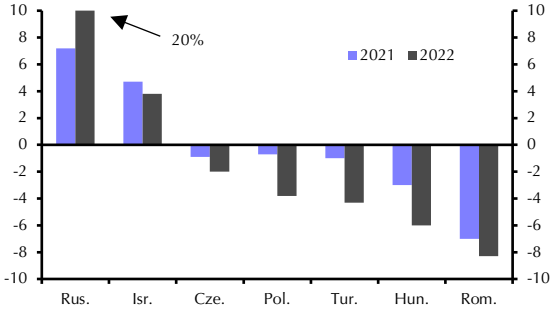


Chart 92: CE Forecasts for Peak in Headline Consumer Prices (Q3 or Q4 2022, % y/y)

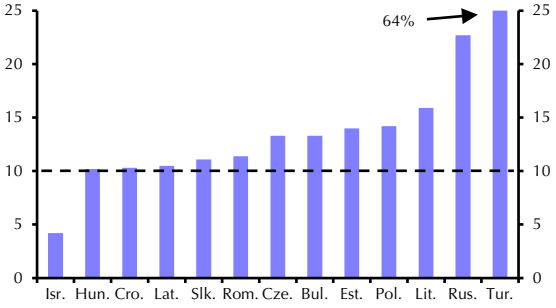


Chart 93: CE Policy Rate Forecasts vs Market-Implied Rates (At End-2022, bp Difference)

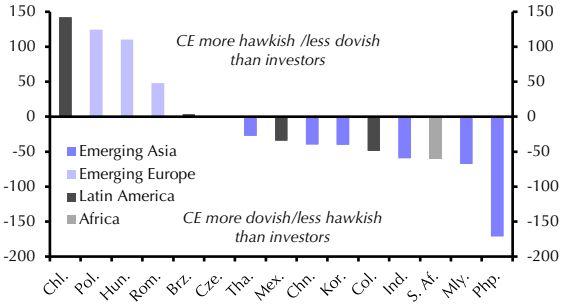


Chart 94: CE Forecasts for GDP (SA, % q/q)

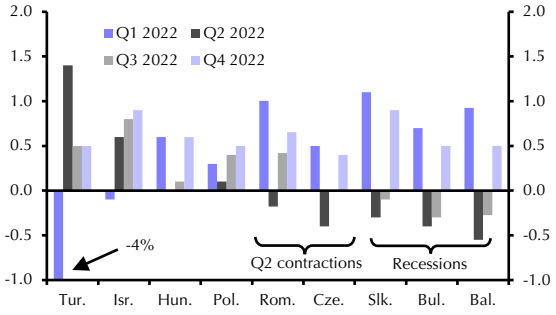


Chart 95: GDP Growth Forecasts (%, 2022)

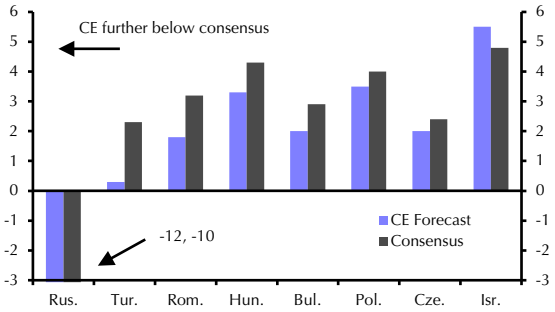
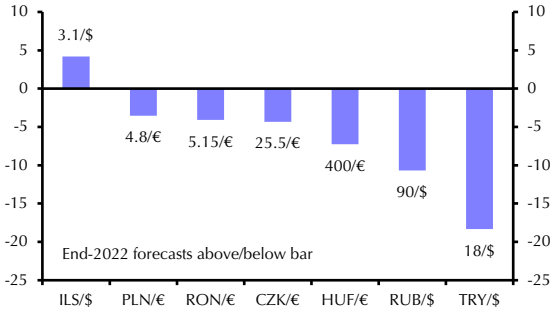


Chart 96: Exchange Rate (vs $ or €, %-Change Now to End-2022)



Sources: Refinitiv, OECD TIVA, Eurostat, CEIC, Capital Economics

Latin America

High commodity prices won't lift all boats

- The surge in commodity prices will drive stronger regional growth than the consensus expects this year, but not all economies will benefit. Inflation will be higher across Latin America and monetary policy is likely to be tighter than most analysts anticipate.

- Output in across Latin America held up despite the Omicron virus waves in Q1, and prospects for the region have brightened in Q2. New COVID-19 cases have fallen sharply (see Chart 97), restrictions have been lifted, and services sectors should recover. Meanwhile, the recent surge in commodity prices will support the region's exports in the near term (see Chart 98) and should feed through to higher investment.

- However, high commodity prices aren't a boon for all. While Colombia, Argentina and Brazil should see an improvement in their overall terms of trade, in Peru and Chile, the boost to export prices will be more than offset by higher import prices (mainly oil). (See Chart 99.)

- This will cause their current account deficits to be alarmingly wide this year (see Chart 100), leaving Chile and Peru especially vulnerable to tighter global financial conditions. Elsewhere, Mexico's external sector will be hit by slowing US growth and ongoing global supply issues.

- Within economies, households will lose out from higher food and fuel prices. Headline inflation is likely to rise by a further 0.3-1.0%-pts in the coming months and remain well above central banks' targets over the next year or so. (See Chart 101.) Our inflation forecasts are a bit higher than most analysts'.

- Central banks will react by raising policy rates further than most analysts expect. (See Chart 102.) They should have room to ease policy in 2023 as inflation drops back, although rising interest rates in the US will keep Mexico's central bank on the sidelines.

- All told, Latin American GDP growth will hold up better than most expect this year, at 2.4%. Brazil and Colombia's economies should beat consensus expectations, but Mexico, Chile and Peru will disappoint. (See Chart 103.) With the impact from high commodity prices set to partly unwind, we expect that regional growth will slow to below 2% in 2023 and 2024.

- The commodities windfall has eased fiscal concerns. But governments may face political pressure to spend more to safeguard consumers (as has been the case in Chile and Peru). And shifts to the left are likely at upcoming elections in Colombia and Brazil. As a result, we think that public debt-to-GDP ratios will stay high across the region. (See Chart 104.) In Argentina, we doubt that the latest IMF deal will prevent another debt restructuring later this decade. With fiscal risks lingering and commodity prices likely to fall, the region's currencies will probably give up some of their recent gains.

Table 14: Latin America Key Forecasts (% y/y)

	World Share[1]	GDP				Consumer Prices			
		2021	2022	2023	2024	2021	2022	2023	2024
Latin America[2]	**6.7**	**6.9**	**2.4**	**1.8**	**1.7**	**6.2**	**8.1**	**4.5**	**3.5**
Brazil	2.4	4.6	1.3	1.8	1.5	8.3	9.5	4.8	3.5
Mexico	1.8	4.8	1.8	2.0	1.8	5.7	7.0	4.5	4.0
Argentina	0.7	10.3	3.5	1.0	0.8	48.4	56.0	52.5	47.5
Colombia	0.6	10.6	6.0	2.0	2.0	3.5	8.5	4.8	3.5
Chile	0.4	11.7	2.0	1.0	1.5	4.5	9.0	4.5	3.0

Sources: Refinitiv, CE. 1) Share of World GDP in 2021 PPP terms. 2) Regional GDP excl. Venezuela; regional CPI excl. Argentina & Venezuela.

Latin America Charts

Chart 97: Latin America Daily New COVID-19 Cases* (Thousands, 7d Avg.)

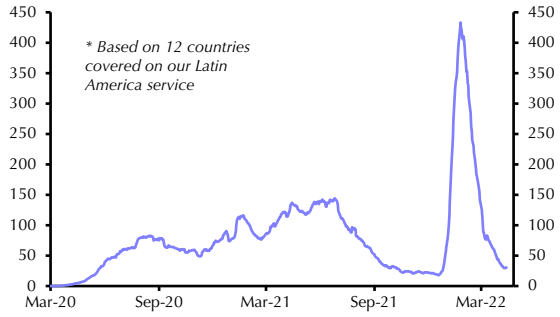


Chart 98: S&P GSCI Commodity Price Index & Latin America Goods Exports

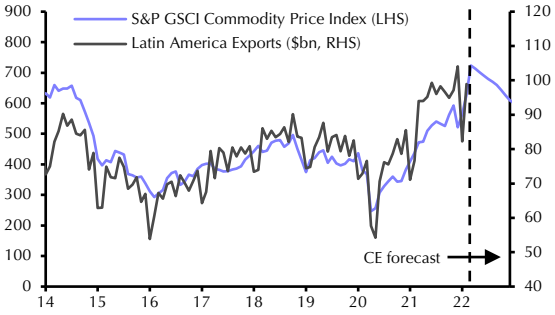


Chart 99: CE Estimate of Change in Net Exports from Commodity Prices (% of GDP, 2022 vs. 2021)

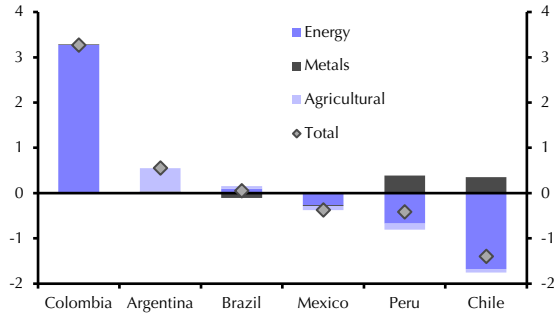


Chart 100: Current Account Balances (% of GDP)

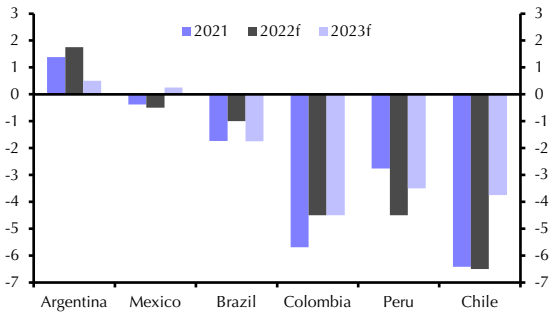


Chart 101: Consumer Prices (% y/y)

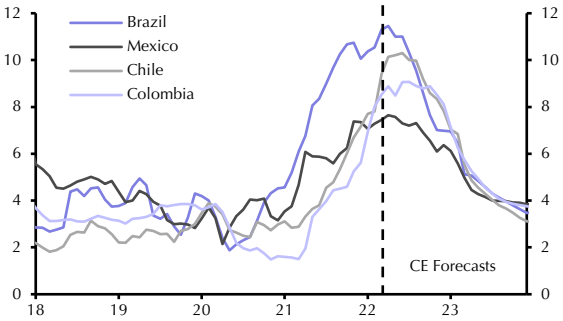


Chart 102: Policy Interest Rates (%)

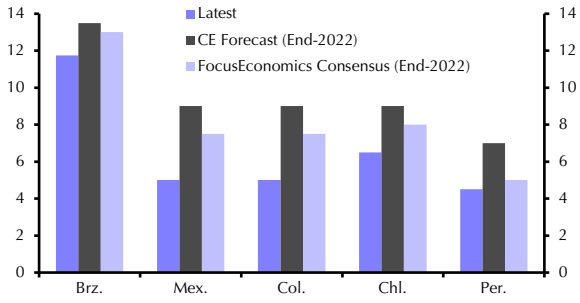


Chart 103: GDP Growth (%, 2022)

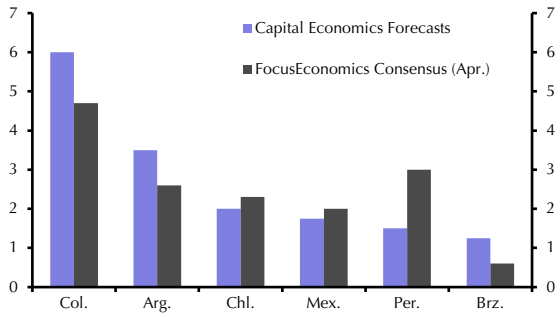
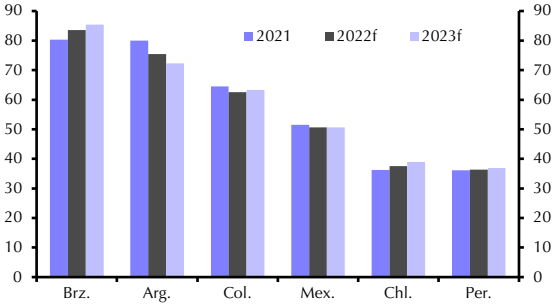


Chart 104: Public Debt (% of GDP)



Sources: Refinitiv, OWID, Intracen, FocusEconomics, Capital Economics

Middle East & North Africa

Gulf leads the way as Ukraine war drives divergence

- The Gulf economies will be major beneficiaries from higher oil prices and our growth forecasts sit far above the consensus. Outside the Gulf, higher inflation and tighter fiscal policy will weigh on growth, while balance sheet problems are likely to build.
- Since the Omicron-driven dip in activity in January, recoveries have got back on track more recently. The Gulf economies fared better than other MENA economies earlier in the year, and spillovers from the war in Ukraine will cause this divergence to widen.
- High energy prices will cause the Gulf's hydrocarbon export revenues to surge by around 8%-pts of GDP this year relative to 2021. Much of these accrue to governments, which should mean all Gulf economies run twin budget and current account surpluses. (See Chart 105.) This will give officials in Saudi, the UAE, and Qatar scope to loosen fiscal policy to support non-oil sectors.
- At the same time, we think Saudi Arabia and the UAE will raise oil output faster than is currently pencilled in under the OPEC+ deal. This will provide a significant boost GDP growth this year and next. All told, our growth forecasts are much stronger than the consensus in the Gulf. (See Chart 106.)
- Tighter monetary policy may weigh on Gulf non-oil sectors. By virtue of their dollar pegs, central banks in the Gulf need to raise rates in line with the US Fed, where we have pencilled in 250bp of hikes by end-2023. That said, swings in oil prices tend to be a stronger driver of credit growth in the Gulf due to looser fiscal policy and improved confidence. (See Chart 107.)
- The non-Gulf economies are more vulnerable to the fallout from the Ukraine war. Higher commodity prices will increase subsidy costs in North Africa, which is likely to prompt governments to cut expenditure elsewhere. At the same time, inflation will be stronger and will erode household incomes.
- Higher commodity prices will also cause external positions to deteriorate further. (See Chart 108.) Egyptian officials responded to this by devaluing the pound in March, and we think policymakers need to allow the currency to weaken further. This will push inflation higher (see Chart 109), prompting another 350bp of interest rate hikes (to 12.75%) by the end of this year – this is more tightening than analysts currently expect. (See Chart 110.)
- Building external strains in Tunisia could prompt officials to loosen their grip on the dinar, which would pose a risk to the country's large FX debts. Options available to policymakers to arrest the country's looming debt crisis are dwindling and we think they will ultimately be forced to default as debt repayments ramp up. (See Chart 111.)
- We expect the region's economy to grow by 7.1% this year and 2.8-4.8% in 2023-24. This would leave regional GDP 1% above its pre-virus trend by end-2024. (See Chart 112.)

Table 15: Middle East & North Africa Key Forecasts (% y/y)

	World Share[1]	GDP				Consumer Prices			
		2021	2022	2023	2024	2021	2022	2023	2024
MENA[2]	**3.9**	**2.8**	**7.1**	**4.8**	**2.8**	**3.4**	**5.8**	**4.1**	**3.3**
Saudi Arabia	1.2	3.2	10.0	5.3	2.0	3.1	2.0	1.3	1.3
Egypt	1.0	4.5	5.3	4.8	4.5	5.2	13.3	10.8	7.8
UAE	0.5	2.5	9.8	6.8	2.8	0.1	3.8	2.0	1.8
Morocco	0.2	7.3	3.8	5.5	2.5	1.4	3.0	1.3	1.3

Sources: Refinitiv, Capital Economics. 1) Share of World GDP in 2021 PPP terms. 2) Regional CPI excl. Lebanon

Middle East & North Africa Charts

Chart 105: Budget & Current Account Balances (% of GDP)

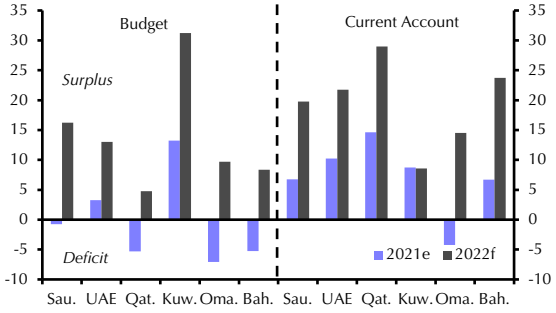


Chart 106: 2022 GDP Forecasts (% y/y)

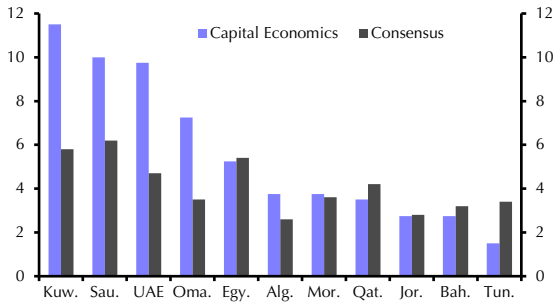


Chart 107: Gulf Private Sector Credit (% y/y, Simple Average)

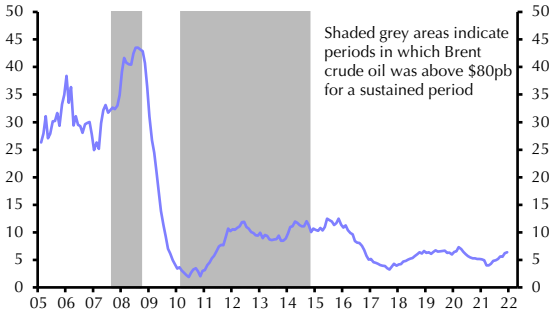


Chart 108: Change in Net Exports Due to Commodity Price Effects (2021 vs. 2022 CE Forecasts, % of GDP)

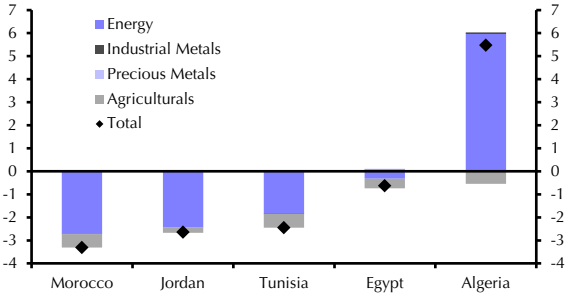


Chart 109: Egypt Consumer Prices (% y/y)

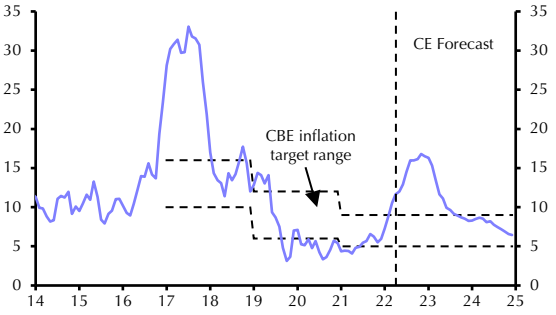


Chart 110: Central Bank of Egypt O/N Deposit Rate (%)

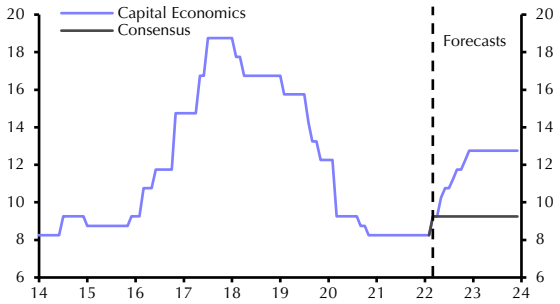


Chart 111: Tunisia Sovereign FX Debt Repayment Schedule ($bn)

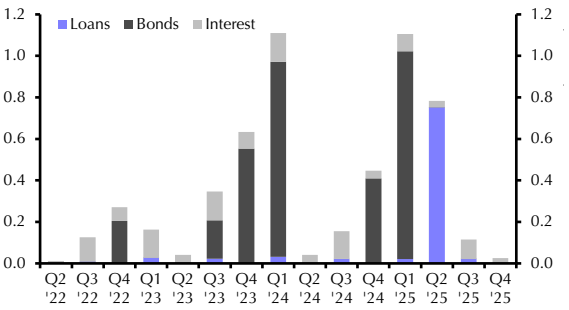
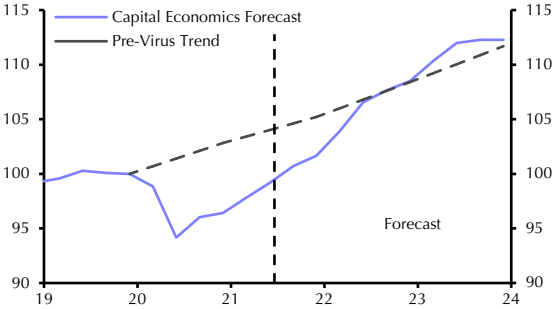


Chart 112: Middle East and North Africa GDP (Index, Q1 2019 = 100)



Sources: Our World in Data, CEIC, Refinitiv, Capital Economics

Sub-Saharan Africa

Debt problems building

- Sub-Saharan Africa's economic recovery is likely to remain slow going and our growth forecasts are generally below the consensus. Spillovers from the war in Ukraine will cause debt problems to grow in parts of the region. Risks are highest in Ethiopia and Ghana.

- Recoveries across Sub-Saharan have been underwhelming. GDP has yet to return to its pre-virus level in South Africa, and is well below its pre-pandemic trend elsewhere.

- Omicron virus waves have abated and daily new COVID-19 cases are now at their lowest level since the early days of the pandemic. (See Chart 113.) Governments have eased restrictions and tourism-led economies are likely to be key beneficiaries. (See Chart 114.)

- Spillovers from the war in Ukraine will have a varied impact across Africa. Angola and, to a lesser extent, Nigeria will benefit from high oil prices, which should allow for looser fiscal policy. But in Nigeria, we doubt that higher export revenues will prompt policymakers to move away from draconian FX restrictions that are hindering activity and pushing inflation up.

- For the rest of the region, terms of trade will deteriorate this year as the boost from higher export prices will be more than offset by higher import bills. That's a concern for countries with large current account deficits, including Kenya, Uganda and Mauritius. African currencies are likely to struggle.

- That will only fuel fears about countries with large FX-denominated sovereign debt. (See Chart 115.) Ghana is currently in the spotlight, but dollar borrowing costs are also high in Ethiopia and Kenya. (See Chart 116.)

- For countries that run into trouble servicing debts, Zambia's experience reinforces the point that the varied array of creditors facing governments (see Chart 117) means that securing debt restructurings is likely to prove more difficult than in the past.

- South Africa's debt problem is different in nature. Much more of the country's public debt is denominated in local currency and held at home. While the government looks set to stick to fiscal austerity – which will keep the recovery weak – we don't think that it will do enough to stabilise the public debt ratio.

- Meanwhile, with higher commodity prices adding to inflation pressures (see Chart 118), the Fed turning hawkish and the fog of the pandemic clearing, more central banks will raise interest rates. (See Chart 119.) In South Africa, we think that the SARB will tighten more slowly than investors currently expect.

- All told, we expect regional GDP growth to slow from 4.5% last year to 3.2-3.3% in 2022-24. Our forecasts are below consensus in much of the region, including South Africa, Nigeria and Angola. (See Chart 120.)

Table 16: Selected Sub-Saharan Africa Key Forecasts (% y/y)

	World	GDP				Consumer prices			
	Share[1]	2021	2022	2023	2024	2021	2022	2023	2024
Sub-Saharan Africa	**2.5**	**4.5**	**3.3**	**3.2**	**3.2**	**12.1**	**12.9**	**9.4**	**8.4**
Nigeria	0.8	3.6	2.3	2.3	2.0	17.0	16.0	13.5	12.5
South Africa	0.6	5.0	2.0	1.8	1.0	4.6	5.3	4.0	4.3
Angola	0.2	0.7	3.0	2.0	2.0	25.8	23.0	15.8	14.0
Kenya	0.2	7.8	6.3	5.0	5.0	6.4	5.8	5.5	5.3

Sources: Refinitiv, IMF, NBS, Stats SA, INE, KNBS, National Sources, Capital Economics. 1) Share of World GDP in 2021 PPP terms.

Sub-Saharan Africa Charts

Chart 113: Daily New COVID-19 Cases (7d avg.)

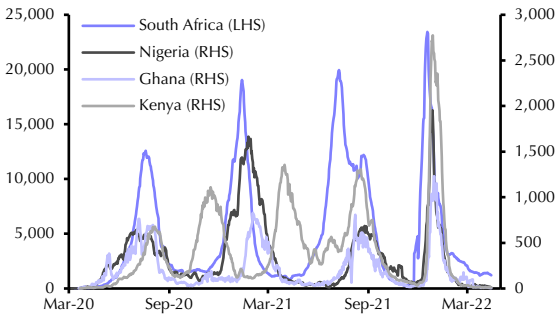


Chart 114: Tourism (% of GDP, Total Contribution)

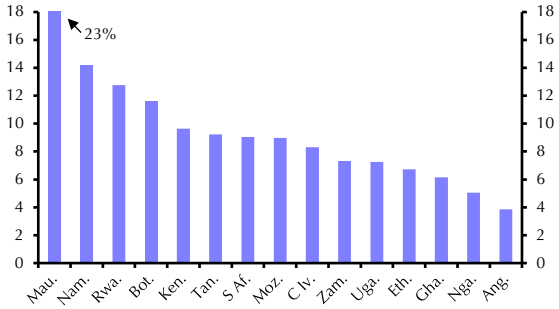


Chart 115: FX-Denominated Public Debt (% of GDP, Latest)

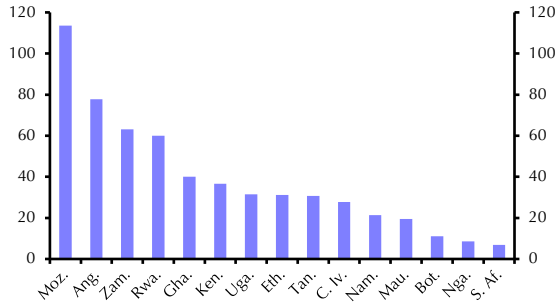


Chart 116: JP Morgan EMBI Yield (%, Latest)

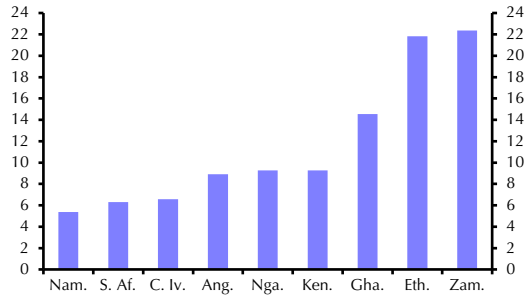


Chart 117: Long-term External Debt by Creditor (% of Total)

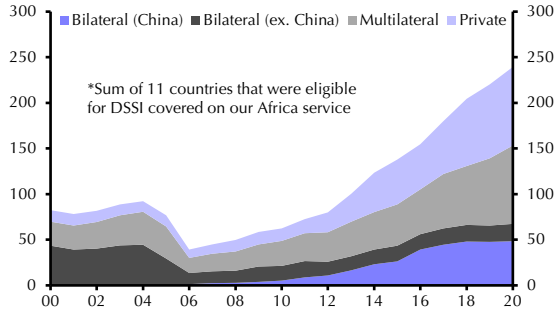


Chart 118: Consumer Prices (% y/y)

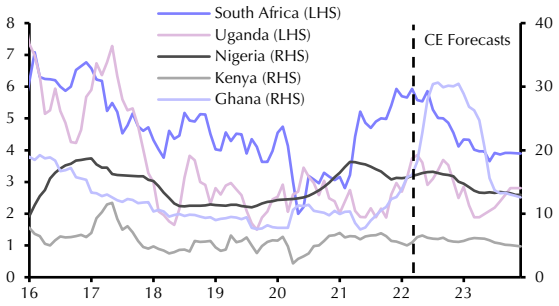


Chart 119: Interest Rates (%)

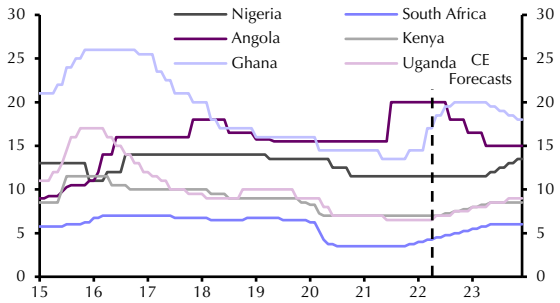
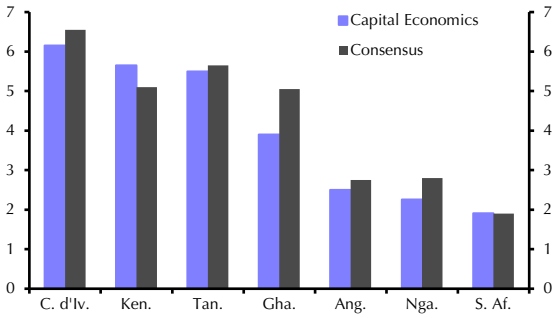


Chart 120: GDP Growth Forecasts (%, 2022-23 Avg.)



Sources: Refinitiv, CEIC, Consensus Economics, WTTC, Capital Economics

Commodities

Prices to stay high for longer

- We now expect commodity prices, led by the energy complex, to remain historically high for the remainder of this year. In our last *Outlook*, we had expected prices to ease back in 2022, but the war in Ukraine and its negative impact on the supply of many commodities, has forced us to reconsider our forecasts. That said, we still expect prices to move lower in 2022-23 as supply chains adjust and, in some cases, producers raise output, incentivised by higher prices. At the same time, slower global economic growth (and high prices) will weigh on commodities demand. (See Chart 121.)

- Energy prices have led the rally in prices so far this year (see Chart 122), which is not surprising given that Russia is one of the world's largest exporters of all the fossil fuels. The US has imposed a ban on Russian energy imports, while Europe has banned coal imports and is aiming to reduce its reliance on Russian oil and natural gas. The discount on Russia's oil (see Chart 123) suggests difficulty in finding buyers.

- Even if the war were to end quickly, we think that it will spark a structural change in the global energy mix whereby Europe will progressively reduce its energy imports from Russia. This will be logistically difficult and costly, which is a key reason why we forecast that energy commodity prices will stay high for some time yet. (See Table 17.) OPEC's apparent inability to raise output even to reach its own unambitious targets (see Chart 124) is another reason why oil prices will stay high for longer.

- Meanwhile, higher energy-related production costs mean that we have also revised up our end-2022 forecasts for industrial metals prices. Mining and metal fabrication are typically energy intensive. However, the slowdown in global economic activity, particularly in key metals consumer, China (see Chart 125), will still mean that prices ease back this year.

- Elsewhere, the gold price has benefitted from safe-haven demand (see Chart 126) and some hedging against inflation so far this year. But we do not think it can shrug off rising US real yields indefinitely (see Chart 127) and expect prices to fall back later this year.

- Finally, we think that the prices of most agricultural commodities will also decline in 2022. Current high prices will incentivise planting and falling energy costs later in the year should boost fertiliser use. However, much will depend on the progression of the war in Ukraine. That said, exports of agricultural commodities from Ukraine are likely to be limited for the next year or so, which will mean higher grains and edible oils prices for some time yet. (See Chart 128.)

Table 17: Commodity Prices (Year-end)

				Forecasts	
	2019	2020	2021	2022	2023
Indices					
S&P GSCI Index	436	409	561	620	495
Bloomberg Index	355	397	502	515	425
Energy					
Brent ($ per barrel)	66	52	78	100	80
US Natural Gas[1]	2.2	2.5	3.7	5.0	4.0
Coal[2]	68	81	170	160	100
Metals ($ per tonne)					
Copper	6,149	7,749	9,741	9,000	8,000
Aluminium	1,781	1,974	2,806	2,500	2,000
Iron Ore	92	160	121	90	60
Gold ($ per oz)	1,517	1,896	1,828	1,600	1,550
Agriculturals (US cents per bushel)					
Corn	388	484	593	600	450
Soybeans	943	1,315	1,329	1,400	1,000
Wheat	559	641	771	800	500

Sources: Refinitiv, Bloomberg, Capital Economics.
1) Henry Hub, $ per mBtu, 2) Newcastle, $ per tonne

Commodities Charts

Chart 121: Global GDP & Oil Demand Growth (%)

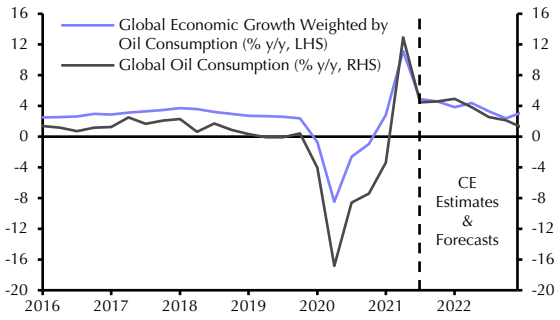


Chart 122: S&P GSCI (1st Jan. 2022 = 100)

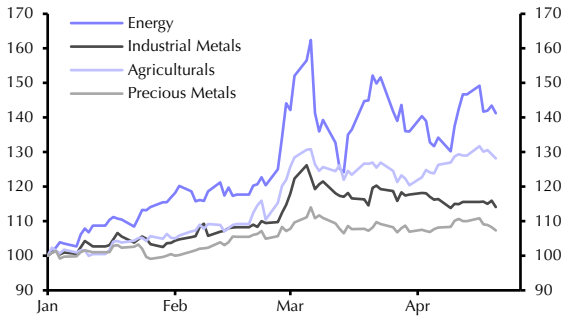


Chart 123: Russia Urals -Brent Price (US$ per Barrel)

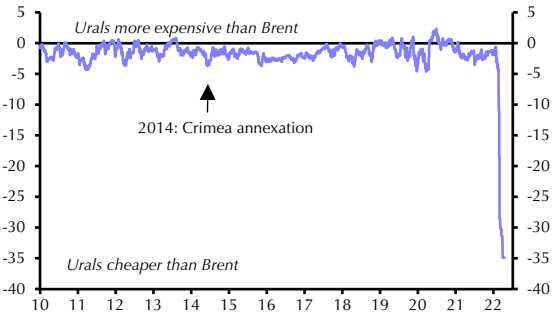


Chart 124: OPEC* Output and Quotas (Mn. BpD)

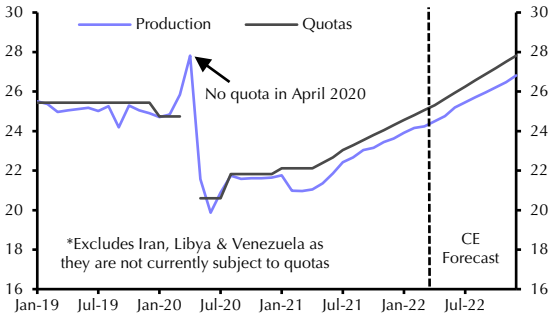


Chart 125: China Manufacturing PMI & Industrial Metals Prices

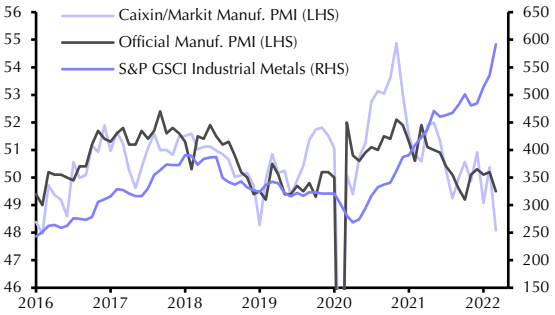


Chart 126: SPDR ETF Holdings & Gold Price

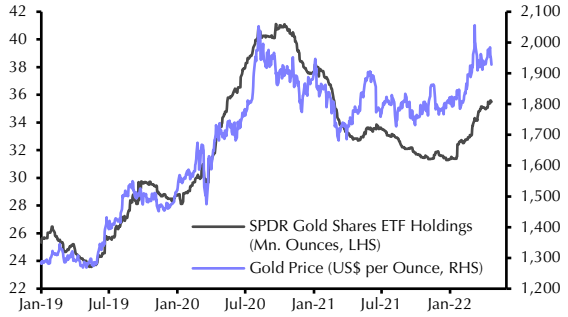


Chart 127: Gold Price & US 10Y TIPS Yield

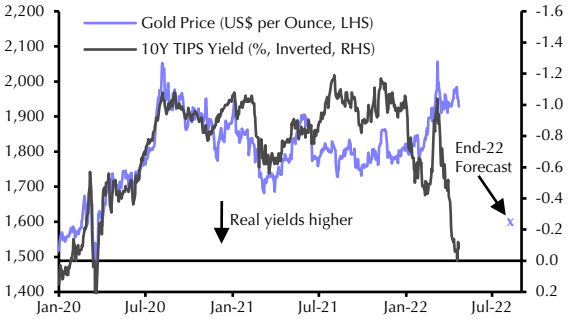
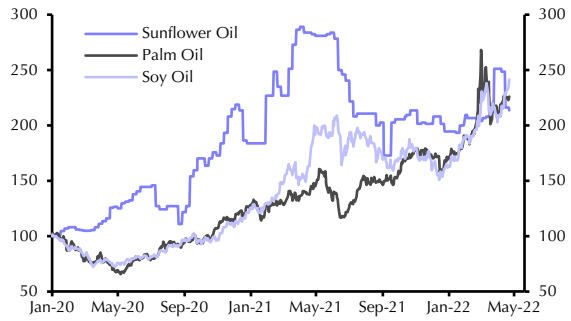


Chart 128: Edible Oils Prices (1st Jan. 2020 = 100)



Sources: Refinitiv, S&P Global, BP, IEA, EIA, Capital Economics

Long-term Outlook

Inflation unlikely to return to the low pre-pandemic rates

- The pandemic will not do much permanent damage to the level of GDP in most countries, especially DMs. Nonetheless, it will accelerate some of the structural trends that were already set to weaken the long-term growth prospects of EMs. This will result in global GDP growth easing to 2.5% by 2050. Meanwhile, even once the temporary factors pushing up inflation wane, it is likely to be modestly higher over the next few decades than it was in the last one.
- Bank vulnerabilities and limited policy support suggest that EMs in much of Latin America, Africa and South East Asia will fail to return to their pre-virus paths of output. But elsewhere, particularly in DMs, there remains little evidence that the pandemic has resulted in widespread capital-scrapping or permanently lower productivity growth.
- Beyond the pandemic, we are optimistic that stronger productivity growth will broadly offset the drag on employment from ageing populations in most DMs. We expect the US to remain at the forefront of technological advances and, helped by more favourable demographics, it should continue to be one of the fastest growing advanced economies.
- Growth in EMs will continue to outpace that in DMs, but not to the extent seen in the recent past. Reforms have slowed in many large EMs and globalisation has stalled. China's structural slowdown is set to intensify, and, unlike many forecasters, we don't expect it to surpass the US as the world's largest economy. And the war in Ukraine will accelerate Russia's shift towards isolation and weigh on its growth prospects.
- The near-term strength of inflation means that central banks will tighten policy more quickly than we previously expected. However, real short-terms rates will remain low by historical standards. This is partly because any rise in equilibrium interest rates is likely to be limited and gradual. And the higher levels of debt that are a legacy of the pandemic might act as a constraint on how quickly interest rates rise.
- The risk of central banks going very soft on inflation has faded but inflation in DMs is still likely to be higher over the coming decades than in the previous one. Some of the structural forces that contributed to the low inflation era are now easing or reversing. And the transition to green energy, which should be accelerated by the war in Ukraine, will add to inflationary pressures over the medium term.

Table 18: Selected Long-term Forecasts (% y/y, Averages)

	World Share[1]	GDP				Consumer Prices			
		2011-20	2021-25	2026-30	2031-50	2011-20	2021-25	2026-30	2031-50
World[2]	*100*	**2.7**	**3.7**	**2.8**	**2.7**	**3.0**	**3.6**	**2.7**	**2.8**
Advanced Economies	*37.5*	**1.1**	**2.5**	**1.6**	**1.8**	**1.4**	**3.0**	**1.8**	**2.0**
US	*15.7*	1.6	2.7	2.1	2.3	1.7	3.4	2.3	2.3
Euro-zone	*12.0*	0.6	2.4	1.1	1.1	1.2	3.1	1.5	2.0
Japan	*3.8*	0.3	1.7	0.6	0.8	0.5	0.5	0.1	0.5
UK	*2.3*	0.9	3.1	1.7	1.7	2.0	3.7	2.0	2.0
Emerging Economies[3]	*62.5*	**3.8**	**4.4**	**3.5**	**3.1**	**4.1**	**3.9**	**3.1**	**3.1**
China[2]	*18.6*	5.6	4.7	2.5	1.8	2.5	1.1	1.5	1.5
India	*7.0*	5.3	7.8	6.1	5.0	6.3	5.2	4.3	3.7

Sources: Refinitiv, Capital Economics. 1) Share of World GDP in 2021 PPP terms. 2) We use our own China Activity Proxy (CAP)-derived GDP estimates for China for world aggregates. 3) Excluding Venezuela for GDP and inflation and Argentina & Turkey for inflation only.

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Email **sales@capitaleconomics.com** Visit **www.capitaleconomics.com**

Strategas Research Partners

Jason DeSena Trennert	(212) 906-0133	jtrennert@strategasrp.com
Nicholas Bohnsack	(212) 906-0132	nbohnsack@strategasrp.com
Don Rissmiller	(212) 906-0134	drissmiller@strategasrp.com
Dan Clifton	(202) 223-7644	dclifton@strategasrp.com
Chris Verrone, CMT	(212) 906-0135	cverrone@strategasrp.com
Tom Tzitzouris	(202) 223-7646	ttzitzouris@strategasrp.com

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EB-2021-0110
Exhibit I-22-O-SEC-244
Attachment 2

KEY TAKEAWAYS FROM STRATEGAS' RESEARCH VERTICALS

Overriding Investment Thesis: While the strength of the labor market, robust corporate and consumer balance sheets, and still excessively accommodative monetary policy lead us to believe that recession is unlikely in the next year, we believe the risks to the equity markets are rising due to the likelihood of aggressive central bank tightening to fight inflation. Although we are in line with the consensus on S&P 500 operating earnings (~$230), our valuation models suggest that current rates of inflation are wholly inconsistent with a market multiple of 19x. In our view, a multiple of 16-17x might be more appropriate if the CPI drops from its current level of 8.5% to the 4-6% range by the end of the year. In the short-term, still-tight labor markets, rapid home price increases, and environmental policies that keep the price of oil and gas higher for longer are all likely to lead to stubbornly-high rates of inflation. In the long-term, the rather abrupt end of globalization as we had known it for the past three decades may also cease to be a tailwind for disinflation. Given these risks, we think it is important for investors to favor high-quality, shorter-duration stocks of companies willing to distribute cash to shareholders in the form of dividends or share repurchases. A company whose stock is totally dependent upon its terminal value, on the other hand, is likely to act as a zero-coupon bond in an inflationary environment. We are overweight the Energy, Basic Materials, Health Care, and Industrials sectors, have a bias toward the U.S. versus international stocks, and favor high-quality small caps over large caps.

I. INVESTMENT STRATEGY – JASON TRENNERT

Base Case for Bearish U.S. Equity Forecast:

- There has historically been a strong inverse correlation between the rate of inflation and earnings multiples. The C.P.I. currently rests at 8.5%.
- The Fed appears committed to tightening monetary policy aggressively. Theoretically, it is difficult to get control of inflation until the Fed Funds rate is positive in real terms.
- Higher input costs such as labor and commodities may negatively impact profit margins and slow earnings growth.

Major Risks to the Bearish Forecast:

- The spread between the earnings yield of the S&P 500 and the 10-year Treasury (the equity risk premium) remains wide. Real long-term interest rates remain negative.
- S&P 500 earnings are expected to be up +8.5% in 2022. There is a chance that the "money illusion" leads to earnings surprising to the upside.
- A resolution of supply-chain issues might allow inflation to drop more quickly than we anticipate, allowing the Fed to slow the pace of tightening.

II. ASSET ALLOCATION – NICHOLAS BOHNSACK

- **Equities –** In the wake of rising covid cases in China and global central banks embarking on a course to normalize policy in a new era of quantitative tightening, we pared our equity exposure to neutral weight in April (to 60% from 62% vs. 60% neutral exposure). While equity markets have enjoyed generally positive momentum in recent weeks, we view the potential to be greater that odds of a U.S. recession will rise in coming months and bring with it another bout of equity market volatility. We have largely reduced our allocation to U.S. Large-Cap Growth shares with smaller downward adjustments to U.S. Large-Cap Core, Developed International and Emerging Markets. We continue to favor Value over Growth and Small & Mid-cap over Large & Mega-cap.
- **Cash –** Overweight Cash (8% weight vs. 2% benchmark). We also like the prospects of Gold and maintain 4% of our 8% cash allocation in Gold. Amid the market volatility, we remain comfortable with our positions here.
- **Fixed Income –** We remain very underweight fixed income in a traditional 60/40 portfolio (30% vs. 38% benchmark). As 2022 progresses, the bond market will have to face the twin tightening tools of rate hikes and balance sheet reduction. That said, we are watching global non-USD currency weakness to increase natural safe haven across the curve which could entice natural buyers to upgrade portfolio holdings, i.e. dampening the rise in Treasury and high grade I.G. yield while eliciting modest spread widening.
- **Alternatives -** With the increased correlation between stocks and bonds making it more challenging to hedge one with the other, we are establishing a beachhead position in the ostensibly less correlated Alternative asset sleeve, namely Commodities (+200bps) with the allocation reduction from Equities. While the timing may seem spurious given the recent run in nearly all commodity segments, we are compelled by both the risk management profile, particularly in more liquid corners, as well as the fundamental underpinnings we see in Commodities given the increasingly structural dislocation in global supply chains and the thematic momentum behind de-globalization.

Overweight Sectors – Industrials, Health Care, Energy & Materials

- **Industrials** are a diverse sector, devoid of rampant concentration risk that is present in other GICS sectors. Economic re-opening and the Biden infrastructure plan ostensibly provides a multi-year tailwind, but we recognize the near-term foggy economic outlook in the wake of persistent supply chain issues, rising covid cases, and a strengthening dollar. Aerospace and Defense can benefit from heightened geopolitical tensions. Travel recovery is a tailwind for the airlines. We are wary of potential fiscal drag and Biden's proposed increase of corporate tax rates. Organic driver(s) of growth will be an important lever to help transition the economy from recovery to durable expansion. Their absence could soften normalized forward demand curve.
- **Health Care** can function as a late cycle defensive sector hedge if a recession is imminent. The longer-term relative return performance profile is also favorable for sector outperformance. Drug pricing provision are still possible if B.B.B. goes through, but it keeps falling down list versus higher priority policy items… perhaps a 2Q story. Status quo remains more favorable for larger-cap pharma. Administration going after Pharma mergers poses risk of some mergers getting blocked, which is especially a negative for small biotech firms who are prime acquisition targets. Biotech is home to some of the highest multiple shares in the market, a risk in a rising interest rate environment.
- **Energy** is broadly levered to the global economic re-opening, and demand appears robust for now despite higher prices. Limited industry investment in recent years (and proposed environmental constraints moving forward) in combination with increased demand related to the global economic recovery has created upward price dislocation. While there may be a "war premium" baked into energy prices as a result of the Russia/Ukraine war, price levels are far and away clear of prices needed to maintain profitability, with the average price of W.T.I. Oil up 50% Y/Y. The Energy sector's contribution to overall index earnings is growing more significant.
- **Materials** have acted well amid the surge in commodity prices in 2022. Auto 2.0 + China 3.0 + Biden infrastructure proposals provide structural demand for commodities. Profit outlook remains constructive with economic recovery. Margins have stayed buoyant despite higher inflation and a strengthening dollar, a surprising but welcomed development. In the metals and mining industry, free cash flow generation is at the highest levels since 1995.

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III. TECHNICAL STRATEGY – CHRIS VERRONE

5 Key Takeaways:

1) At a minimum, significant time will be needed to repair broken and wounded trends among some of the market's most important groups and constituents. Stocks are short-term oversold here, but best guess remains that major support will ultimately be found where the speculative covid ramp began.

2) Unconvinced a capitulative moment has been seen yet – the surveys reflect pessimism, but V.I.X. below 40 and put/calls have not flagged extreme. On the "right side of the low," powerful momentum and risk-seeking leadership both absent thus far. Until this changes, remain inclined to view bounces into resistance (4400-4475 on S&P / 345 to 355 on Q.Q.Q.) with skepticism.

3) Continue to emphasize leadership… Energy, Basic Resources, Defense Contractors, Pharma, REITs, Insurance, Utes, Staples remain best trends in the market (inclined to view pullbacks here opportunistically).

4) Expecting a battle to be fought at 3.00-3.25% 10-year yields – it's the 40-year trend line and we don't expect the bond bulls to roll over without putting up some fight. Equity leadership suggests pause / correction in yields may be close as well.

5) The BoJ is having a "Break the BoE" moment… we've been on this for months, appreciating both the macro significance of the Yen move and marveling at what we continue to believe is a structural breakout / regime change. The decline in J.P.Y. this year – about -15% – isn't quite in the same category of the "break the Bank of England" trade in September '92 (Sterling fell -25% in 2 months), but there's a similarity between the stubbornness of a central bank vs. the will of the F.X. market. Ultimately, the Yen makes a compelling case that the ceiling on J.G.B. yields is likely to fail.

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IV. ECONOMICS – DON RISSMILLER

- Supply & demand do not match. There's continued inflation, given global imbalances & continued shocks. Numerous central banks now look to be aiming for a period of below-trend economic growth, to remove the current pressures.
- How did we get here? Pre-pandemic, there were some economic headwinds (Japan's V.A.T. tax increase, China tariffs) but the global economy was growing adequately. COVID-19 hit confidence in early 2020, and activity plunged around 2Q of 2020. Lockdowns in some countries controlled the virus temporarily (eg, China, New Zealand) but additional variants have made zero-Covid tough to maintain.
- But fiscal & monetary supports have been aggressive (demand bounced back). Central banks acted quickly, so there was not a widespread financial crisis in addition to the lockdown (as there easily could have been, had 2008's tools not been dusted off quickly & expanded). Big businesses were able to access credit markets.
- By 2021, vaccines provided hope, and U.S. core inflation started to ease in the summer ("transitory!"). But this did not last. The Delta variant hit, and child-care & U.S. schools opened cautiously in the fall of 2021. The labor market started to overheat. Then the Omicron variant hit & global supply-chain interruptions as well as surging U.S. wage data spooked the Fed in 4Q.
- In 1H of 2022 there have been new supply shocks: the Russia/Ukraine conflict pressuring food & energy and new China lockdowns & port backups.
- Against this backdrop, the U.S. labor market is dealing with the thrust from previous 2020/21 stimulus. The labor market is basically overheating.
- Accordingly this is where we are: the market has digested the Fed pivoting from emergency monetary policy (0% fed funds) to neutral (2-3% fed funds + Q.T.). We have seen some "peak inflation" evidence (eg, U.S. used-car prices reversing), so the Fed does not yet have to aim for overly "tight" (4-5% fed funds). But Fed Chair Powell has indicated that U.S. rate hikes should accelerate, as there's a desire to get to neutral quicker … just in case that's not enough.
- Bottom line: The Fed is still trying for an economic soft landing. The pathway has become narrow for this outcome. This is going to have to be a joint effort (Fed + private sector). The Fed cannot bring inflation down by themselves without another pivot & shock to the financial system.

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V. WASHINGTON POLICY – DAN CLIFTON

- **Midterm Election Years Are The Most Volatile Of The Four-Year Presidential Cycle.** Midterm election years are the most volatile for stocks during the four-year presidential cycle, with an average intra-year correction of 19 percent. This year is no different although the timing has been faster and the scope of the decline has been deeper than usual. Interestingly, the S&P 500 has been trending very similarly to its 1982 pattern, the last time we were dealing with inflation, Russia, and a midterm election at once. The good news is that the faster and steeper the decline, the stronger the recovery has been with an average 32 percent gain of the S&P 500 off its midterm election low.
- **Fiscal Policy, Monetary Policy, And Geopolitical Frameworks Have All Been Upended:** During the pandemic, policymakers in Washington and at the Federal Reserve provided extraordinary support for the U.S. economy. Now, with inflation at 8%, the Fed needs to shift from preventing inflation to crushing it. Russia's invasion of Ukraine has fractured the post-Cold War mindset with borders changing, energy being used as a weapon, and a Russia, China, and potentially Saudi alliance facing off against a unified West, which can have enormous consequences for the U.S. Dollar in the future.
- **Energy Independence And Onshoring Are Key Themes:** With Russia using energy as a weapon against Europe and China cozying up with Russia during the conflict, U.S. policymakers are increasingly pushing for energy independence (for the U.S. and Europe) and securing U.S. supply chains, despite the current dragging of their feet in this high inflation and heightened geopolitical risk environment.
- **Democrats May Still Revive A Slimmed-Down Build Back Better Bill:** Democrats fear that they are going to lose in the midterm elections and are making one last push for a slimmed-down Build Back Better. There are wide disagreements in the party over the best path to taxation and how much spending should be included. But with the clock running out and a wave election building, never rule out a party to get something done before the August recess starts.
- **Democrats Are Likely To Lose Both The House & Senate**: Biden's approval rating remains in the low-40s which is consistent with losing both the House and Senate. In the key swing states, Biden has fallen by an average of 20 percentage points. Inflation is the top issue for voters but geopolitical issues, immigration, and crime are also important. These issues are all cutting against the Democrats. As such, a wave election is building against the Democrats. The equity market is already assuming a Republican takeover so the big question is whether the election is a tsunami or a ripple. Inflation and Republican candidate quality matter in the Senate**.**

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VI. FIXED INCOME STRATEGY – TOM TZITZOURIS

Key Investment Conclusions

- May will likely deliver the most substantial tightening of monetary policy in the last 25 years, if not the last 40 years. Of this, we feel confident. But there's a great deal of room for surprise, both hawkish and dovish, and on both ends of the curve.

- On the front end, the market and Fed seem to be in agreement that 50 bps is a done deal for May, but there are plenty of hints that 75 bps is also on the table. Likewise, a 50 bps follow up in June seems to be the consensus within the Fed, and markets, but there are whispers of both 25 and 75. Collectively, we see room for a surprise to either side of market pricing over the next 2 meetings, and with that, comes uncertainty in curve slope and the odds of a recession this year or next.

- On the back end, balance sheet reduction is an even bigger wildcard, with no firm consensus (at least publicly) from the Fed about how fast and how high to cap reduction, nor is there a concrete roadmap about when and how to begin asset sales, if needed. We believe that balance sheet reduction is where the primary market risk resides in 2022. On the high end of possibilities, if runoff and asset sales exceed $2 trillion over the next 2 years, then we would expect 10 year yields to make at least one more major move higher to, and above 3%, and possibly reach as high as 3.5%, before stalling. If reduction comes in on the low end (less than 1.5 trillion over the next 2 years), then we would expect 10s to stall near 3%, and eventually reverse lower and invert vs 2s somewhere around 2.75% no later than early Q3. In the former scenario (high pace of runoff), 10s would be off another 5% from current levels, and we would expect equity markets to be a good 5% or more softer as well. The slower pace scenario would likely lead to about another 2% downside in 10 year notes, followed by about a 3.5% gain on the reversal lower in yields, and we would expect to see credit and equity markets perform about flat from here to year end.

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APPENDIX – IMPORTANT DISCLOSURES

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Attachment 3

NOTLEY'S NOTES Weekly Update

Volume 36, Number 18

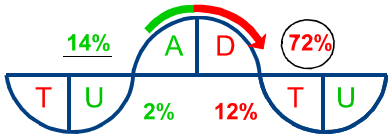
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Jonathan C. Arter,
Editor and Senior Analyst

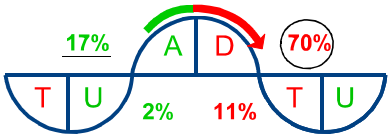
Sales Inquiries:
Bonnie Nakashian (203) 800-7297
Bonnie@taniscott.com

The Long Term Cyclic Bear Is Likely To Remain In Place Through Into Q4 2022 And On.

Current Week - Long Term Trend



Last Week - Long Term Trend



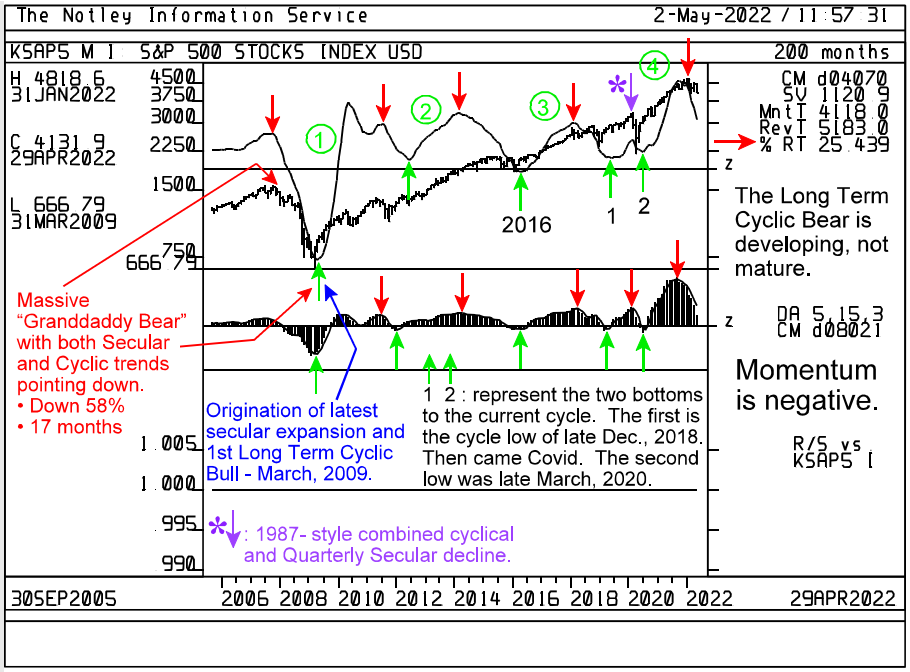
Data in sine waves is taken from our Cycle Measure screen, Submenu Three, Screen 2 - S&P 500 - All Constituent Stocks.

S&P 500 STOCKS INDEX

Long Term Trend

(Monthly Data)

Investor Strategy



COMMENTS: The long term trend changes infrequently and records cyclic bottoms every four to four and a half years. The Long Term trend is down - - just as it has been since early January. What has changed is the amount of upward price effect needed to reverse the downtrend. That "effort" is recorded through the Reverse Trend metric on the %RT value, shown in the upper right-hand corner of each chart (→). This week the reversal number is +25%. Last week it was +21%, then 18%. At the start of April it was +14%. At the start of the year when the Bear market was born, the %RT was a small +5.96%. The Reversal Percentage will grow larger - - in proportion to the strengthening of the downtrend. Since late January it has grown more and more and has been outside of the "striking distance" threshold of +5%. In other words, today, at +25%, the amount of upward price movement needed to reverse the downtrend is very very large - - well outside of the +5% "striking distance" and, therefore, it is highly improbable that we return to uptrend over the next observation or month. We will need to be patient, let the Bear market run its full course, and then find its bottom. Then a new cycle can commence.

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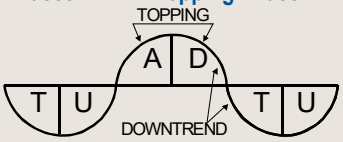
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LONG TERM TREND TOPPING AND BOTTOMING MONITOR BY SECTOR

Phases A + D = Topping Phase.



Consistent readings above 50% in Cyclic Phase A indicate a Buying Climax and a possible Long Term Cyclic Top lies ahead.
Consistent readings in Cyclic Phase D above 40% indicate the birth and presence of a Long Term Bear for that sector.

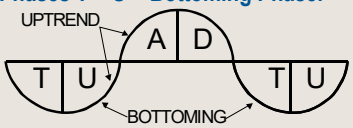
Cyclic Phase Readings Monthly		Front-End			Middle			Back-End		
		Utilities	Telecom	Financials	Consumer	Technology	Industrials	Cyclicals	Energy	Golds
A	December	73%	37%	48%	45%	45%	42%	25%	71%	6%
Advancing	January	80%	32%	10%	31%	7%	8%	0%	55%	9%
Phase	February	35%	21%	3%	15%	4%	8%	4%	53%	9%
	March	78%	28%	7%	23%	2%	14%	20%	55%	19%
	April	80%	21%	1%	27%	2%	6%	9%	24%	18%
D	December	15%	53%	51%	53%	53%	53%	66%	27%	22%
Down	January	15%	58%	88%	65%	89%	86%	89%	44%	19%
Phase	February	58%	63%	96%	77%	91%	86%	86%	45%	18%
	March	20%	50%	91%	66%	85%	76%	68%	45%	17%
	April	18%	42%	97%	51%	80%	73%	79%	73%	13%

For the month ending April 29th,

One sector qualifies with a reading of 50% or above in Cyclic Phase A - Utilities.

Seven sectors qualify with a reading of 40% or above in Cyclic Phase D - Telecoms, Financials, Consumer, Technology, Industrials, Cyclicals, and Energy.

Phases T + U = Bottoming Phase.



Consistent readings above 40% in Cyclic Phase T indicate a Selling Climax, possible Long Term Cyclic Bottoms are forming.
Consistent readings above 30% in Cyclic Phase U imply the birth of a new Long Term Bull for that sector.

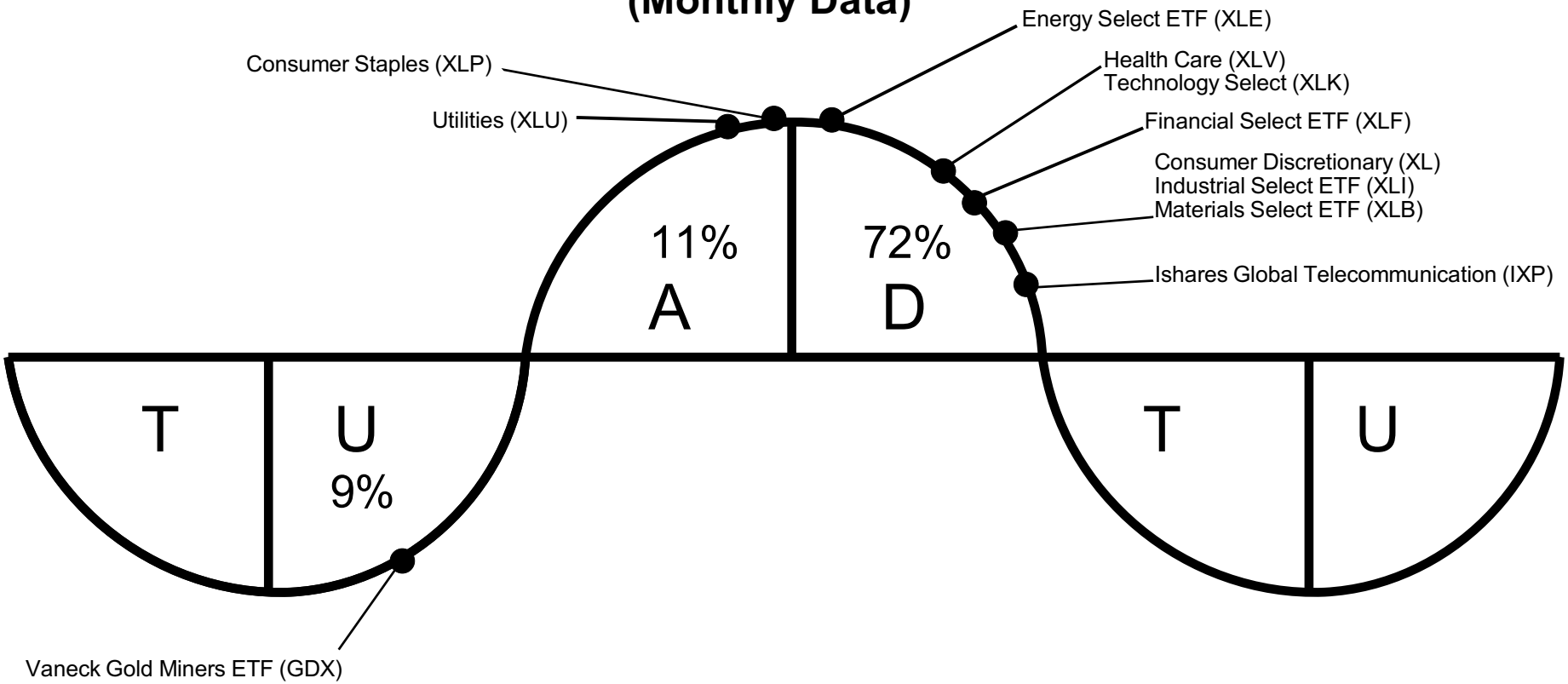
Cyclic Phase Readings Monthly		Front-End			Middle			Back-End		
		Utilities	Telecom	Financials	Consumer	Technology	Industrials	Cyclicals	Energy	Golds
T	December	3%	11%	1%	1%	2%	2%	5%	0%	50%
Terminating	January	3%	11%	1%	1%	4%	3%	5%	0%	41%
Phase	February	5%	16%	1%	6%	5%	6%	5%	0%	26%
	March	0%	22%	1%	9%	13%	6%	9%	0%	8%
	April	3%	37%	1%	19%	18%	19%	9%	4%	21%
U	December	10%	0%	0%	1%	0%	3%	4%	2%	22%
Early Up	January	3%	0%	0%	3%	0%	3%	5%	2%	31%
Phase	February	3%	0%	0%	1%	0%	0%	5%	2%	47%
	March	2%	0%	0%	1%	0%	3%	4%	0%	56%
	April	0%	0%	0%	3%	0%	2%	4%	0%	48%

Conclusion: Long Term Trend Monthly Comment - A Long Term Cyclic Bear is in place with virtually all sectors positioned in the same downtrending point-of-cycle. All are in "D" Phase or the early downtrend quadrant. Gold sector is an exception. It's counter-cyclic and is in a cyclic Bull, on the left-hand side of the Bell Curve (topping the first intermediate upleg - - Point A to Point B). Utilities are also different. They are only now starting to top their cyclic Bull lagging the general market by four months.

The Nine Major Equity Market Sectors From Front-End To Middle And Through To Back-End-Of-Cycle Long Term Cyclic Trend (Monthly Data)

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Cyclic Phase Coding:

U = Up Phase *A = Advancing Phase*
D = Down Phase *T = Termiinating Phase*
Trough to Trough Estimate is 4 to 4 1/2 ± Years.

NAFTA - CANADA, MEXICO & U.S. - MONITORING STOCK ROTATION

SECTOR COLUMNS ARE LISTED BY ROTATIONAL SEQUENCE FRONT-END LEADING, MIDDLE COINCIDENTAL & BACK-END LAGGING.

U.S. - UNMARKED, *CANADIAN STOCKS, +MEXICAN STOCKS, ✓EUROPEAN LISTING

FRONT-END-OF-EQUITY SECTORS (5,1)

Utilities 40 (5,4)

AES Corp.	AES
Alliant Energy	ILNT
Ameren Corp.	AEE
Amer. Elec. Power	IAEP
*ATCO Ltd. Class I	ACO.X
*Canadian Utilities	CU
CenterPoint Energy	CNP
CMS Energy	CMS
Consol. Edison	ED
DTE Energy	DTE
Dominion Energy	D
Duke Energy	DUK
Edison Int'l	EIX
*Emera	EMA
*Enbridge	ENB
Entergy Corp.	ETR
EQTCorp.	EQT
Evergy Inc.	EVRG
Eversource Energy	ES
Exelon Corp.	IEXC
Firstenergy Corp.	FE
*Fortis	FTS
Hawaiian Electric Indu	HE
MDU Resources	MDU
National Fuel Gas	NFG
National Grid	NGG
Nextera Energy	NEE
Nisource	NI
OGE Energy	OGE
PG&E Corp	PCG
Pinnacle West Capital	PNW
PPL Corp	PPL
Public Service Entrprs	PEG
Sempra Energy	SRE
Southern Co.	SO
*TransAlta	TA
WEC Energy Group	WEC
Williams Co.	WMB
Xcel Energy	IXEL
Utilities SPDR ETF	**XLU**

Telecoms 19 (5,5)

America Movil	AMX
AT&T	T
*BCE Inc	BCE
Lumen Technologies	LUMN
Charter Comm	ICHTR
IDT Corp.	IDT
LM Ericsson	IERIC
Nokia	NOK
Orange	ORAN
*Rogers Comm.	RCI.B
Telephone & Data Sys	TDS
*Telus	T
T-Mobile	ITMUS
Verizon Comm.	VZ
Vodafone Group	IVOD
Communication Services Select ETF	**XLC**
SPDR S&P Telecom ETF	**XTL**
Ishares Global Telecom ETF	**IXP**
Vanguard Telecom Services	**VOX**

Financial 69 (5,6)

AFLAC Inc.	AFL
*AGF Management	AGF.B
Allstate Corp	ALL
American Express	AXP
American Int'l	AIG
AON Plc	AON
Bank of America	BAC
*Bank of Montreal	BMO
Bank of NY Mellon	BK
*Bank of Nova Scotia	BNS
Berkshire Hathaway	BRK.A
BlackRock Inc.	BLK
*Brookfield Asset	BAM.A
*CI Financial Corp.	CIX
Capital One Financial	COF
Charles Schwab	SCHW
Chubb Corp	CB
*C.I.B.C.	CM
Citigroup Inc	C
Credit Suisse	CS
*Dundee Corp.	DC.A
*E-L Financial	ELF
Equity Residential	EQR
*Fairfax Financial	FFH
Franklin Resources	BEN
Globe Life	GL
*Great-West Lifeco	GWO
Goldman Sachs Group	GS
H&R Block	HRB
Hartford Financial	HIG
HSBC Holdings	HSBC
*Industrial Alliance Insur	IAG
*IGM Financial	IGM
ING Groep	ING
J.P. Morgan Chase	JPM
Keycorp	KEY
*Laurentian Bnk of Can	LB
Lincoln National	LNC
Loews Corp.	L
*Manulife Financial	MFC
Marsh & McLennan	MMC
Mastercard	MA
MBIA	MBI
MetLife Inc.	MET
Moody's Corp.	MCO
Morgan Stanley	MS
*Nat'l Bank of Cdn	NA
PNC Financial	PNC
*Power Corp of Can	POW
Principal Financial	IPFG
Progressive Corp	PGR
Prudential Financial	PRU
Regions Financial	RF
*Royal Bank of Canada	RY
SLM Corp.	ISLM
Simon Property Group	SPG
State Street Corp.	STT
*Sun Life Financial Serv	SLF
T Rowe Price Grp	ITROW
Truist Financial Corp	TFC
*Toronto-Dominion Bnk	TD
Travelers Companies	TRV
UBS Group AG	UBS
U.S. Bancorp	USB
Virtus Invest Partners	IVRTS
Visa	V
Wells Fargo	WFC
Financial SPDR ETF	**XLF**
SPDR S&P Regional Banking ETF	**KRE**

MIDDLE-OF-EQUITY SECTORS (5,2)

Consumer 78 (5,7)

DISCRETIONARY 39 (5,13)

Amazon.com Inc.	IAMZN
Bed, Bath & Beyond	IBBBY
Best Buy Co.	BBY
Booking Holdings Inc.	IBKNG
Carnival Corp	CCL
Comcast Corp.	ICMCSA
Costco Wholesale	ICOST
Ford Motor	F
Fox Corp	IFOX
Gap Inc.	GPS
General Motors	GM
Goodyear Tire & Rubber	IGT
Harley-Davidson	HOG
Home Depot	HD
International Game Tech	IGT
KB Home	KBH
Kohl's Corp.	KSS
Lowe's Companies	LOW
*Magna International	MG
Marriott Int'l	IMAR
Mattel	IMAT
McDonald's Corp	MCD
Newell Brands	INWL
Netflix	INFLX
NIKE	NKE
Office Depot	IODP
Omnicom Group	OMC
Paramount Global	IPARA
Pulte Group	PHM
Starbucks Corp.	ISBUX
Target	TGT
Tegna Inc.	TGNA
+Televisa	TLEVISACPO.MX
Tesla Inc	ITSLA
*Thomson Reuters.	TRI
V.F. Corp.	VFC
Wal-Mart Inc	WMT
Walt Disney	DIS
Whirlpool	WHR

STAPLES 36 (5,14)

Abbott Laboratories	ABT
Altria Group	MO
Amgen	IAMGN
Astrazeneca	IAZN
Anthem Inc.	ANTM
Bausch Health Co.	BHC
Biogen Inc	IBIIB
Boston Scientific	BSX
Bristol Myers-Squibb	BMY
Cardinal Health, Inc.	CAH
Coca Cola Company	KO
Colgate-Palmolive	CL
*Corby Spirit & Wine	CSW.A
CVS Health Corp.	CVS
Eli Lilly	LLY
+Fomento	FEMSAUBD.MX
General Mills	GIS
*George Weston Ltd.	WN
Gilead Sciences Inc.	IGILD
Glaxosmithkline	GSK
Johnson & Johnson	JNJ
Kellogg	K
Kroger Co.	KR
*Loblaw Companies	L
Medtronic Inc.	MDT
Merck & Co. Inc.	MRK
McKesson Corp.	MCK
*Molson Coors Can	TPX.B
PepsiCo Inc.	IPEP
Pfizer Inc.	PFE
Procter & Gamble	PG
Stryker Corp.	SYK
Sysco Corp.	SYY
Tenet Healthcare	THC
UnitedHealth Group	UNH
Walgreen Boots Alliance	IWBA
Discretionary SPDRETF	**XLY**
Staples SPDR ETF	**XLP**
Health Care SPDR ETF	**XLV**

Technology 57 (5,8)

ABB Ltd.	ABB
Adobe Inc	IADBE
Accenture	ACN
Advanced Micro Dev.	IAMD
Agilent Technologies	A
Alphabet Inc (Google)	IGOOGL
Analog Devices	IADI
Apple Inc.	IAAPL
Applied Materials	IAMAT
Autodesk	IADSK
Automatic Data	IADP
*Blackberry	BB
*Celestica Inc.	CLS
*CGI Inc	GIB.A
Cisco Systems	ICSCO
Cognex Corp	ICGNX
*Constellation Software	CSU
Corning Inc.	GLW
DXC Technology	DXC
eBay	IEBAY
Electronic Arts	IEA
HP Inc.	HPQ
IBM	IBM
Intel	IINTC
Intuit Inc.	IINTU
KLA Corp.	IKLAC
*Maxar Technologies	MAXR
Meta Platforms (Facebook)	IFB
Micron Tech	IMU
Microsoft	IMSFT
Motorola Solutions	MSI
NCR Corp.	NCR
Netapp	INTAP
Norton LifeLock Inc	INLOK
NVIDIA Corp.	INVDA
*Onex Corp.	ONEX
Onto Innovation	ONTO
*Open Text Corp.	OTEX
Oracle Corp.	ORCL
PTC Inc.	IPTC
Paypal Holdings	IPYPL
PerkinElmer	PKI
Qualcomm	IQCOM
SAP SE	SAP
Steel Connect	ISTCN
STMicroelectronics	STM
Taiwan Semiconductor	TSM
Teradyne Inc.	ITER
Texas Instruments	ITXN
Unisys Corp.	UIS
Viavi Solutions	IVIAV
Vmware Inc.	VMW
Western Union	WU
Wipro Ltd.	WIT
Xerox Holdings Corp	IXRX
Technology SPDR ETF	**XLK**

Industrial 62 (5,9)

*ATS Automation	ATA
Avery Dennison	AVY
Avis Budget Group	ICAR
*Ballard Power Sys	BLDP
Boeing	BA
*Bombardier	BBD.B
*Canadian Nat'l Rail	CNR
*Canadian Pacific Rail	CP
Caterpillar Inc.	CAT
*CAE Inc.	CAE
+CEMEX	CEMEXCPO.MX
CH Robinson	ICHRW
Cintas Corp.	ICTAS
CSX Corp.	ICSX
Crane Co.	CR
Cummins Inc.	CMI
Danaher Corp.	DHR
Deere & Co.	DE
Deluxe Corp.	DLX
Dover Corp.	DOV
Eaton	ETN
Equifax Inc.	EFX
Emerson Electric	EMR
FedEx	FDX
*Finning Int'l	FTT
Fiserv Inc.	IFISV
Fluor Corp.	FLR
General Dynamics	GD
General Electric	GE
Honeywell Intl	IHON
Illinois Tool Works	ITW
ITT Corp.	ITT
JetBlue Airways	IJBLU
Johnson Controls	JCI
+KUO	KUOB.MX
L3Harris Technologies	LHX
Lockheed Martin	LMT
Masco Corp	MAS
3M	MMM
Norfolk Southern	NSC
Northrop Grumman	NOC
Paccar Inc.	IPCAR
Parker-Hannifin	PH
Paychex Inc.	IPAYX
Pitney Bowes	PBI
Raytheon Tech	RTX
Robert Half Int'l	RHI
Rockwell Automation	ROK
Ryder System	R
*SNC-Lavalin	SNC
Southwest Airlines	LUV
Textron	TXT
*Toromont Industries	TIH
Trane Technologies	TT
*Transcontinental	TCL.A
Union Pacific	UNP
United Parcel Serv	UPS
+Vitro	VITROA.MX
WW Grainger	GWW
Waste Connections	WCN
Waste Management	WM
Industrials SPDR ETF	**XLI**

BACK-END-OF-EQUITY SECTORS (5,3)

Cyclic Res 57 (5,10)

Air Prod & Chem	APD
Alcoa	AA
+Alfa A	ALFAA.MX
Allegheny Technologies	ATI
Alto Ingredients	IALTO
Archer-Daniels-Midland	ADM
Ball Corp.	BLL
BHP Group Ltd	BHP
Bunge Limited	BG
*Cameco Corp	CCO
*Canfor	CFP
*Cascades	CAS
Centrus Energy	LEU
*CCL Industries Inc.	CCL.B
Clevland-Cliffs Inc	CLF
Commercial Metals	CMC
+CYDSA	CYDSASAA.MX
*Denison Mines	DML
DuPont de Nemours	DD
Eastman Chemical	EMN
Ecolab Inc.	ECL
*First Quantum Minerals	FM
FMC Corp.	FMC
✓Glencore	GLEN.L
Ingredion Inc.	INGR
*Interfor Corp.	IFP
Int'l Flavors & Fragrances	IFF
International Paper	IP
*Intertape Polymer Group	ITP
+Kimberly A	KIMBERA.MX
Kimberly-Clark	KMB
*Labrador Iron Ore	LIF
Louisiana-Pacific	LPX
Materion Corp	MTRN
*Methanex Corp	MX
Mosaic Co.	MOS
Nucor Corp.	NUE
*Nutrien	NTR
PotlatchDeltic Corp.	IPCH
PPG Industries	PPG
Rio Tinto Plc	RIO
Rayonier Advanced Materials	RYAM
Sealed Air Corp.	SEE
*Sherritt Int'l	S
*Teck Resources	TECK.B
*Thompson Creek Metals	TCM
*Turquoise Hill Resources	TRQ
U. S. Steel	X
VALE S.A.	VALE
Vulcan Materials	VMC
*West Fraser Timber	WFG
*Western Forest Prods	WEF
Weyerhaeuser	WY
*Wheaton Precious Mtls	WPM
Worthington Ind.	WOR
Yara International	YAR.OL
Materials SPDR ETF	**XLB**

Energy 58 (5,11)

*Altagas Ltd.	ALA
APA Corp	IAPA
*Arc Resources	ARX
Ashland Inc	ASH
BP Plc	BP
Baker Huges Co.	IBKR
*Baytex Energy	BTE
*CDN Natural Res	CNQ
*Cenovus Energy	CVE
Chevron	CVX
China Petro & Chem	SNP
ConocoPhillips	COP
*Crescent Point Ener	CPG
Devon Energy	DVN
EOG Resources	EOG
Enerplus	ERF
*Ensign Energy	ESI
Equinor	EQNR
Exxon Mobil	XOM
Forum Energy Tech	FET
Getty Realty Corp.	GTY
Halliburton Co.	HAL
Helix Energy	HLX
Helmerich & Payne	HP
Hess	HES
*Imperial Oil	IMO
Kinder Morgan	KMI
Marathon Oil	MRO
Murphy Oil	MUR
Nabors Inds.	NBR
NOV Inc	NOV
*Obsidian Energy	OBE
Occidental Pete	OXY
Oceaneering Int'l	OII
*Ovintv Inc	OVV
*Paramount Res	POU
*Pembina Pipeline	PPL
Petrochina	PTR
*Peyto Explo & Deve	PEY
*Precision Drilling	PD
Schlumberger	SLB
*Shawcor	SCL
Shell Plc	SHEL
SM Energy Co.	SM
*Suncor Energy	SU
Tidewater	TDW
TotalEnergies	TTE
*TC Energy Corp	TRP
Transocean	RIG
*Trican Well Service	TCW
Valero Energy	VLO
*Vermilion Energy	VET
World Fuel Serv	INT
YPF S.A.	YPF
Energy SPDR ETF	**XLE**

Prec Metals 66 (5,12)

Australia (8)

AIC Mines	A1M
Helix Resources	HLX
Kingsgate	KCN
Newcrest Mining	NCM
Oceangold	OGC
OZ Minerals	OZL
Resolute Mining	RSG
Silver Lake Resources	SLR

Canada (22)

*Agnico-Eagle	AEM
*Alamos Gold	AGI
*B2Gold Corp	BTO
*Barrick Gold Corp	ABX
*Centerra Gold	CG
*Endeavour Silver	EDR
*Erdene Resource Dev	ERD
*First Majestic Silver	FR
*Gabriel Resources	GBU
*Galiano Gold	GAU
*IAMGold	IMG
*Kinross Gold	K
*New Gold	NGD
*Novagold Resources	NG
*Pan American Silver	PAAS
*Pretium Resources	PVG
*Sandstorm Gold	SSL
*Seabridge Gold Inc.	SEA
*Sprott Physical G&S	CEF
*Taseko Mines	TKO
*Torex Gold	TXG
*Wesdome Gold Mines	WDO

U.S.A. Listings (17)

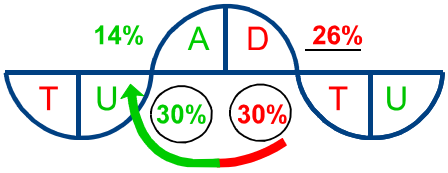
Anglogold Ashanti	AU
ASA Gold & Precious M	ASA
Buenaventura S.A.	BVN
Coeur Mining	CDE
DRD Gold	DRD
Eldorado Gold Corp	EGO
Endeavour Silver	EXK
First Majestic Silver	AG
Freeport McMoRan	FCX
Franco Nevada	FNV
Gold Fields	GFI
Harmony Gold	HMY
Hecla Mining	HL
Newmont Corp	NEM
Royal Gold	IRGLD
Seabridge Gold	SA
Sibanye Stillwater Ltd	SBSW
SSR Mining	ISSRM
Yamana	AUY

Others (4)

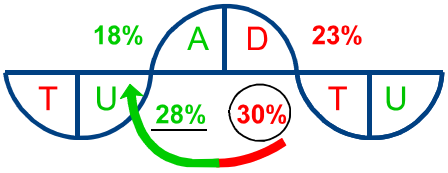
Centamin	CEY.L
+Ind Penoles	PE&OLES.MX
Pan African Res	PAF.L
Zijin Mining	2899.HK
AMEX Gold Bugs Index	HUI0
DB Gold Double Long	DGP
DB Gold Double Short	DZZ
iShares MSCI Global Gold Miners	RING
iShares S&P/TSX Global Gold	XGD
iSharesSilverTrust ETF	SLV
NYSE Arca Gold Miners Index	GDM
PHLX Gold & Silver Ind	KAALP
*S&P/TSX GICS Global Gold Index	GSPTTGD
S&P GICS Gold Sub	KSPGA
SPDR Gold SharesETF	GLD
Sprott Physical Gold	PHYS
Sprott Gold Eqty Fund	SGDLX
Vaneck Gold Miners ETF	GDX
Vaneck Jr Gold Miner ETF	GDXJ

The Intermediate Recovery Rally Failed After Producing Just One Short Term Rebound Cycle.

Current Week - Intermediate Trend



Last Week - Intermediate Trend



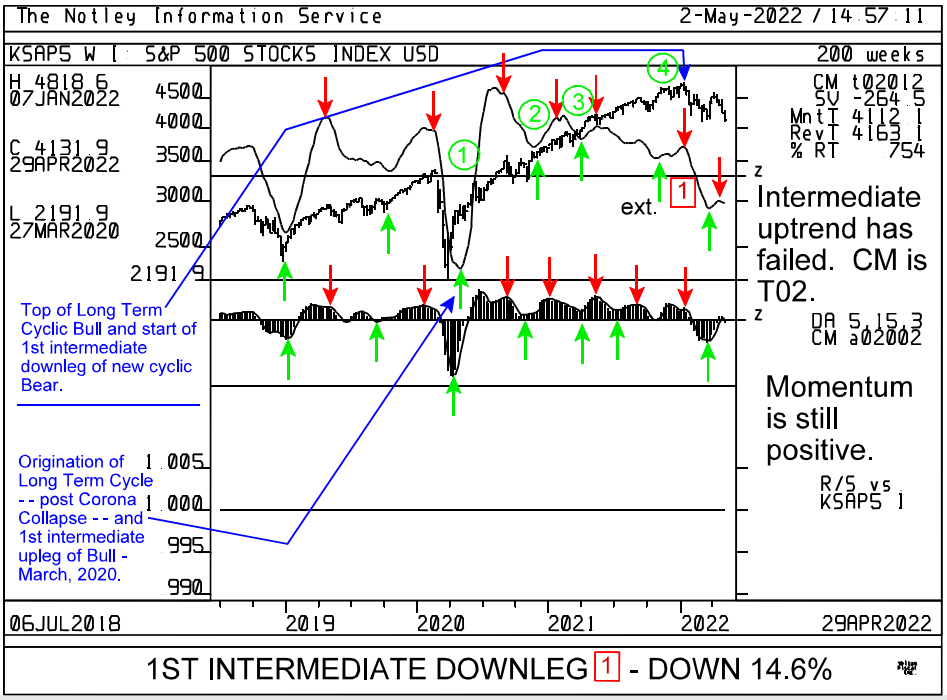
Data in sine waves is taken from our Cycle Measure screen, Submenu Three, Screen 2 - S&P 500 - All Constituent Stocks.

S&P 500 STOCKS INDEX

Short Term Trend

(Daily Data)

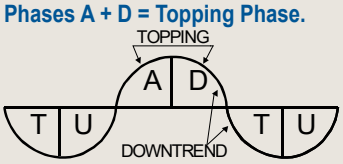
Execution Strategy



COMMENT: Usually markets will produce two upward stages or two short term uptrends within the context of an intermediate rebound effort. As we expressed it in early April: "...This recent bounce needs to be understood in its proper context... It's not a new Bull (left-hand side of the 4 to 4 1/2 year cycle)... We are completing the first short term up stage of the intermediate recovery rally. Most rebound rallies will have two short term up stages within their structure. We have already recovered more than half of the loss so the next up stage - - or short term uptrend two - - may not add much to what has already been done." (*Notes* #14, 5 April). Obviously, this market is in a hurry to undo the previous excesses and is correcting rapidly. We are now at or through the prior short cycle low of late February. The reflex rally was quite vigorous and front-loaded gaining back about 60% of the prior loss. But the duration of that rally was short. The long term trend is dominant and the power of the Bear is now, once again, fully evident. We have, in effect, gone straight over to the next intermediate downleg - - Downleg Two. We are at the cusp of the month, a period where very often we see short term junctures. The market may yet produce another try at a recovery but, again, that is the small picture.

INTERMEDIATE TREND TOPPING AND BOTTOMING MONITOR BY SECTOR

Phases A + D = Topping Phase.

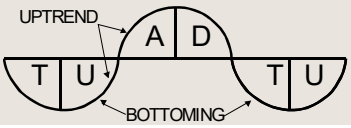


Consistent readings above 50% in Cyclic Phase A indicate a Buying Climax and a possible peak lies ahead.
Consistent readings in Cyclic Phase D above 40% imply the birth and presence of an Intermediate Downtrend for that sector.

Cyclic Phase Readings Weekly		Utilities	Telecoms	Financials	Consumer	Technology	Industrials	Cyclicals	Energy	Golds
A	April 1	75%	26%	23%	31%	4%	29%	50%	67%	82%
Advancing	April 8	83%	32%	23%	37%	2%	27%	36%	75%	81%
Phase	April 15	78%	26%	9%	37%	2%	29%	41%	44%	85%
	April 22	70%	21%	4%	28%	2%	19%	18%	9%	40%
	April 29	53%	0%	6%	26%	5%	18%	14%	9%	6%
D	April 1	3%	16%	28%	19%	11%	6%	13%	29%	5%
Down	April 8	0%	11%	25%	15%	13%	6%	23%	22%	7%
Phase	April 15	8%	16%	35%	17%	11%	6%	18%	49%	3%
	April 22	18%	16%	29%	27%	9%	19%	40%	82%	48%
	April 29	35%	37%	26%	24%	5%	24%	40%	80%	84%

For the week ending April 29th:
One sector qualifies with a reading of 50% or above in Cyclic Phase A - Utilities.
Three sectors qualify with a reading of 40% or above in Cyclic Phase D - Cyclicals, Energy, and Golds.

Phases T + U = Bottoming Phase.



* Consistent readings above 40% in Cyclic Phase T indicate a Selling Climax, possible lows, and new uptrend is just ahead.
Consistent readings above 30% in Cyclic Phase U imply the birth of a new Intermediate Uptrend for that sector.

Cyclic Phase Readings Weekly		Front-End			Middle			Back-End		
		Utilities	Telecoms	Financials	Consumer	Technology	Industrials	Cyclicals	Energy	Golds
T	April 1	3%	21%	38%	33%	47%	33%	20%	0%	9%
Terminating	April 8	3%	16%	39%	26%	42%	43%	27%	0%	9%
Phase	April 15	3%	11%	48%	27%	50%	39%	27%	4%	6%
	April 22	0%	47%	62%	27%	57%	37%	16%	5%	6%
	April 29	3%	47%	64%	27%	46%	32%	21%	7%	9%
U	April 1	20%	37%	12%	17%	38%	32%	18%	4%	5%
Early Up	April 8	15%	42%	13%	22%	44%	24%	14%	4%	3%
Phase	April 15	13%	47%	9%	19%	38%	26%	14%	4%	6%
	April 22	13%	16%	4%	18%	32%	24%	26%	4%	6%
	April 29	10%	16%	4%	23%	43%	26%	25%	4%	1%

Conclusion: Intermediate Term Trend Weekly Comment - Technology Sector has led the way down on an intermediate trend basis and since last November has traveled through "D" Phase, below the zero line into and well into "T" Phase with leading stocks working into uptrend since early April. Industrials, Cyclicals, and Consumers are trailing. Gold Sector has just made its intermediate top. Energy Sector is similar.

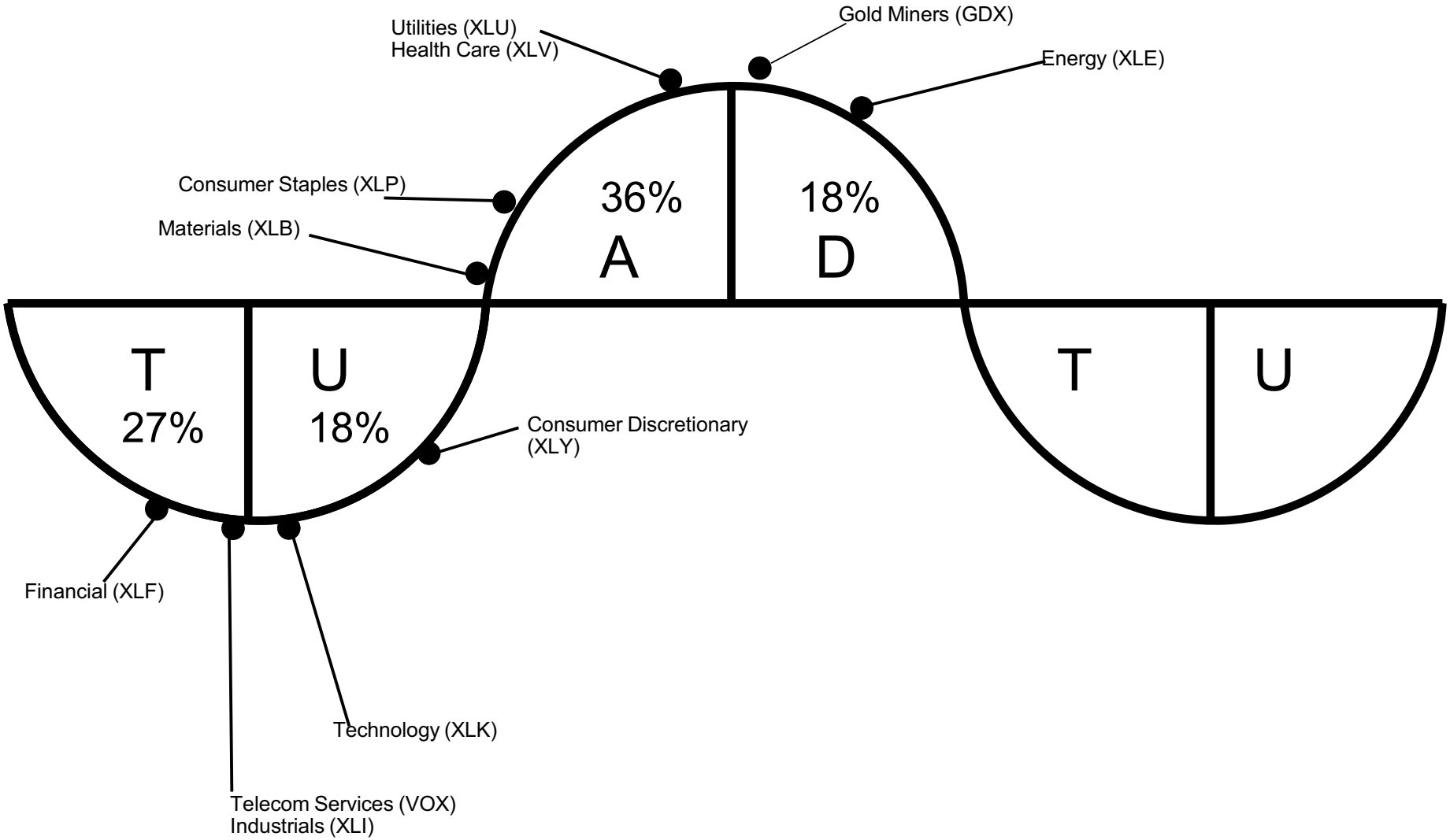
The Nine Major Equity Market Sectors From Front-End To Middle And Through To Back-End-Of-Cycle

Intermediate Trend View

(Weekly Observations/Data)

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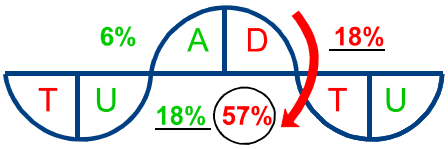


Cyclic Phase Coding:

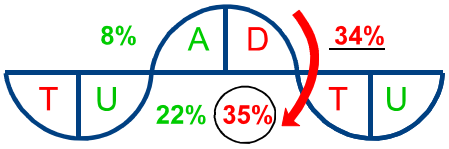
U = Up Phase *A = Advancing Phase*
D = Down Phase *T = Termiinating Phase*
Trough to Trough Estimate is 4 to 4 1/2 ± Years.

Short Term, The Market Is Oversold And At Or Through Support.

Current Week - Short Term Trend



Last Week - Short Term Trend



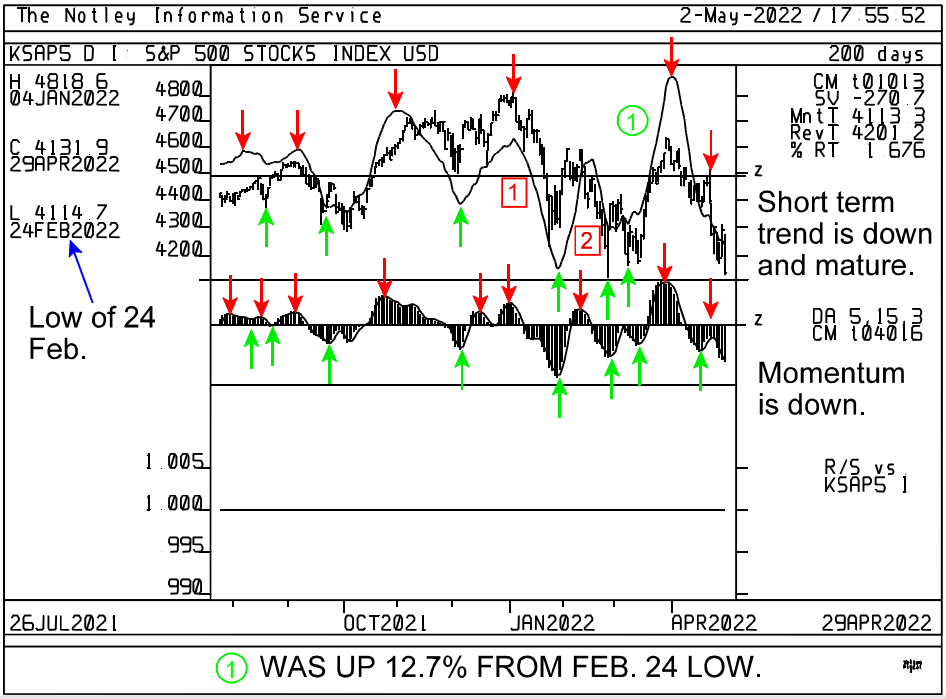
Data in sine waves is taken from our Cycle Measure screen, Submenu Three, Screen 2 - S&P 500 - All Constituent Stocks.

S&P 500 STOCKS INDEX

Short Term Trend

(Daily Data)

Execution Strategy



COMMENT: The low of the chart is 24 February. A new closing low, however, was made on Friday. The market may be oversold on a short term trend basis but that is only the very small picture. The long term picture is down. The Bear is in control. The market is at new short and intermediate cycle lows and the Bear is only four months old.

GLOBAL SUMMARY
154 SERIES FOR CALCULATING %RT NUMBERS
ON A COUNTRY AND CONTINENT BASIS

To better monitor the global market condition we use %RT (Percentage to Reverse Trend) readings to gauge the acceleration or deceleration of trends at top or bottom junctures. Percentage to Reverse Trend (%RT) indicates the percentage change (in price) needed to reverse the current trend for the next period (day, week, month, etc.). A positive (negative) number is a measure of the advance (decline) necessary to reverse or abort the existing downtrend (uptrend).

The %RT reading appears on all charts in the right-hand top corner for all five market rhythms. It is also published on all cycle measure screens and appears on the right-hand column.

In terms of top or bottom junctures, "Striking Distance" is the nominal number needed to reverse by next observation. The intermediate term trend "Striking Distance" is within 5% range. For example, we use the term "new trend pending" when %RT is between zero and +5%.

DATA: Calculations were made at close of April 29, 2022. Therefore, most of the %RT numbers shown on the next 2 pages have to change by their percentage amount by May 6, 2022 close to reverse the current intermediate uptrend.

Negative %RT numbers reflect uptrends that are positioned within Cyclic "U" or "A" Quadrants.
Positive %RT numbers reflect downtrends that are positioned in "D" or "T" Quadrants.

ANALYSIS AND CONCLUSION - To the data on pages 10 and 11.

Many country and continental market categories now have positive average %RT values, indicating that intermediate uptrends (recovery rallies all) have been undone. The failure of the latest short term rebound attempt has driven prices low enough to reverse even the intermediate uptrends. The long term cyclic Bear is in control and it is nowhere near to its downtrend maturity.

NOTE:
NEGATIVE %RT IMPLIES A BULLISH TREND. POSITIVE %RT REFLECTS A BEARISH TREND.
%RT MEANS: PERCENT TO REVERSE TREND.

MONITORING THE INTERMEDIATE TREND JUNCTURES

Measuring Acceleration and Deceleration of Price Movements at Cyclic Junctures.

NORTH AMERICA (11 Series)

Country & Index	%RT - 04/22	%RT - 04/29
N.Y.S.E. A/D Line (T02)	- 0.20%	- 0.08%
NASDAQ 100 (U01)	- 3.98%	- 0.85%
Dow Jones 30 (T02)	- 1.83%	+ 0.26%
Canadian Big-Cap (D02)	+ 1.85%	+ 2.87%
S&P 500 (T02)	- 2.07%	+ 0.75%
Mexico (D02)	+ 2.54%	+ 3.73%
Wilshire 5000 (T02)	- 2.57%	+ 0.25%
N.Y.S.E. Composite (T02)	+ 0.26%	+ 1.94%
NASDAQ Comp. (T02)	- 3.79%	- 0.53%
Amex Composite (D02)	+ 5.10%	+ 5.60%
Russell 2000 (U07)	- 4.01%	- 0.57%
AVERAGE	**- 0.79%**	**+ 1.21%**

U.S. MARKET - Sampling Largest Stocks (20 Series)

Stock	%RT - 04/22	%RT - 04/29
Apple (T05)	+ 0.22%	+ 3.62%
Microsoft (U01)	- 2.82%	- 2.62%
Alphabet (T03)	+ 2.98%	+ 7.21%
Amazon.Com (T02)	- 5.06%	+ 10.05%
Facebook (U04)	- 10.55%	- 19.17%
Tesla (U06)	- 17.27%	- 8.37%
Berkshire Hathaway (D03)	+ 5.07%	+ 9.04%
Nvidia (T02)	+ 1.78%	+ 5.30%
JP Morgan Chase (T18)	+ 1.79%	+ 6.40%
Visa (T02)	+ 4.25%	+ 5.69%
Johnson & Johnson (A07)	- 4.57%	- 2.59%
Wal-Mart Stores (A05)	- 8.88%	- 5.26%
Unitedhealth (A06)	- 3.18%	- 0.88%
Bank of America (T09)	+ 12.30%	+ 13.91%
Home Depot (U02)	- 5.47%	- 4.12%
Mastercard (U01)	+ 2.27%	+ 1.78%
Procter & Gamble Co (U02)	- 2.10%	- 1.89%
Walt Disney Co (T05)	+ 10.23%	+ 15.30%
Paypal (U07)	- 8.32%	- 14.12%
Adobe Systems (U06)	- 8.50%	- 5.92%
AVERAGE	**- 1.79%**	**+ 0.66%**

U.S. SPECULATIVE MODE - 1999 IPOs - Sampling - (4 Series) - Cycle Measure Screen (5, 17)

Stock	%RT - 04/22	%RT - 04/29
Broadcom Ltd (U01)	- 6.96%	+ 1.26%
F5 Networks (T01)	- 7.76%	+ 5.62%
Juniper Networks (D15)	- 0.86%	+ 10.85%
Akamai Tech (D01)	- 4.10%	- 4.31%
AVERAGE	**- 4.92%**	**+ 3.35%**

NORTH AMERICA - U.S. AND CANADA (10 Series)

Sectors	%RT - 04/22	%RT - 04/29
Utilities (A06)	- 4.52%	- 1.26%
Telecoms (T02)	+ 0.44%	+ 3.37%
Financials (T05)	+ 4.55%	+ 7.68%
Consumer Discret. (T01)	- 7.68%	- 0.38%
Consumer Staples (A04)	- 3.00%	- 0.89%
Technology (U01)	- 2.15%	- 0.53%
Industrials (T01)	- 3.26%	- 0.62%
Basic Cyclicals (A01)	- 3.56%	- 2.82%
Energy (D03)	+ 12.64%	+ 14.25%
Precious Metals (D01)	+ 4.71%	+ 10.02%
AVERAGE	**- 0.18%**	**+ 2.88%**

CANADIAN MARKET - Sampling Largest Stocks (20 Series)

Stock	%RT - 04/22	%RT - 04/29
Shopify Inc (U01)	- 8.89%	- 14.51%
Royal Bank (T02)	+ 11.68%	+ 9.61%
Toronto-Dominion Bank (T02)	+ 14.08%	+ 11.18%
Enbridge (D03)	+ 6.03%	+ 6.58%
Brookfield Asset (T02)	+ 1.73%	+ 0.30%
Bank of Nova Scotia (T02)	+ 10.22%	+ 12.35%
Cdn. Natl. Railway (D01)	- 0.24%	+ 4.36%
Bank of Montreal (D06)	+ 8.02%	+ 10.38%
Cdn. Imperial Bank (T02)	+ 15.87%	+ 13.78%
TC Energy Corp (D03)	+ 4.13%	+ 12.73%
BCE Inc. (D01)	- 2.73%	+ 3.87%
Canadian Pacific Railway (D04)	+ 1.70%	+ 2.36%
Cdn Nat. Resources (D03)	+ 11.29%	+ 12.92%
Nutrien (D01)	- 2.47%	+ 2.52%
Manulife Financial (D03)	+ 7.70%	+ 10.79%
Waste Connections (A04)	- 9.29%	- 7.47%
Constellation Software (U01)	- 1.80%	- 1.16%
Barrick Gold Corp (D02)	+ 7.69%	+ 17.21%
Alimentation Couche (A06)	- 4.84%	- 7.10%
Suncor Energy Inc (A01)	+ 9.21%	- 0.71%
AVERAGE	**+ 3.95%**	**+ 4.99%**

U.K. - 15 LARGEST (FTSE)

Stock	%RT - 04/22	%RT - 04/29
AstraZeneca (A09)	- 4.12%	- 4.47%
Unilever (U02)	- 3.61%	- 7.57%
Diageo (A01)	- 6.90%	- 10.04%
HSBC (D09)	+ 14.05%	+ 15.98%
GlaxoSmithKline (A04)	- 4.25%	- 7.46%
BP (D05)	+ 9.81%	+ 5.69%
Shell Plc Ordinary Shares (D03)	+ 5.66%	+ 6.42%
Rio Tinto (D04)	+ 17.05%	+ 12.77%
British American Tobacco (D09)	+ 13.21%	+ 11.19%
Glencore PLC (D02)	+ 11.67%	+ 5.42%
Relx Plc (A03)	- 5.44%	- 5.82%
Reckitt Benckiser (U03)	- 3.86%	- 5.40%
BHP Group (D02)	+ 14.33%	+ 12.13%
Prudential (T03)	+ 1.38%	- 0.95%
London Stock Exchange (D01)	- 0.42%	- 4.96%
AVERAGE	**+ 3.90%**	**+ 1.52%**

MONITORING THE INTERMEDIATE TREND JUNCTURES
Measuring Acceleration and Deceleration of Price Movements at Cyclic Junctures (Ctd).

15 LARGEST CONTINENTAL EUROPE (STOXX)

Stock	%RT - 04/22	%RT - 04/29
ASML Holding (U07)	- 9.62%	- 9.31%
LVMH Moet Hennes (T01)	- 2.81%	+ 0.89%
SAP SE (U02)	- 3.16%	- 8.33%
Linde (A01)	- 10.42%	- 10.42%
Totalenergies (T02)	+ 14.68%	+ 8.71%
Sanofi (A04)	- 1.11%	+ 0.65%
Siemens (T12)	+ 1.38%	- 1.91%
L'Oreal (U05)	- 7.79%	- 7.35%
Allianz (T02)	+ 2.25%	+ 3.38%
Schneider Electric (U03)	- 5.64%	- 6.32%
Air Liquide (A04)	- 5.73%	- 6.69%
Airbus (T04)	+ 8.52%	+ 3.09%
Mercedes-Benz Group (U07)	- 4.41%	- 4.45%
Iberdrola (A02)	- 7.13%	- 11.20%
Enel (U01)	- 0.74%	- 3.69%
AVERAGE	**- 2.11%**	**- 3.53%**

WESTERN EUROPE (21 Series)

Country & Index	%RT - 04/22	%RT - 04/29
Austria (T09)	+ 3.79%	- 0.84%
Belgium (T08)	+ 2.30%	- 0.05%
Croatia (T03)	+ 1.42%	- 1.04%
Denmark (A01)	- 8.44%	- 10.33%
Finland (U04)	- 4.37%	- 5.72%
France (T09)	- 0.12%	- 1.48%
Germany (U01)	- 0.42%	- 2.85%
Greece (T01)	- 0.95%	- 0.85%
Ireland (T10)	+ 1.34%	- 2.04%
FTSE Italia (T11)	+ 0.85%	- 1.58%
Netherlands (U06)	- 3.41%	- 5.14%
Norway (A07)	- 1.99%	- 1.19%
Portugal (A05)	- 6.93%	- 5.42%
Spain (T01)	- 0.32%	- 1.30%
Sweden (T11)	- 0.42%	- 2.51%
Switzerland (U04)	- 3.59%	- 4.30%
Turkey Istanbul (A04)	- 6.97%	- 6.09%
FTSE 100 Index (D03)	+ 1.92%	+ 0.02%
FTSE Mid 250 Index (U05)	- 3.32%	- 5.29%
FTSE All Small Index (U04)	- 1.55%	- 3.43%
FTSE Fledgling (U06)	- 2.66%	- 3.06%
AVERAGE	**- 1.61%**	**- 3.07%**

LATIN AMERICA (5 Series)

Country & Index	%RT - 04/22	%RT - 04/29
Argentina (D03)	- 0.64%	+ 7.27%
Brazil (D03)	+ 8.87%	+ 12.27%
Chile (D01)	+ 3.44%	+ 3.12%
Peru (D05)	+ 15.26%	+ 15.22%
Venezuela (U05)	- 10.84%	- 9.09%
AVERAGE	**+ 3.21%**	**+ 5.75%**

ASIA PACIFIC (17 Series)

Country & Index	%RT - 04/22	%RT - 04/29
Australia (A02)	- 4.09%	- 4.63%
China (T13)	+ 4.27%	+ 4.73%
Hong Kong (T10)	+ 10.35%	+ 1.98%
India (T02)	+ 0.21%	- 1.43%
Indonesia (A09)	- 0.66%	- 0.55%
Japan Nikkei 225 (U07)	- 3.64%	- 4.84%
Japan Topix (1st) (U07)	- 1.99%	- 3.81%
Japan Topix (2nd) (U03)	- 2.47%	- 2.47%
Korea (U05)	- 4.98%	- 7.20%
Malaysia (D03)	+ 1.49%	+ 1.85%
New Zealand (U01)	- 1.81%	- 3.66%
Pakistan (T02)	- 0.07%	- 0.11%
Philippines (T05)	+ 3.03%	+ 6.76%
Singapore (D03)	+ 5.13%	+ 3.62%
Sri Lanka (T04)	+ 51.46%	+ 50.30%
Taiwan (T05)	+ 5.81%	+ 5.23%
Thailand (D04)	+ 1.73%	+ 2.44%
AVERAGE	**+ 3.75%**	**+ 2.83%**

EASTERN EUROPE (5 Series)

Country & Index	%RT - 04/22	%RT - 04/29
Prague (T07)	+ 1.18%	+ 1.82%
Hungary (T10)	+ 3.58%	- 0.05%
Poland (T02)	+ 2.30%	+ 3.43%
Romania (T06)	- 0.92%	+ 0.81%
Russia (U01)	+ 10.18%	- 7.27%
AVERAGE	**+ 3.26%**	**- 0.25%**

MIDDLE EAST (5 Series)

Country & Index	%RT - 04/22	%RT - 04/29
Egypt (U01)	+ 4.20%	- 2.30%
Israel (D02)	- 1.73%	- 0.87%
Jordan (A16)	- 5.00%	- 4.57%
Kuwait (D01)	+ 2.37%	+ 1.78%
Saudi Arabia (D02)	+ 3.20%	+ 1.36%
AVERAGE	**+ 0.60%**	**- 0.92%**

AFRICA (Sub-Sahara and Eastern Africa) (2 Series)

Country & Index	%RT - 04/22	%RT - 04/29
Morocco (T07)	+ 1.64%	+ 0.17%
Johannesburg (T01)	+ 7.62%	+ 5.03%
AVERAGE	**+ 4.63%**	**+ 2.60%**

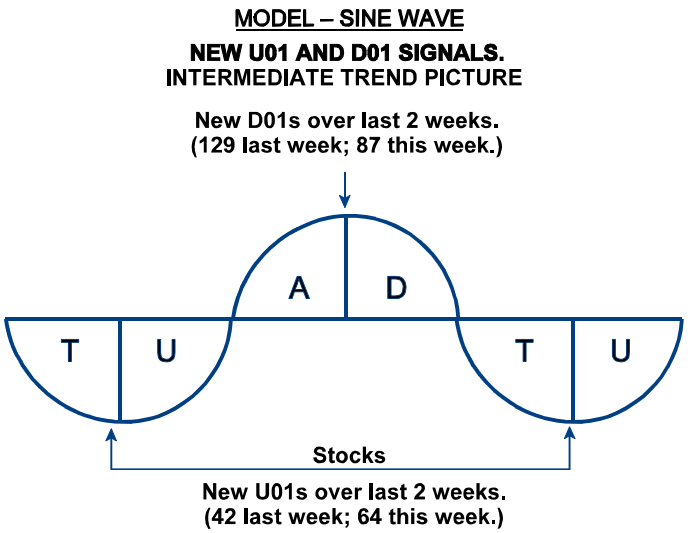
CONTINENTAL INDICES AND GLOBAL (4 Series)

Country & Index	%RT - 04/22	%RT - 04/29
Asia EMF Cap. (T11)	+ 4.21%	- 0.98%
Europe (T11)	+ 1.35%	+ 0.18%
Eur., Far East, Aus. (T11)	+ 1.74%	+ 0.38%
World Index (T02)	- 0.99%	+ 0.55%
AVERAGE	**+ 1.57%**	**+ 0.03%**

INTERMEDIATE JUNCTURE SIGNALS - NEW U01s AND D01s

The "U01" and "D01" are computer driven screens indicating bottom and top junction formation respectively. They are buy and sell candidates. Managers have voiced to us their need to know on an ongoing basis the necessity of the "hedge"; counter-cyclicality present on a stock basis as well as knowing cyclic position of the majority of issues adhering to market sentiment and rotation.

Current list starts with week ending July 16, 2021. The list analyzes a universe of 1,200 stocks.



NOTE:

The initial rush of panic selling, done as the second short term recovery rally attempt failed, produced 129 new intermediate downtrends or D01s. In the follow-up week - - this latest week - - there were fewer D01s. And U01s picked up. Most of the uptrends have come from the Tech Sector. See next page and the Intermediate Monitor Table, page 6.

	Week Ending	U01	D01
	July 16	19	81
	July 23	11	59
	July 30	41	32
	August 6	52	21
	August 13	38	60
	August 20	20	42
	August 27	85	43
	September 3	81	36
Distribution →	September 10	16	**125**
	September 17	57	67
Accumulation →	September 24	**115**	30
Distribution →	October 1	62	**101**
	October 8	63	25
	October 15	67	15
	October 22	43	24
	October 29	30	74
	November 5	87	18
	November 12	28	84
Distribution →	November 19	13	**111**
	November 26	24	82
→	December 3	42	**103**
	December 10	78	25
	December 17	58	59
	December 24	56	23
	December 31	23	39
	January 7	79	85
Distribution	January 14	46	57
→	January 21	13	**164**
	January 28	54	49
	February 4	75	26
	February 11	48	32
	February 18	20	68
	February 25	26	63
	March 4	42	58
Accumulation	March 11	18	50
→	March 18	**104**	44
	March 25	94	41
	April 1	50	47
	April 8	35	44
Distribution	April 15	31	82
→	April 22	42	**129**
	April 29	64	87

NEW U01S INTERMEDIATE BOTTOM SIGNALS - IN LAST TWO WEEKS.

NASDAQ 100
(Data Base N, USS)
17 Stocks, 17% of Universe

Week ending 22nd April -

STOCK	TICKER
Pepsico Inc	IPEP

Week ending 29th April -

STOCK	TICKER
Broadcom Ltd	IAVGO
KLA Corp	IKLAC
Lam Research Corp	ILRCX
Marvell Technology Group	IMRVL
Fiserv Inc	IFISV
Netease Inc	INTES
Microchip Technology Inc	IMCHP
Microsoft Corp	IMSFT
NXP Semiconductors	INXPI
Old Dominion Freight Line	IODFL
Nasdaq 100 Index	KNDQK
Invesco QQQ Nasdaq 100	QQQ
Workday Inc Ordinary	IWDAY
JD.com Inc-Adr	IJD
Autodesk Inc	IADSK
Pinduoduo Inc Adr	IPDD

UTILITIES
(Data Base N, ETF, T)
1 Stocks, 2% of Universe

Week ending 22nd April -

STOCK	TICKER
MDU Resources Group Inc	MDU

Week ending 29th April -

STOCK	TICKER
NONE	

TELECOMS
(Data Base N, USS, ETF, T)
1 Stocks, 5% of Universe

Week ending 22nd April -

NONE

Week ending 29th April -

STOCK	TICKER
Nokia	NOK

U.S. 60
(Data Base N, USS)
10 Stocks, 16% of Universe

Week ending 22nd April -

STOCK	TICKER
Procter & Gamble Co	PG
Pepsico Inc	IPEP
Abbott Laboratories	ABT
Home Depot Inc	HD

Week ending 29th April -

STOCK	TICKER
Mastercard Inc	MA
Broadcom LTD	IAVGO
Pfizer Inc	PFE
Lowe's Companies Inc	LOW
Microsoft Corp	IMSFT
Salesforce Ord	CRM

FINANCIALS
(Data Base N, T, USS)
1 Stocks, 1% of Universe

Week ending 22nd April -

NONE

Week ending 29th April -

STOCK	TICKER
Mastercard Inc	MA

CONSUMERS
(Data Base N, USS, ETF, T, MXP)
10 Stocks, 12% of Universe

Week ending 22nd April -

STOCK	TICKER
Procter & Gamble Co	PG
Pepsico Inc	IPEP
Abbott Laboratories	ABT
Home Depot Inc	HD

Week ending 29th April -

STOCK	TICKER
Pfizer Inc	PFE
Lowe's Companies Inc	LOW
Goodyear Tire & Rubber Co	IGT
Magna International Inc	MG
Whirlpool Corp	WHR
General Motors Co	GM

CANADA 60
(Data Base T)
5 Stocks, 8% of Universe

Week ending 22nd April -

STOCK	TICKER
Open Text Corp	OTEX

Week ending 29th April -

STOCK	TICKER
Magna International Inc	MG
Constellation Software Ord	CSU
Shopify Inc	SHOP
CGI Inc	GIB.A

WORLD TOP 350+
34 Stocks, 9% of Universe

Week ending 22nd April -

STOCK	TICKER	DATA BASE
Saudi Telecom Co	7010.SE	SAU
Richemont	CFR.S	CHF
Heineken	HEIA.AS	NLG
Japan Tobacco Inc	2914.T	JPY
ABB Ltd	ABBN.S	CHF
LVMH Moet Hennessy Louis Vuitt	MC.PA	FRF
Atlas Copco	ATCOA.ST	SEK
Christian Dior Se	CDI.PA	FRF
Subaru Corp	7270.T	JPY
Rosneft Oao	ROSN.MM	RUR
Inditex Sa	ITX.MC	ESP
Mitsubishi Electric Corp	6503.T	JPY
Panasonic Corp	6752.T	JPY
SAP Se	SAP.F	DEM
Danone	BN.PA	FRF
Hyundai Mobis	012330.KS	KRW
Fanuc Corp	6954.T	JPY

Week ending 29th April -

STOCK	TICKER	DATA BASE
AP Moller Maersk	MAERSKB.CO	DKK
Toyota Motor Corp	7203.T	JPY
Denso Corp	6902.T	JPY
Unilever PLC Ordinary	UNA.AS	NLG
Sony Group Corp	6758.T	JPY
Surgutneftegas	SNGS.MM	RUR
Magna International Inc	MG	T
Shin-etsu Chemical Co	4063.T	JPY
Gazprom OAO	GAZP.MM	RUR
Hanjaya Madala Sampoerna	HMSP.JK	IDN
Sberbank	SBER.MM	RUR
Great Wall Motor Co	2333.HK	HKD
Bank VTB PAO	VTBR.MM	RUR
Fresenius SE & CO	FRE.F	DEM
Continental AG	CON.F	DEM
GMK Noril'sky Nikel PAO	GMKN.MM	RUR
Enel SPA	ENEL.MI	ITL

NEW U01S INTERMEDIATE BOTTOM SIGNALS - IN LAST TWO WEEKS.

TECHNOLOGY
(Data Base N, USS, ETF, T)
10 Stocks, 17% of Universe

Week ending 22nd April -

STOCK	TICKER
Intl Business Machine	IBM
Open Text Corp	OTEX

Week ending 29th April -

STOCK	TICKER
KLA Corp	IKLAC
Technology Select SPDR	XLK
Microsoft Corp	IMSFT
Constellation Software Ord	CSU
Wipro Ltd	WIT
CGI Inc	GIB.A
Autodesk Inc	IADSK
PTC Inc	IPTC

INDUSTRIALS
(Data Base N, USS, ETF, T, MXP)
9 Stocks, 14% of Universe

Week ending 22nd April -

STOCK	TICKER
WW Grainger Inc	GWW
Eaton Corp	ETN
Johnson Controls Corp	JCI
Avery Dennison Corp	AVY

Week ending 29th April -

STOCK	TICKER
Norfolk Southern Corp	NSC
Fiserv Inc	IFISV
Masco Corp	MAS
Textron Inc	TXT
Ryder System Inc	R

CYCLICALS
(Data Base N, A, ETF, MXP, T)
8 Stocks, 14% of Universe

Week ending 22nd April -

STOCK	TICKER
Weyerhaeuser Co	WY
Potlatchdeltic Corp	IPCH
Kimberly-Clark Corp	KMB
Materion Corp	MTRN
Vulcan Materials	VMC
PPG Industries Inc	PPG
Cascades Inc	CAS

Week ending 29th April -

STOCK	TICKER
Louisiana-Pacific Corp	LPX

ENERGY
(Data Base N, A, T)
0 Stocks, 0% of Universe

Week ending 22nd April -

NONE

Week ending 29th April -

STOCK	TICKER
NONE	

GOLDS
(Data Base N, USS, A, MXP, T, V, AUS)
1 Stocks, 1% of Universe

Week ending 22nd April -

STOCK	TICKER
DB Gold Double Short	DZZ

Week ending 29th April -

STOCK	TICKER
NONE	

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Phone: (203) 431-9910 Email: info@tanicott.com
www.taniscott.com

NEW D01S INTERMEDIATE TOP SIGNALS - IN LAST TWO WEEKS.

NASDAQ 100
(Data Base N, USS)
9 Stocks, 9% of Universe

Week ending 22nd April -

STOCK	TICKER
Fortinet Inc	IFTNT
Sirius XM Holdings Inc	ISIRI
Splunk Inc	ISPLK
Vertex Pharmaceuticals Inc	IVRTX

Week ending 29th April -

STOCK	TICKER
Regeneron Pharm Ord	IREGN
T-Mobile US Inc	ITMUS
Amgen Inc	IAMGN
Exelon Corp	IEXC
O'Reilly Automotive Inc	IORLY

CANADA 60
(Data Base T)
18 Stocks, 30% of Universe

Week ending 22nd April -

STOCK	TICKER
Kinross Gold Corp	K
Barrick Gold Corp	ABX
Dollarama Inc	DOL
First Quantum Minerals	FM
Teck Resources	TECK.B
Telus Corp	T
TSX 60 Index	TSE60

Week ending 29th April -

STOCK	TICKER
CAE Inc	CAE
Canadian National Railway Co	CNR
Agnico Eagle Mines Ltd	AEM
Saputo Inc	SAP
Algonquin Power & Utilities Co	AQN
Franco-Nevada Corp	FNV
Wheaton Precious Metals Corp	WPM
Rogers Communications Inc	RCI.B
Brookfield Infrastructure Pa	BIP.UN
BCE Inc	BCE
Nutrien Ltd	NTR

UTILITIES
(Data Base N, ETF, T)
11 Stocks, 27% of Universe

Week ending 22nd April -

STOCK	TICKER
Hawaiian Electric Industries	HE
Pinnacle West Capital	PNW
Dominion Energy Inc	D
Williams Cos Inc	WMB

Week ending 29th April -

STOCK	TICKER
AES Corp	AES
Sempra Energy	SRE
Alliant Energy Corp. Ordinary	ILNT
OGE Energy Corp	OGE
Public Service Enterprise Group	PEG
Firstenergy Corp	FE
Exelon Corp	IEXC

U.S. 60
(Data Base N, ETF, T)
6 Stocks, 10% of Universe

Week ending 22nd April -

STOCK	TICKER
Raytheon Technologies	RTX
Bristol-Myers Squibb	BMY
Chevron Corp	CVX

Week ending 29th April -

STOCK	TICKER
Medtronic PLC	MDT
T-Mobile US Inc	ITMUS
Amgen Inc	IAMGN

TELECOMS
(Data Base N, USS, ETF, T)
5 Stocks, 26% of Universe

Week ending 22nd April -

STOCK	TICKER
Telus Corp	T

Week ending 29th April -

STOCK	TICKER
T-Mobile US Inc	ITMUS
Rogers Communications Inc	RCI.B
America Movil	AMX
BCE Inc	BCE

FINANCIALS
(Data Base N, T, USS)
5 Stocks, 7% of Universe

Week ending 22nd April -

STOCK	TICKER
Dundee Corp	DC.A
Hartford Financial Services	HIG
Allstate Corp	ALL
Fairfax Financial Holdings	FFH

Week ending 29th April -

STOCK	TICKER
Aon PLC	AON

WORLD TOP 350+
45 Stocks, 12% of Universe

Week ending 22nd April -

STOCK	TICKER	DATA BASE
Assicurazioni Generali	G.MI	ITL
Singapore Telecomm	Z74.SI	SGD
Deutsche Telekom	DTE.F	DEM
Fresenius Medical Care	FME.F	DEM
Takeda Pharmaceutical	4502.T	JPY
Nippon Steel Corp	5401.T	JPY
Barrick Gold Corp	ABX	T
Swisscom Ag	SCMN.S	CHF
Repsol Sa	REP.MC	ESP
Galaxy Entertainment	0027.HK	HKD
CNOOC	0883.HK	HKD
Citic Bank	0998.HK	HKD
Nintendo Co	7974.T	JPY
Arcelormittal	MT.AS	NLG
Grupo Mexico Sab De	GMEXICOB.M	MXP
Banco Do Brasil	BBAS3.SA	BRC
National Grid Plc	NG.L	GBP
Tenaris Sa	TEN.MI	ITL
Woodside Petroleum	WPL	AUS
Zurich Insurance	ZURN.S	CHF
Telekom Indones Persero	TLKM.JK	IDN
Telus Corp	T	T
Qatar National Bank	QNBK.QA	QTR
China Shenhua Energy	1088.HK	HKD
Equinor Asa	EQNR.OL	NOK
Glencore Plc	GLEN.L	GBP

Week ending 29th April -

STOCK	TICKER	DATA BASE
East Japan Railway Co	9020.T	JPY
Canadian National Railway	CNR	T
Komatsu Ltd	6301.T	JPY
Westpac Banking Corp	WBC	AUS
Astellas Pharma Inc	4503.T	JPY
Coal India Ltd	533278.BO	IND
Industrial & Commercial Bank	601398.SS	CHN
BAE Systems PLC	BA.L	GBP
Unibail-Rodamco-Westfield	URW.AS	NLG
Telefonica SA	TEF.MC	ESP
Agricultural Bank of China	601288.SS	CHN
Public Bank	1295.KL	MYR
Rogers Communications Inc	RCI.B	T
Bayer AG	BAYN.F	DEM
Walmart De Mexico-Ser	WALMEX.MX	MXP
BCE Inc	BCE	T
Etisalat-Emirates Telecom	ETISALAT.A	UAE
Industries Qatar Ord	IQCD.QA	QTR
Nutrien Ltd	NTR	T

NEW D01S INTERMEDIATE TOP SIGNALS - IN LAST TWO WEEKS.

CONSUMERS
(Data Base N, USS, ETF, T, MXP)
14 Stocks, 17% of Universe

Week ending 22nd April -

STOCK	TICKER
Glaxosmithkline	GSK
Bed Bath & Beyond Inc	IBBBY
Stryker Corp	SYK
Paramount Global	IPARA
Grupo Televisa SA CPO	TLEVISACPO
Tegna Inc	TGNA
Bristol-Myers Squibb	BMY
Kroger Co	KR
McKesson Corp	MCK
Tenet Healthcare Corp	THC

Week ending 29th April -

STOCK	TICKER
Medtronic Plc	MDT
Sysco Corp	SYY
Cardinal Health Inc	CAH
Amgen Inc	IAMGN

TECHNOLOGY
(Data Base N, USS, ETF, T)
0 Stocks, 0% of Universe

Week ending 22nd Arpil -
NONE

Week ending 29th April -

STOCK	TICKER
NONE	

CYCLICALS
(Data Base N, A, ETF, MXP, T)
17 Stocks, 29% of Universe

Week ending 22nd Arpil -

STOCK	TICKER
CYDSA A	CYDSASSAA.M
Alto Ingredients Inc	IALTO
Allegheny Technologies	ATI
Sherritt Intl	S
Turquoise Hill Resources	TRQ
FMS Corp	FMC
Commercial Metals	CMC
First Quantum Minerals	FM
Archer-Daniels-Midland	ADM
Bunge	BG
Mosaic	MOS
Teck Resources	TECK.B
Glencore	GLEN.L

Week ending 29th April -

STOCK	TICKER
Denison Mines Corp	DML
Alfa SAB DE CV	ALFAA.MX
Wheaton Precious Metals Corp	WPM
Nutrien Ltd	NTR

INDUSTRIALS
(Data Base N, USS, ETF, T, MXP)
12 Stocks, 19% of Universe

Week ending 22nd Arpil -

STOCK	TICKER
L3Harris Technologies Inc	LHX
Finning Intl	FTT
Raytheon Tech	RTX
Lockheed Martin Corp	RTX
Deere & Co	DE
Northrop Grumman Corp	NOC
Crane Co	CR
General Dynamics	GD

Week ending 29th April -

STOCK	TICKER
CAE Inc	CAE
Canadian National Railway	CNR
Caterpillar Inc	CAT
Toromont Industries Ltd	TIH

ENERGY
(Data Base N, A, T)
21 Stocks, 36% of Universe

Week ending 22nd Arpil -

STOCK	TICKER
Forum Energy Technologies	FET
Helix Energy Solutions Group	HLX
Transocean Ltd	RIG
YPF Sa	YPF
Helmerich & Payne Inc	HP
Kinder Morgan Inc	KMI
Nabors Industries	NBR
Precision Drilling Corp	PD
Tidewater Inc	TDW
Chevron Corp	CVX
Hess Corp	HES
Valero Energy Corp	VLO
Occidental Petroleum Corp	OXY
Baker Hughes Co	IBKR
ARC Resources Ltd	ARX
Ovintiv Inc	OVV
Equinor Asa	EQNR
Baytex Energy Corp	BTE
Paramount Resources	POU

Week ending 29th April -

STOCK	TICKER
Ensign Energy Services Inc	ESI
Altagas Ltd	ALA

GOLDS
(Data Base N, USS, A, MXP, T, V, AUS)
53 Stocks, 80% of Universe

Week ending 22nd Arpil -

STOCK	TICKER
Kinross Gold Corp	K
Taseko Mines	TKO
First Majestic Silver	AG
First Majestic Silver	FR
Centamin Plc	CEY.L
Drdgold Ltd	DRD
Hecla Mining Co	HL
Ishares Silver Trust ETF	SLV
Torex Gold Resources Inc	TXG
PHLX Gold and Silver Index	KAALP
Ishares Msci Global Gold Miner	RING
Zijin Mining Group Co	2899.HK
Amex Gold Bugs Index	HUI0
Barrick Gold Corp	ABX
Wesdome Gold Mines	WDO
Buenaventura Sa	BVN
S&P GICS Gold Sub	KSPGA
Newmont Corporation	NEM
ASA Gold & Precious Metals	ASA
Harmony Gold Mining Co	HMY
DB Gold Double Long ETN	DGP
SPDR Gold Shares ETF	GLD
New Gold Inc	NGD
Sprott Physical Gold Trust Uni	PHYS
Anglogold Ashanti Ltd	AU
Centerra Gold Inc	CG
Eldorado Gold Corp	EGO
Freeport-McMoran Inc	FCX
Gold Fields Ltd	GFI
Pan African Resources	PAF.L

Week ending 29th April -

STOCK	TICKER
Erdene Resource Development	ERD
Endeavour Silver Corp	EDR
Endeavour Silver Corp	EXK
Seabridge Gold Inc	SA
Seabridge Gold Inc	SEA
Alamos Gold Inc	AGI
Novagold Resources Inc	NG
Pan American Silver Corp	PAAS
Industrias Penoles SA	PE&OLES.MX
Agnico Eagle Mines Ltd	AEM
B2Gold Corp	BTO
Vaneck Junior Gold Miners	GDXJ
Iamgold Corp	IMG
Franco-Nevada Corp	FNV
Vaneck Gold Miners	GDX
NYSE ARCA Gold Miners Index	GDM
Sandstorm Gold Ltd	SSL
Yamana Gold Inc	AUY
Sprott Physical Gold & Silver	CEF
Royal Gold Inc	IRGLD
S&P/TSX GICS Global Gold	GSPTTGD
ISHARES S&P/TSX Global Gold	XGD
Silver Lake Resources Ltd	SLR

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Exhibit I-22-O-SEC-244
Attachment 4
Page 1 of 16

Monthly Portfolio Update

Can The Fed Achieve A Soft Landing? Hint: It Doesn't Have A Good Track Record

Monthly Report

Listen to a short summary of this report

In this Issue

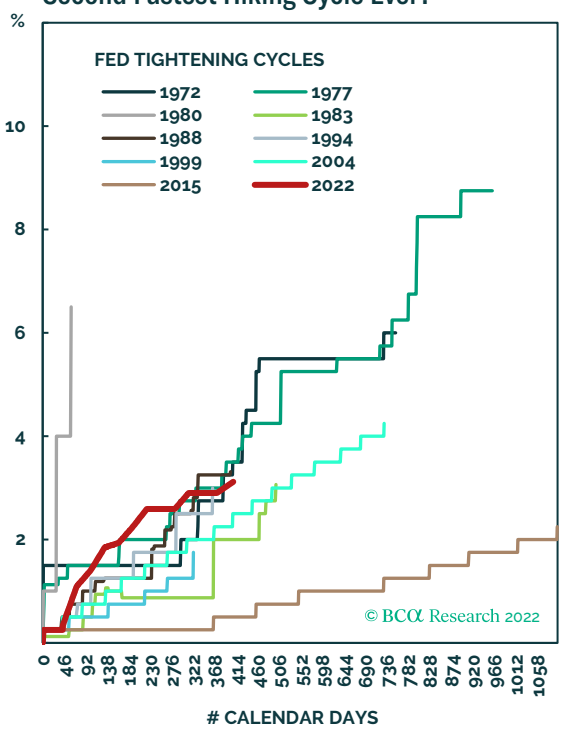
02 Can The Fed Achieve A Soft Landing? Hint: It Doesn't Have A Good Track Record

14 Recommended Asset Allocation

Executive Summary

- Can the Fed achieve a soft landing, bringing inflation back to its 2% target without causing growth to slow significantly below trend?
- It has managed this only once in the past (in 2004). Every other cycle triggered a recession or, at best, a fall in the PMI to below 50.
- Recession is not a certainty. A higher neutral rate than in the past – partly due to the build-up of household savings – means the economy may be unusually robust this time. But the risk is high.
- We recommend a neutral weighting in equities, with a tilt to more defensive positioning: Overweight the US, and a focus on quality and defensive growth sectors.

Second Fastest Hiking Cycle Ever?



- China's slowdown is particularly worrying. We expect the RMB to fall, which will put downward pressure on other Emerging Markets.

Recommendation Changes

	This Month Recommendation	Last Month Recommendation
CNY	Underweight	Neutral

Bottom Line: Investors should maintain low-risk portfolio positioning until the outcome of the sharp tightening of financial conditions is clearer.

Editorial Board

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Can The Fed Achieve A Soft Landing? Hint: It Doesn't Have A Good Track Record

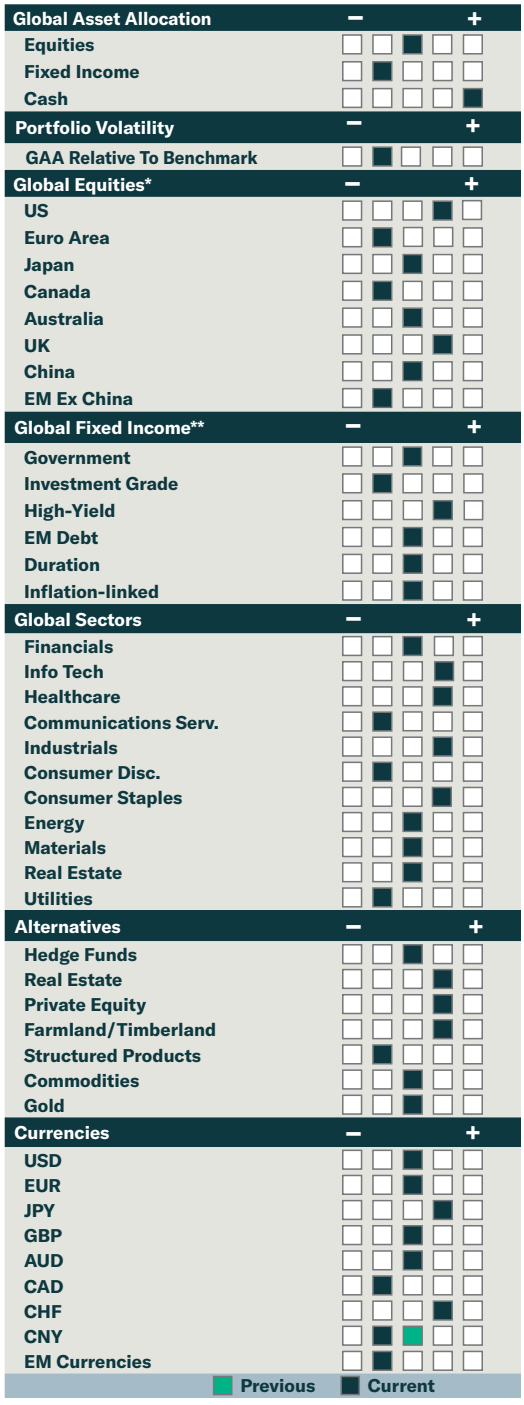
The key to the performance of financial markets over the next year is whether the Fed and other central banks can kill inflation without killing economic growth. This is not impossible. But the risk that aggressive tightening of monetary policy triggers a recession – or at best a sharp slowdown – is high. Investors should maintain relatively low-risk portfolio positioning.

If the Fed raises rates in line with what the futures market is projecting – by 286 basis points over the next 12 months – it will be the second fastest tightening on record, after only the "full Volcker" of 1980-1981 (**Chart 1**). Other central banks, even in countries and regions with much weaker growth than the US, are predicted to tighten almost as aggressively (**Table 1**). At the same time, the Fed will start to run down its balance-sheet rapidly; we estimate its holdings of US Treasurys will fall by more than $1 trillion by end-2023 (**Chart 2**).

What was the impact on the economy of previous Fed hiking cycles? It varied, but on only one occasion in the past 50 years (2004) was there neither a recession nor a fall of the Manufacturing ISM to below 50 in the two years or so following the first hike (**Table 2**).[1] The ISM (and other global PMIs) falling to below 50 is important because that is typically the dividing line between equities outperforming bonds and *vice versa* (**Chart 3**).

[1] In 2015, the ISM was already below 50 when the Fed hiked in December.

Recommended Allocation



* RELATIVE TO MSCI ACWI (UNHEDGED).
** RELATIVE TO BLOOMBERG BARCLAYS GLOBAL AGGREGATE.

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CHART 1

Second Fastest Hiking Cycle Ever?

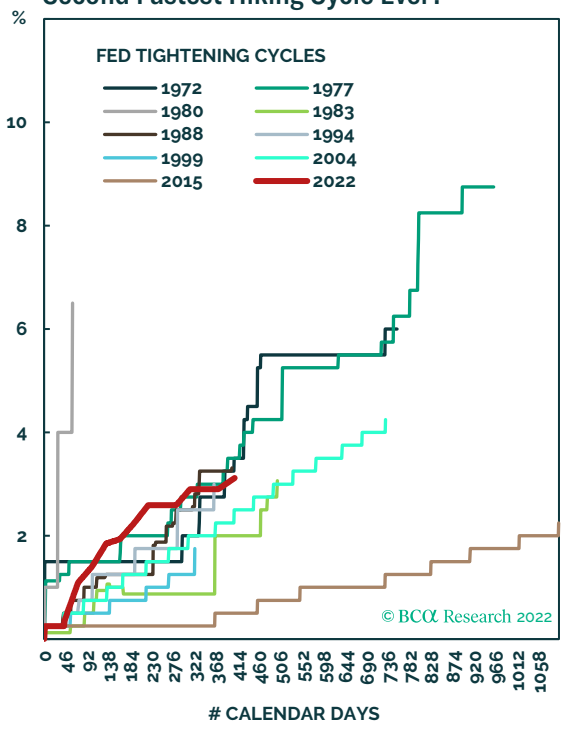


TABLE 1

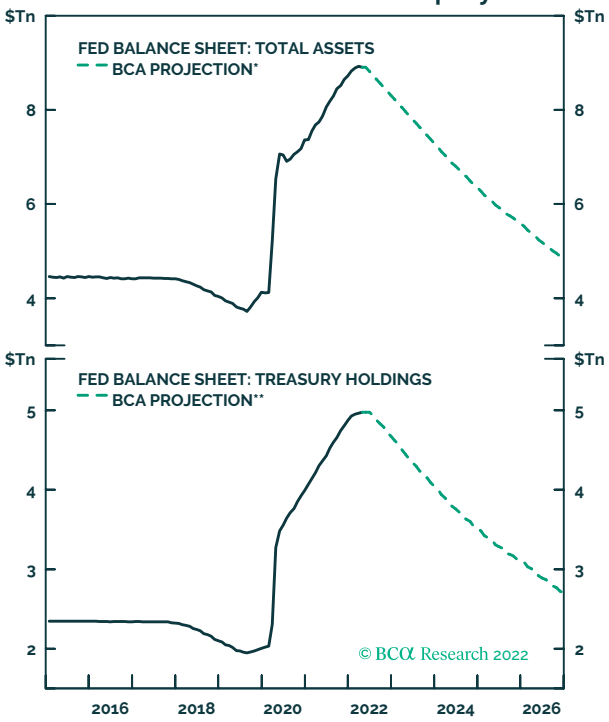
Futures Projected Interest Rate Hikes

	DATE OF NEXT RATE HIKE*	CUMULATIVE TIGHTENING DISCOUNTED BY END-2022 (BPs)	CUMULATIVE TIGHTENING DISCOUNTED BY END-2023 (Bps)
AUSTRALIA	May-22	243	348
US	May-22	233	268
NEW ZEALAND	May-22	200	270
CANADA	May-22	184	201
NORWAY	May-22	155	224
UK	May-22	146	176
SWEDEN	Jun-22	112	239
EURO AREA	Jul-22	98	200
SWITZERLAND	Sep-22	83	173
JAPAN	Dec-22	10	22

* A HIKE IS DEFINED AS 25BPS FOR ALL MARKETS EXCEPT EURO AREA AND JAPAN, WHERE IT IS DEFINED AS 10BPS.

CHART 2

Fed Balance-Sheet Will Shrink Rapidly Too



* ASSUMES MONTHLY CAP ON TREASURYS OF $60 Bn, BILLS REDEEMED IF CAP NOT REACHED,STARTING IN JUNE 2022. MONTHLY MBS RUNOFF ASSUMED TO BE $25 Bn.
** ASSUMES MONTHLY CAP ON TREASURYS OF $60 Bn

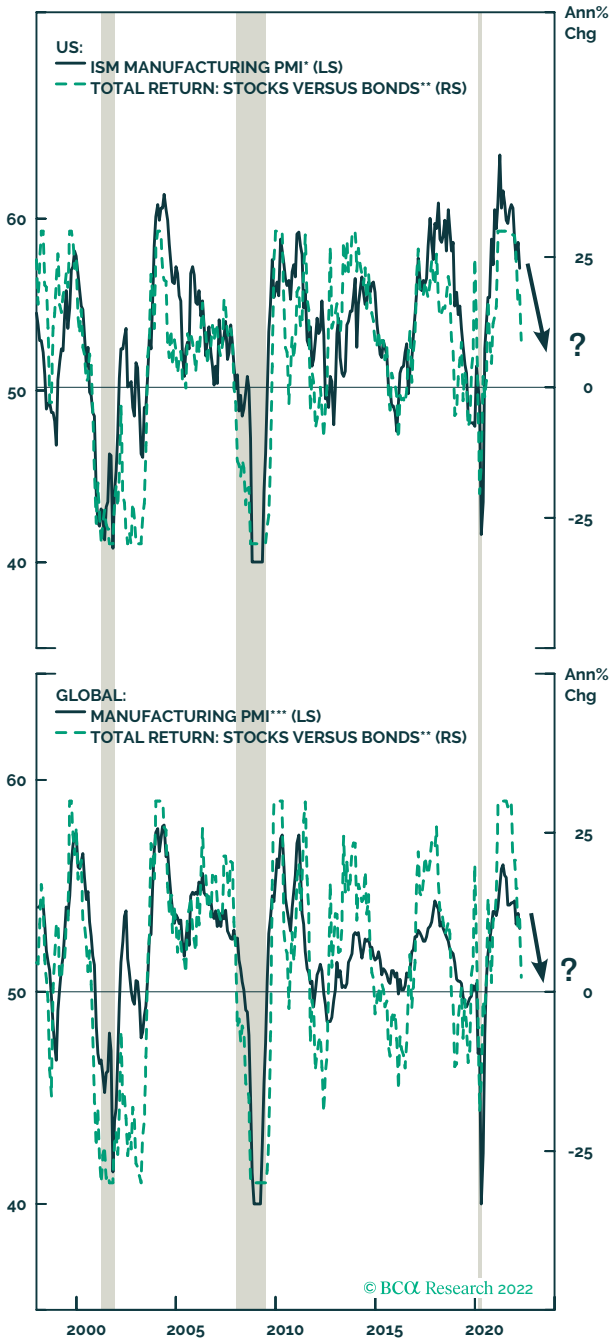
TABLE 2

What Happened To The Economy In Fed Hiking Cycles

FED FIRST HIKE	RECESSION	# MONTHS	PMI BELOW 50	# MONTHS
3/31/1972	11/30/1973	20	9/30/1974	30
7/31/1977	1/31/1980	30	8/31/1979	25
10/31/1980	7/31/1981	9	1/31/1981	3
3/31/1983	7/31/1990	89	2/28/1985	23
3/31/1988	7/31/1990	28	5/31/1989	14
2/28/1994	3/31/2001	86	5/31/1995	15
6/30/1999	3/31/2001	21	8/31/2000	14
6/30/2004	12/31/2007	43	2/29/2008	45
12/31/2015	2/29/2020	51	10/31/2015	-2
3/31/2022	?	?	?	?

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CHART 3
Will PMIs Fall Below 50?



* SOURCE: INSTITUTE FOR SUPPLY MANAGEMENT. SHOWN TRUNCATED AT 40.
** ANNUAL PERCENT CHANGE IN THE EQUITY INDEX TOTAL RETURN MINUS ANNUAL PERCENT CHANGE IN AGGREGATE TREASURY INDEX TOTAL RETURN; SHOWN TRUNCATED AT 30% AND -30%. SOURCE: BLOOMBERG BARCLAYS INDICES, AND MSCI INC. (SEE COPYRIGHT DECLARATION).
*** SOURCE: MARKIT / J.P.MORGAN. SHOWN TRUNCATED AT 40.
NOTE: SHADING DENOTES NBER DESIGNATED RECESSIONS.

A recent paper by Alex Domash and Larry Summers showed that, since 1955, when US inflation was above 4% and unemployment below 5%, there was a 73% probability of recession over the next four quarters, and 100% over the next eight quarters (**Table 3**). On each of the three occasions when inflation was above 5% and unemployment below 4% (as is the case now), recession followed within a year.

How could the Fed avoid a hard landing? Inflation could come down quickly, which would allow the Fed to ease back on tightening. As consumption switches back to services from durables, and the supply side succeeds in increasing production, the price of manufactured goods could fall (**Chart 4**). There were signs of this happening already in March, when US durables prices fell by 0.9% month-on-month. The problem, however, is that because of rising energy costs and lockdowns in China, the supply-side response has been delayed. The fall in semiconductor and shipping costs, which we previously argued would happen this year, is not yet clearly coming through (**Chart 5**). There are also signs of a price-wage spiral, with US wages rising (with a lag) in line with prices (**Chart 6**).

The economy could be more robust than in the past, leaving it unscathed by higher rates. Our model of the equilibrium level of short-term rates is 3.2%, well above the Fed's estimate of 2.4% (**Chart 7**). Our colleague Peter Berezin has argued that the neutral rate could be as high as 4%.[2] In particular, the $2 trillion-plus of excess US household savings (equal to 10% of GDP)

[2] Please see Global Investment Strategy Report, "Is A Higher Neutral Rate Good Or Bad For Stocks?" dated March 18, 2022.

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TABLE 3

This Level of Inflation And Unemployment Usually Leads To Recession

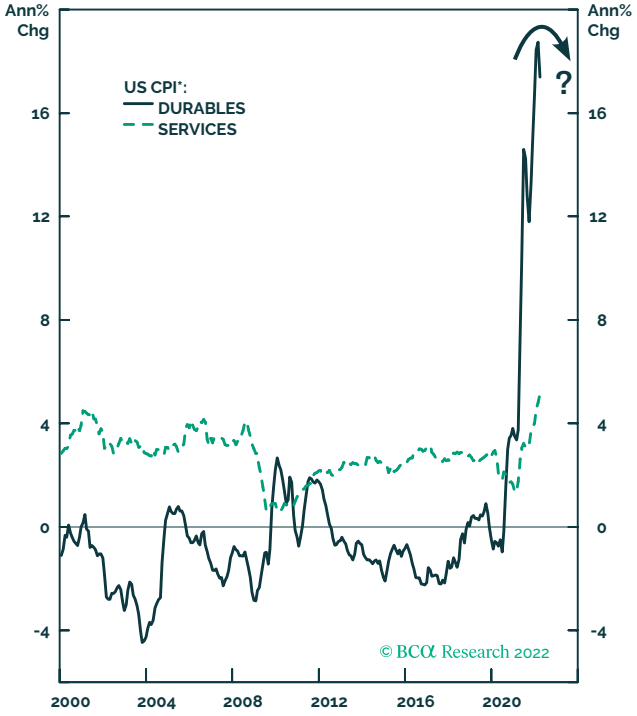
HISTORICAL PROBABILITY OF A RECESSION CONDITIONAL ON DIFFERENT LEVELS OF CPI INFLATION AND UNEMPLOYMENT, USING DATA FROM 1955-2019

	AVG QUARTERLY INFLATION ABOVE:	AVG QUARTERLY UR BELOW:	PROBABILITY OF RECESSION OVER NEXT 4-QUARTERS	PROBABILITY OF RECESSION OVER NEXT 8-QUARTERS	NUMBER OF QUARTERS	WHEN DID US ECONOMY MOST RECENTLY CROSS THRESHOLD?
Inflation only	3%	#N/A	27%	48%	95	Q2 2021
	4%	#N/A	37%	59%	51	Q2 2021
	5%	#N/A	45%	62%	29	Q3 2021
UR only	#N/A	6%	25%	47%	142	Q2 2021
	#N/A	5%	31%	57%	83	Q4 2021
	#N/A	4%	42%	69%	26	Q1 2022
Inflation and UR	3%	6%	43%	75%	53	Q2 2021
	3%	5%	54%	85%	26	Q4 2021
	3%	4%	54%	85%	13	Q1 2022
	4%	6%	59%	89%	27	Q2 2021
	4%	5%	73%	100%	11	Q4 2021
	4%	4%	57%	100%	7	Q1 2022
	5%	6%	83%	100%	12	Q3 2021
	5%	5%	100%	100%	5	Q4 2021
	5%	4%	100%	100%	3	Q1 2022

NOTE: THE CALCULATION FOR THE PROBABILITY OF RECESSION OVER THE NEXT 4-QUARTERS AND 8-QUARTERS EXCLUDES QUARTERS WHEN THE US ECONOMY IS ALREADY IN RECESSION. RECESSION IS DEFINED USING NBER BASED RECESSION INDICATORS FOR THE US FROM THE PERIOD FOLLOWING THE PEAK THROUGH THE TROUGH. THE MEASURE OF INFLATION USED IS THE CONSUMER PRICE INDEX FOR ALL URBAN CONSUMERS.
SOURCE: BUREAU OF LABOR STATISTICS VIA FRED; AUTHORS' CALCULATIONS.

CHART 4

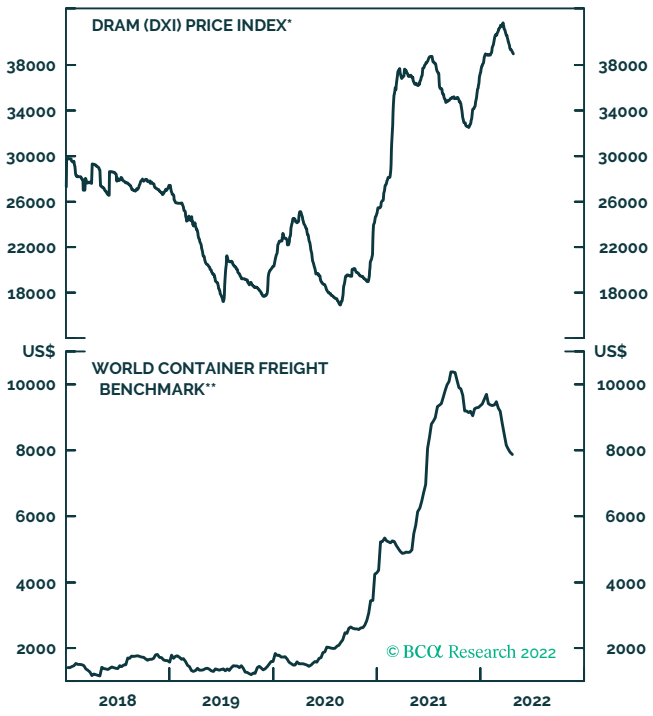
Can The Price Of Durables Now Fall?



* SOURCE: BUREAU OF LABOR STATISTICS.

CHART 5

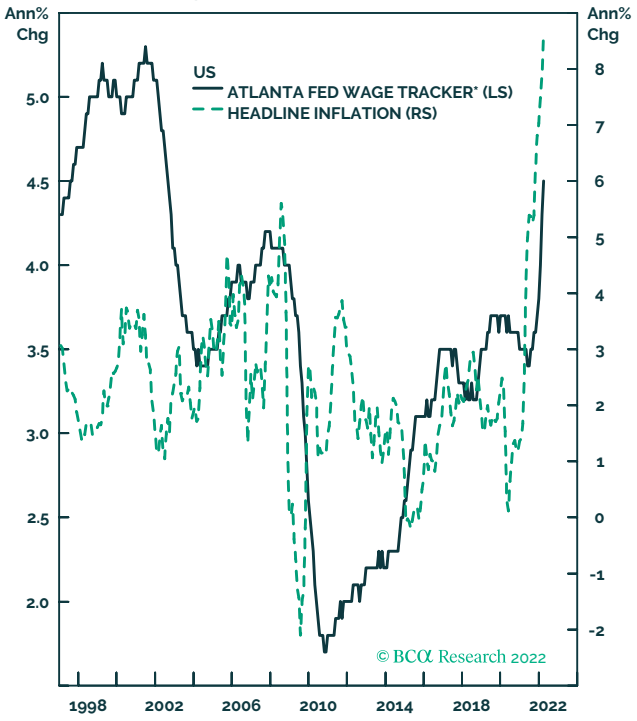
Supply-Side Recovery Delayed?



* SOURCE: DRAMEXCHANGE.
** SOURCE: DREWRY SHIPPING CONSULTANTS. SHOWN IN US$ PER FORTY FOOT CONTAINER.

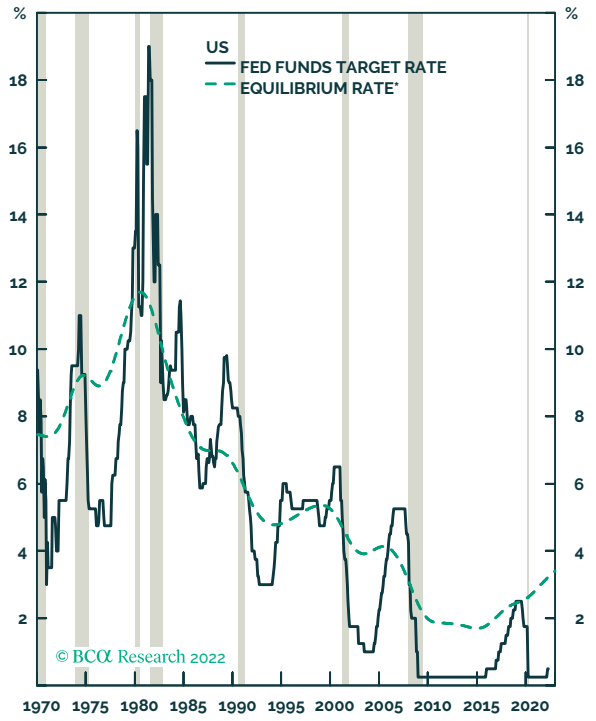
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CHART 6
A Price-Wage Spiral?



* SOURCE: FEDERAL RESERVE BANK OF ATLANTA.

CHART 7
Rates Are Still A Long Way Below Neutral

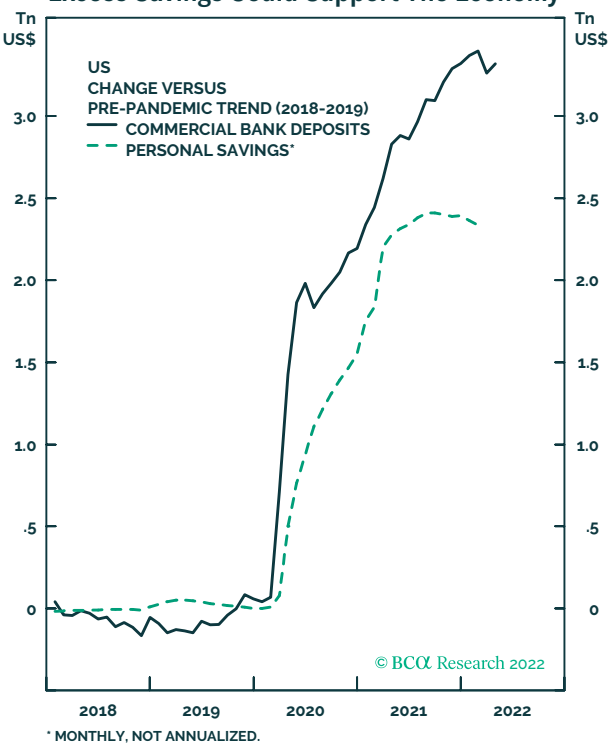


* BCA ESTIMATE BASED ON CYCLICAL-HORIZON AVERAGE OF THE RATE ITSELF AND POTENTIAL GDP GROWTH RATE.
NOTE: SHADING DENOTES NBER DESIGNATED RECESSIONS

could support consumption for some years even if real wage growth is negative (**Chart 8**). However, there are already signs that higher rates are hurting the housing market, the most interest-rate sensitive part of the economy. The average US 30-year fixed-rate mortgage rate has risen to 5.1% from 3.2% since the start of the year. This is negatively impacting home sales and mortgage applications (**Chart 9**). Moreover, even if the Fed can succeed in raising rates without killing the expansion, the markets – for a while – will worry that it cannot.

There are clear signs of a slowdown in the global economy. Europe may already be in recession, with sentiment indicators collapsing to recessionary levels (**Chart 10**). More esoteric indicators, which have historically signaled slowing growth ahead, such

CHART 8
Excess Savings Could Support The Economy

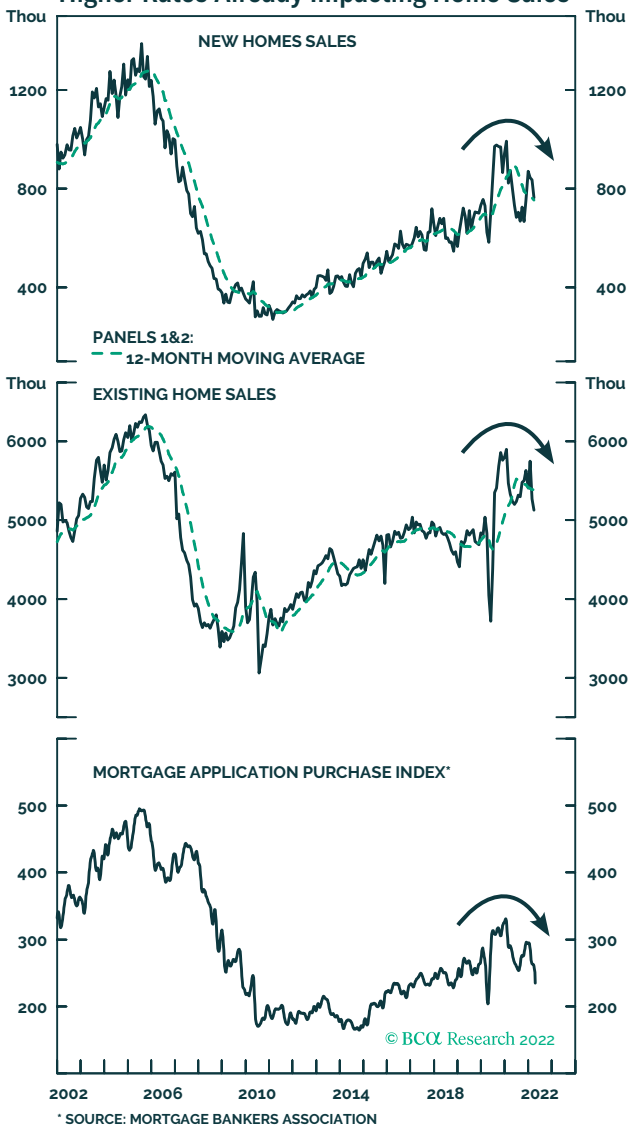


* MONTHLY, NOT ANNUALIZED.

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CHART 9

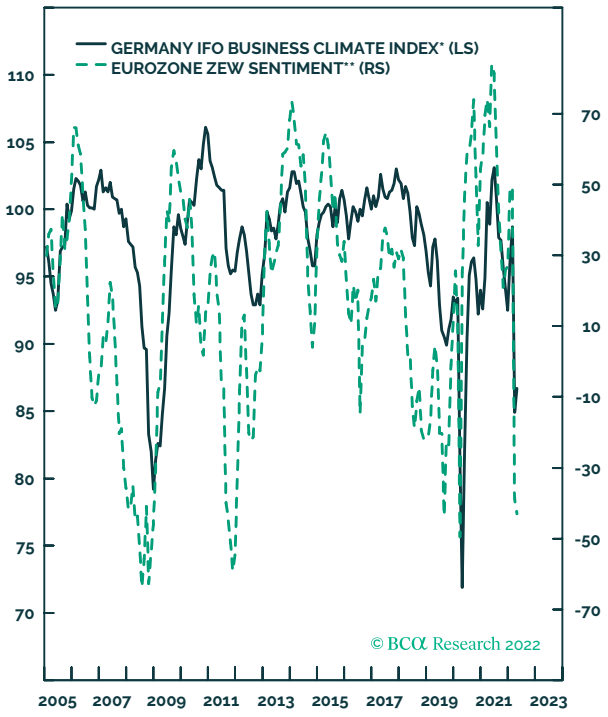
Higher Rates Already Impacting Home Sales



* SOURCE: MORTGAGE BANKERS ASSOCIATION

CHART 10

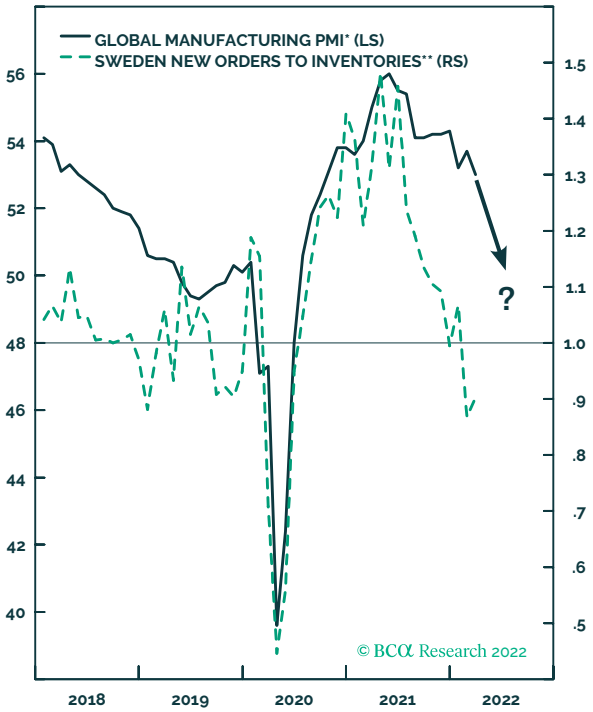
Is Europe Already In Recession?



* IN THE NEXT 6 MONTHS. SOURCE: GERMAN IFO INSTITUTE.
** SOURCE: CENTRE FOR EUROPEAN ECONOMIC RESEARCH (ZEW).

CHART 11

Signs Of Trouble Ahead



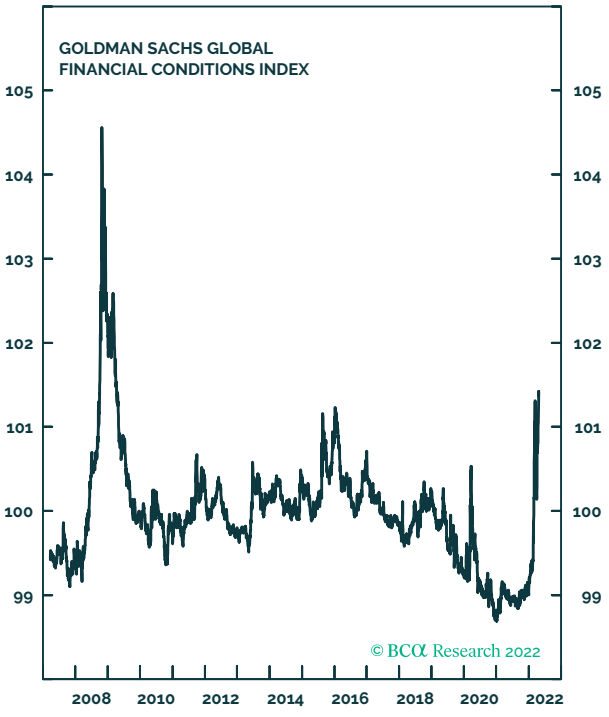
* SOURCE: MARKIT.
** SOURCE: SWEDBANK AND SILF.

as the Swedish new orders/inventories ratio, are also flashing a warning signal (**Chart 11**). Global financial conditions have tightened at the fastest pace since 2008 (**Chart 12**). Corporate earnings forecasts have started to be revised down for the first time in this cycle (**Chart 13**).

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CHART 12

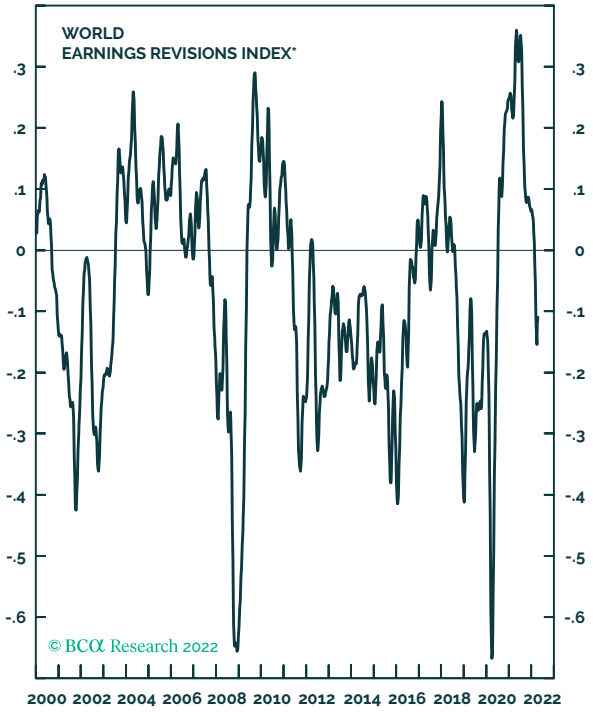
Financial Conditions Have Tightened Significantly



SOURCE: BLOOMBERG FINANCE L.P.

CHART 13

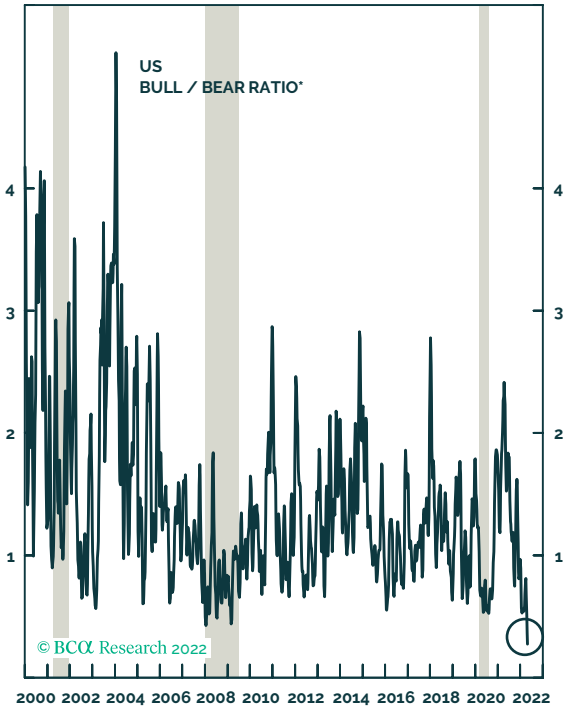
Corporate Earnings Forecasts Being Revised Down



* SOURCE: CITIGROUP.

CHART 14

Investors Are Very Pessimistic...

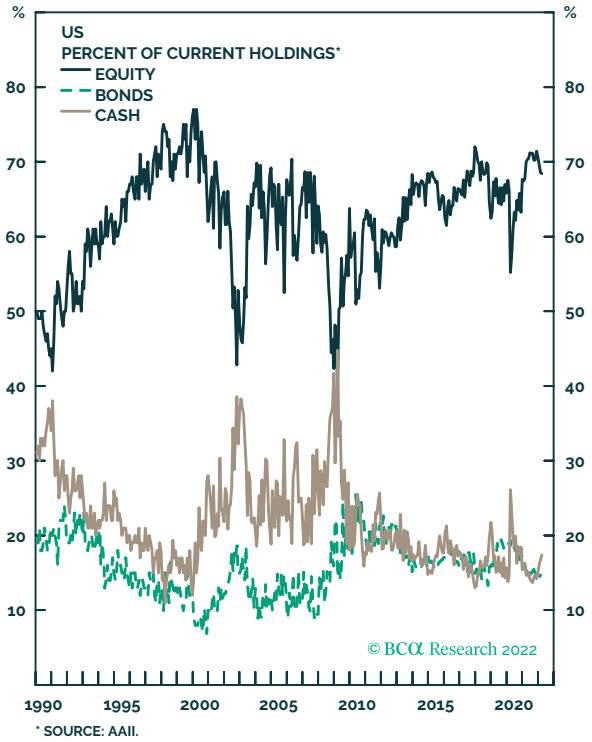


* SOURCE: AMERICAN ASSOCIATION OF INDIVIDUAL INVESTORS. SHOWN SMOOTHED.
NOTE: SHADING DENOTES NBER DESIGNATED RECESSIONS.

But what of the argument that investors have already turned ultra-pessimistic and that all the bad news is in the price? Global equities are down only 14% from their historic peak, barely in correction territory. It is true that sentiment (historically a contrarian indicator) is very poor, with twice as many respondents to the American Association of Individual Investors' weekly survey expecting the stock market to fall over the next six months as expect it to rise (**Chart 14**). But, despite investor pessimism, there are few signs that investors have made their portfolios more defensive. The same AAII survey shows little decline in equity weightings, and no big shift into cash (**Chart 15**).

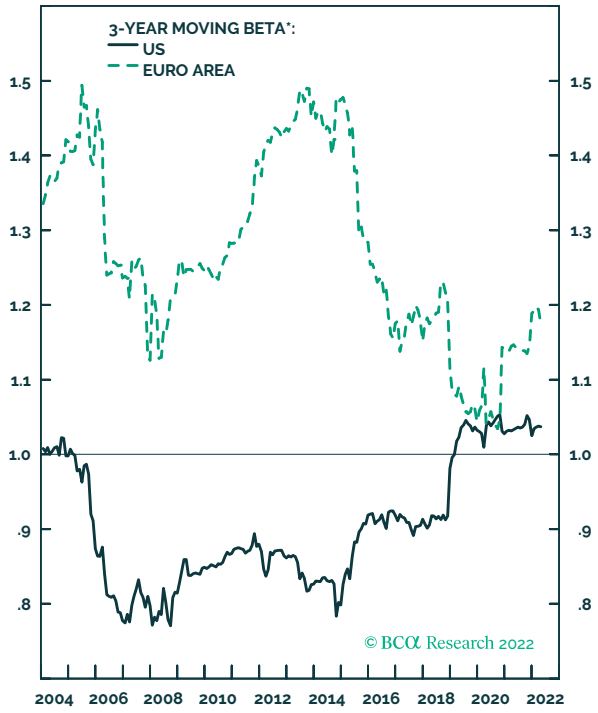
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CHART 15
...But Haven't Moved More Defensive



* SOURCE: AAII.

CHART 16
US Stocks Are Lower Risk

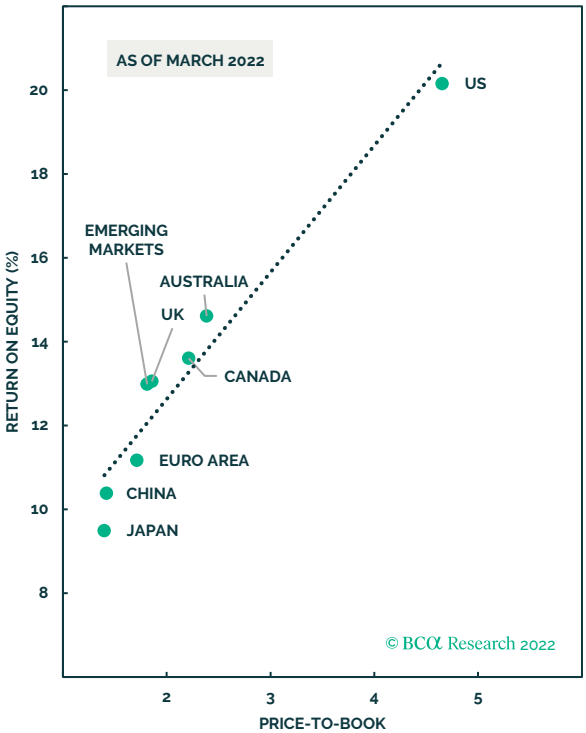


* RELATIVE TO GLOBAL EQUITIES.
SOURCE: MSCI INC. (SEE COPYRIGHT DECLARATION).

Equities: The US is the best house on a tough street. Growth is likely to remain more robust than in the euro area or Japan. The US stock market has a lower beta (**Chart 16**). And, while the US is more expensive, valuations do not drive the 12-month relative performance of stocks and, anyway, the US premium valuation can be justified by higher ROE and the lower volatility of profits (**Chart 17**). Emerging markets continue to look vulnerable to the slowdown in China and tighter US financial conditions (**Chart 18**). We remain under-weight.

Within sectors, our preference remains for quality and defensive growth. Consumer staples tend to outperform when PMIs are falling (**Chart 19**) and are supported by

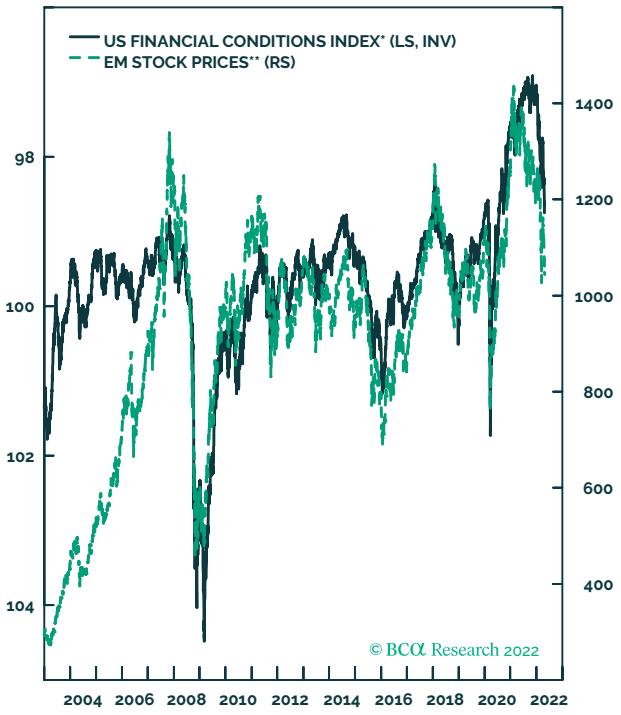
CHART 17
US Premium Valuation Is Justified



SOURCE: MSCI INC. (SEE COPYRIGHT DECLARATION).

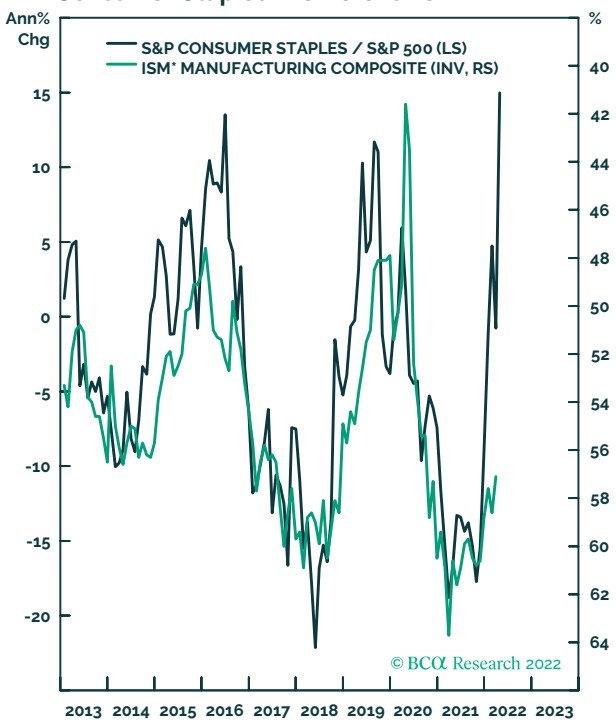
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CHART 18
Tightening Financial Conditions Are Bad For EM



* SOURCE: GOLDMAN SACHS (VIA BLOOMBERG L.P.)
** SOURCE: MSCI INC. (SEE COPYRIGHT DECLARATION); SHOWN IN USD TERMS.

CHART 19
Consumer Staples Are Defensive

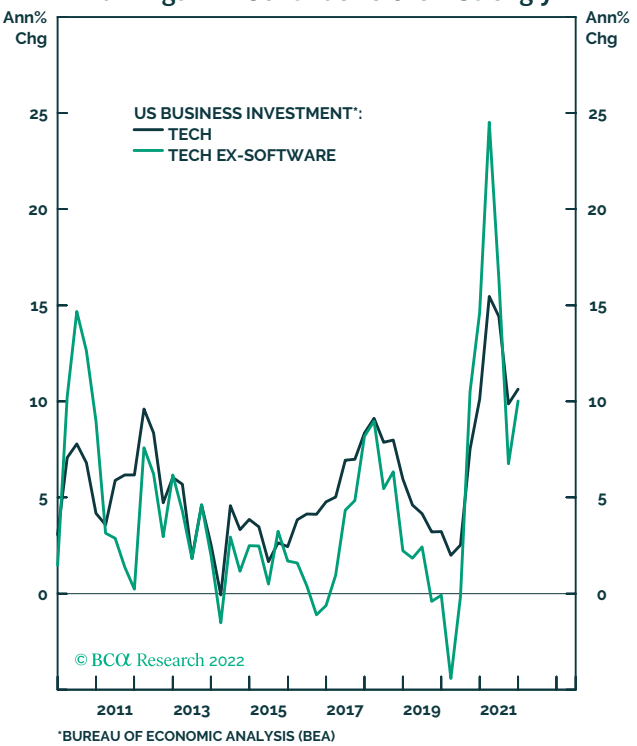


* SOURCE: INSTITUTE FOR SUPPLY MANAGEMENT

attractive dividend yields. Information Technology is a more controversial overweight, given that it is expensive and sensitive to rising rates. Nevertheless, investment in tech hardware and software is likely to continue, giving the sector strong structural earnings growth in coming years (**Chart 20**).

Currencies: The dollar has risen by 7.3% year-to-date driven by interest-rate differentials and the Fed being expected to be more aggressive than other central banks. But we are only neutral, since the Fed will probably not raise rates by as much as the market is pricing in, and because the dollar looks very overvalued (**Chart 21**). We lower our recommendation on the Chinese yuan to underweight. Interest-rate differentials with the US clearly point to it falling further – also the outcome desired by the

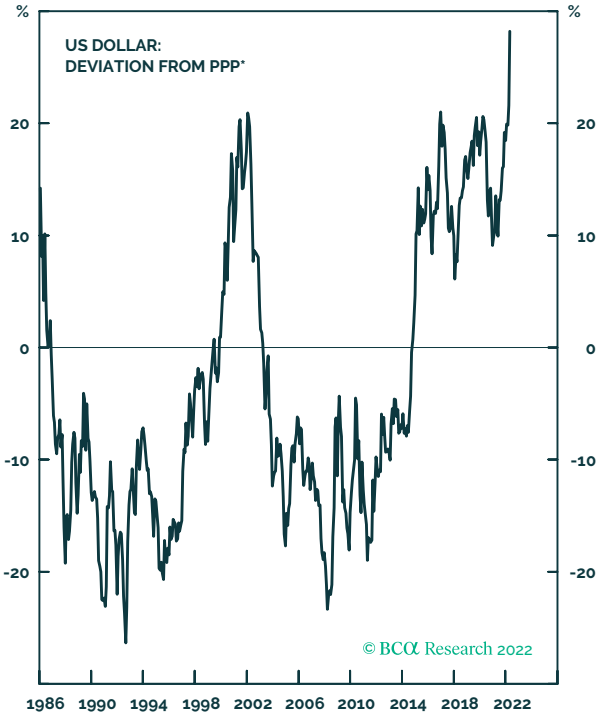
CHART 20
IT Earnings Will Continue To Grow Strongly



*BUREAU OF ECONOMIC ANALYSIS (BEA)

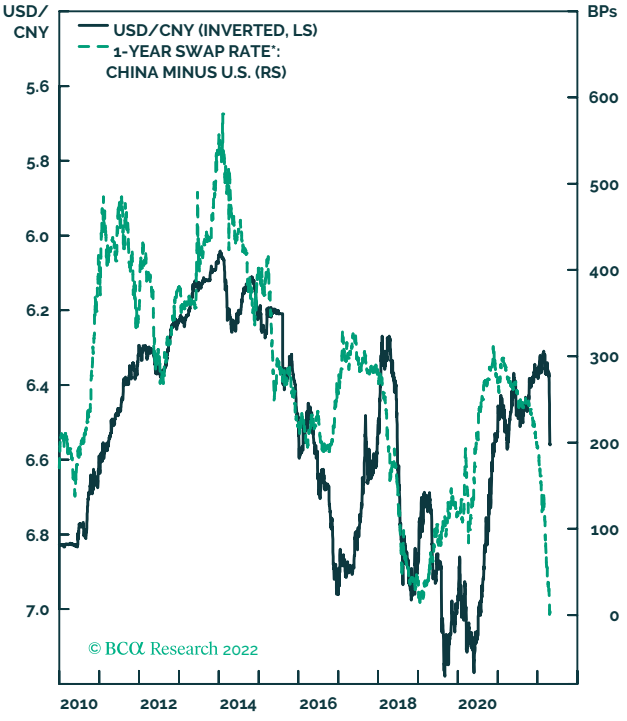
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CHART 21
The Dollar Is Very Overvalued



* BASED ON DXY WEIGHTS.
SOURCE: OECD.

CHART 22
Rate Differentials Point To A Weaker RMB...

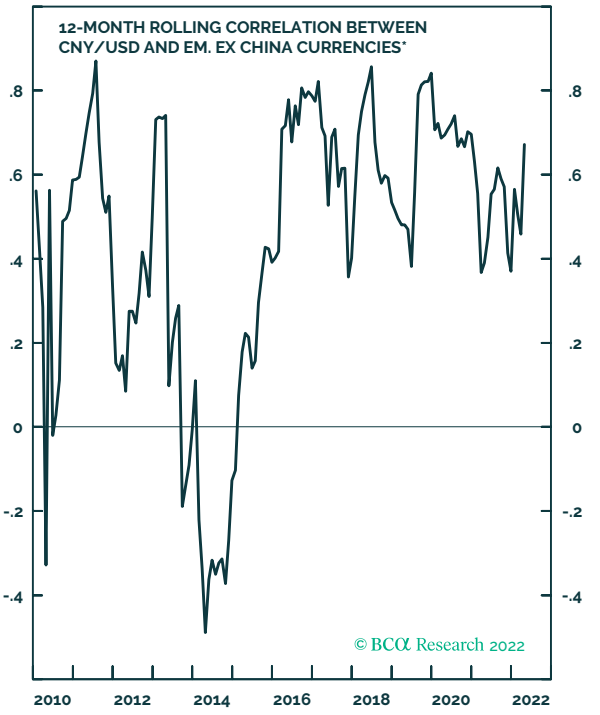


* SOURCE: BLOOMBERG FINANCE L.P.

authorities to help bolster growth (**Chart 22**). The likely CNY weakness will put further downward pressure on other EM currencies, particularly in Asia, given their high correlation to the Chinese currency (**Chart 23**).

Fixed Income: With the 10-year US Treasury yield at 2.9% and that in Germany at 0.9%, there is a stronger argument for marginally raising weightings in government bonds. We are neutral on government bonds within the (underweight) fixed-income category. Remember, though, that real yields are still negative: -0.1% in the US and -2.1% in Germany. We do not expect long-term rates to rise much over the next 6-9 months, and so remain neutral on duration. The "golden rule of bond investing" says that government bond returns

CHART 23
...Which Is Bad News For Other EM Currencies

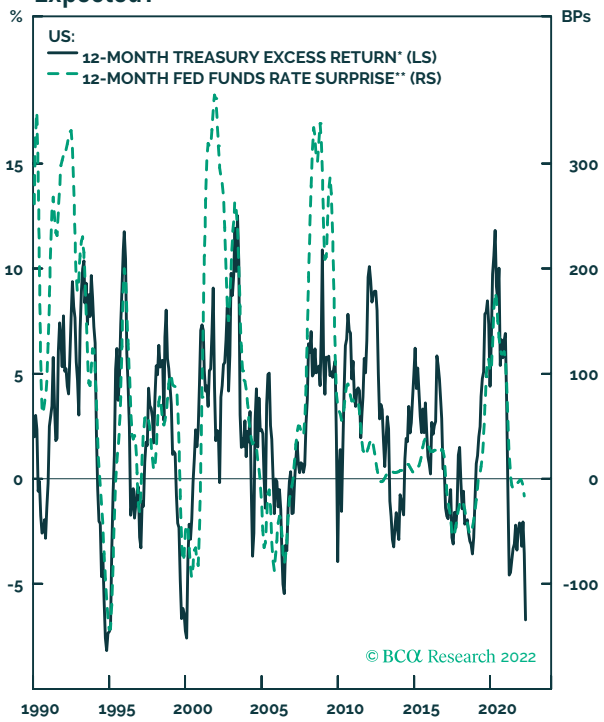


* EQUITY-WEIGHTED BASKET OF EMERGING MARKETS EXCLUDING CHINA.
SOURCE: MSCI INC. (SEE COPYRIGHT DECLARATION)

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CHART 24

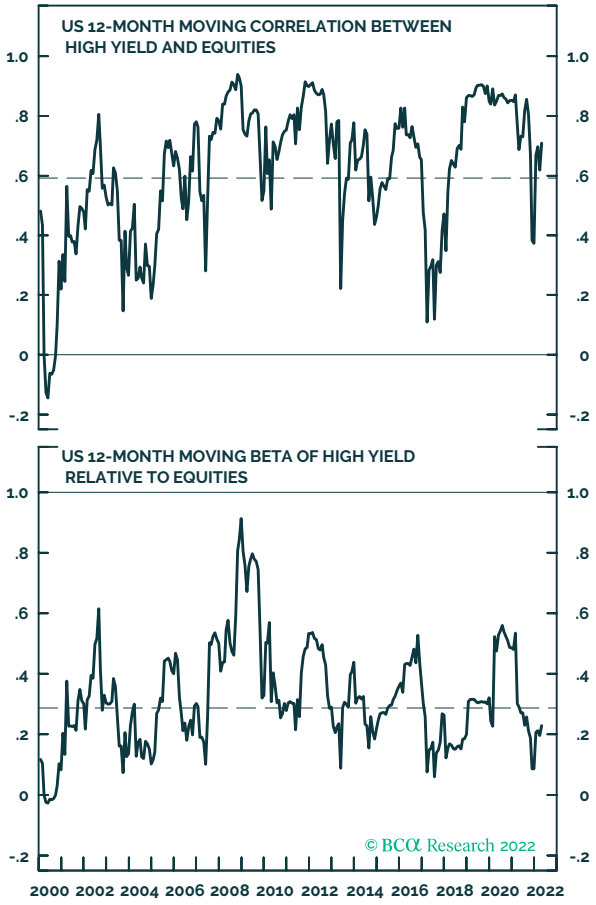
Will The Fed Be More Or Less Hawkish Than Expected?



* EXCESS RETURN RELATIVE TO A POSITION IN CASH.
SOURCE: BLOOMBERG BARCLAYS INDICES
** DIFFERENCE BETWEEN WHAT WAS DISCOUNTED IN THE OIS CURVE AND THE ACTUAL 12-MONTH CHANGE IN THE FED FUNDS RATE.

CHART 25

High Yield Bonds Are Like MinVol Equities



are driven by whether the central bank is more or less hawkish than expected over the next 12 months (**Chart 24**). We would expect the Fed to be slightly less hawkish than currently forecast. US high-yield bonds offer an attractive yield pick-up – as long as US growth does not collapse. In a way, HY bonds are like defensive equities, given their high correlation with equities but beta only one-third that of equities (**Chart 25**).

Commodities: Oil prices are likely to fall back to around $90 a barrel by year-end, as demand softens and increased supply (from Saudi Arabia, UAE, and North American shale, and maybe from Venezuela and Iran) enters the market. But the risk is to the upside if this extra supply does not emerge.

In particular, possible bans on Russian oil and gas into the European Union (or Russia blocking sales) could disturb the market. It will take time for Russia's 11 million b/d of oil production, which used to go mainly to Europe, to be rerouted to Asia. This is why the Urals benchmark is at a 30% discount to Brent (**Chart 26**). The long-term story for industrial commodities remains good, but there is downside risk – especially for iron ore and steel – from China's slowdown (**Chart 27**). Gold is an obvious hedge against geopolitical risks and high inflation. But over the past 20 years, it has been negatively correlated to real interest rates

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CHART 26
Russian Oil Is Going Cheap

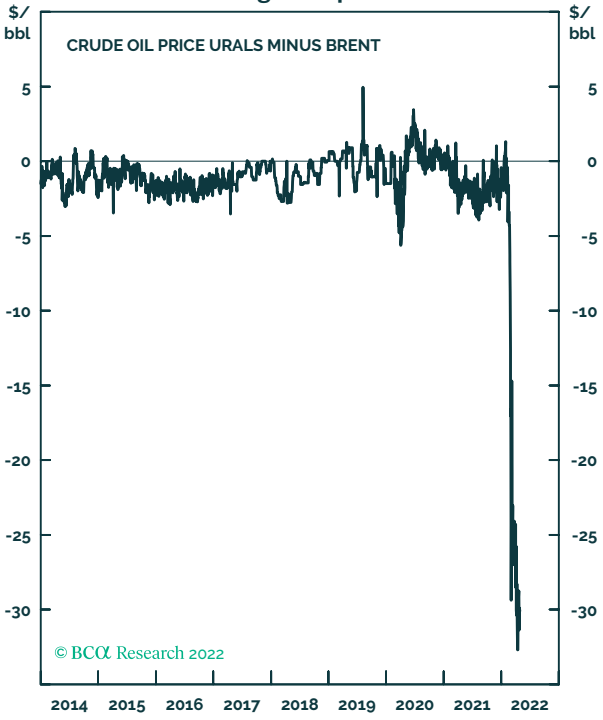
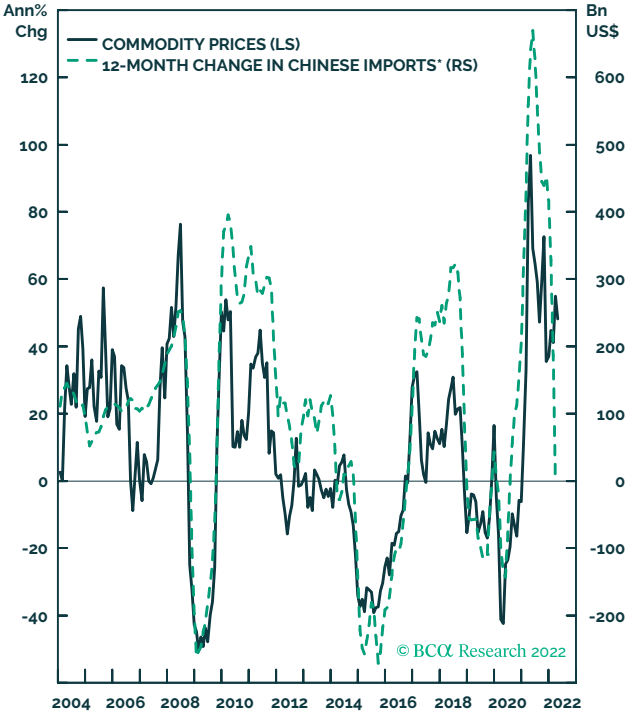
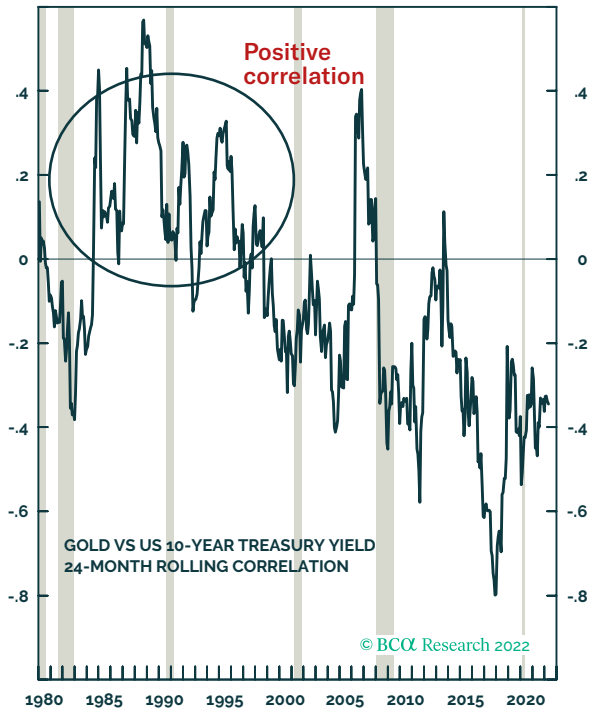


CHART 27
Chinese Slowdown Is Negative For Commodities



* SHOWN IN USD TERMS AND SMOOTHED EXCEPT LAST DATA POINT.

CHART 28
Will Gold Start To Behave As It Did Before 1990?



BASED ON MONTHLY CHANGES IN YIELD VERSUS MONTHLY PERCENTAGE CHANGE IN GOLD PRICE.
NOTE: SHADING DENOTES NBER DESIGNATED RECESSIONS

and the US dollar, suggesting upside is capped. There is a chance, however, that the relationship between rates and gold breaks down, as it did in the 1970s and 1980s (**Chart 28**). We, therefore, remain neutral on gold, believing that a moderate holding is a good diversifier for portfolios.

Garry Evans, Senior Vice President
Global Asset Allocation
garry@bcaresearch.com

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Recommended Asset Allocation

Model Portfolio (USD Terms)

Asset Class Selection				
	Allocation	**Benchmark Weighting**	**Active Weight**	
Equities	50.0%	50.0%	Neutral	Uncertainty is too high to be overweight risk assets
Bonds*	43.5%	47.5%	Underweight	Yields are still low and may rise if inflation surprises further to the upside
Cash	6.5%	2.5%	Overweight	The best hedge against further downside in risk assets
Portfolio Volatility				
	Allocation	**Benchmark Weighting**	**Active Weight**	
Volatility	9.34%	9.46%	Underweight	Risk of recession is rising; too much uncertainty to be risk-on
Equity Allocation By Country/Region				
	Allocation	**Benchmark Weighting**	**Active Weight**	
US	69.5%	65.5%	Overweight	Fundamentals better than other DMs
Euro Area	5.0%	8.0%	Underweight	Economy looking vulnerable
Japan	5.6%	5.6%	Neutral	Cheap and unloved; could have a bounce
UK	4.9%	3.9%	Overweight	Defensive market, with particularly high weight in Cons Staples
Canada	2.4%	3.4%	Underweight	Close link to oil price, which may fall back
Australia	2.1%	2.1%	Neutral	Higher commodities prices not fully reflected
China	3.4%	3.4%	Neutral	Relative safe haven; may rebound on stimulus announcement
Other EM	7.1%	8.1%	Underweight	Vulnerable to tighter US financial conditions and fall in commodity prices
Global Bond Allocation*				
	Allocation	**Benchmark Weighting**	**Active Weight**	
Government	69.9%	69.9%	Neutral	Rates will rise only slightly further to year-end
Investment Grade	20.2%	24.2%	Underweight	Spreads still unattractive
High-Yield	9.9%	5.9%	Overweight	Spreads better than IG; defaults likely to stay low
EM Debt	0.0%	0.0%	Neutral	USD-denominated EM debt has an attractive spread but would suffer if rates rise further
Global Sector Allocation				
	Allocation	**Benchmark Weighting**	**Active Weight**	
Financials	14.4%	14.4%	Neutral	Performance closely linked to rates
Info Tech	23.9%	21.9%	Overweight	Defensive growth; dominated by established winners
Health Care	13.2%	12.2%	Overweight	Demand benefits from an aging population in DM and growing middle class in EM but political risks rising
Consumer Discretionary	9.4%	11.4%	Underweight	Expensive and vulnerable to decline in real wages
Industrials	10.4%	9.4%	Overweight	Structural story based on energy and infrastructure investment, and reshoring
Communication Services	6.7%	7.7%	Underweight	Stretched valuations; earnings deteriorating
Consumer Staples	8.5%	7.5%	Overweight	Adds defensiveness
Energy	4.6%	4.6%	Neutral	Oil price has little further upside
Materials	5.0%	5.0%	Neutral	Strong structural demand for metals, but technically overbought
Utilities	1.0%	3.0%	Underweight	Vulnerable to further rises in bond yields
Real Estate	2.9%	2.9%	Neutral	Inflation hedge, but rising yields are a concern

* BASED ON BCA CALCULATIONS.

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Global Offices

Main Office
Montreal, Canada
1001 de Maisonneuve West,
Suite 1510
Montreal, Quebec H3A 1X8
Phone +1 800 724 2942
+1 514 499 9550

London, United Kingdom
8 Bouverie Street
London, EC4Y 8AX
Phone +44 0 207 556 6008

New York, United States
1120 6th Avenue, 6th Floor
New York, NY 10036
Office +1 212 224 3669

West Coast, United States
Phone: +1 214 212 7765

Hong Kong
12/F, V-Point, 18 Tang Lung Street
Causeway Bay, Hong Kong
Office +852 2912 8055

Sydney, Australia
Level 19, 1 O'Connell Street
Sydney, Australia
NSW 2000
Office +61 02 8249 1867
+61 02 8249 1868

Cape Town, South Africa
16 Ebenezer Road
The Foundry
Cape Town, 8000
South Africa
Office +27 21 276 1927
Mobile +27 83 317 1908

São Paulo, Brazil
Office +55 11 9828 13005

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Attachment 5

Canadian Yearly Forecasts

Analytical Contacts:

- Ryan Brecht +1 714-213-8470
  ryan.brecht@actioneconomics.com

Action Economics

Thursday, May 5, 2022

Action Front Page

Annual Indicators: Action Economics, LLC								
REAL CHAIN-WEIGHTED GDP	2015	2016	2017	2018	2019	2020	2021	2022
G.D.P. (Y/Y Chg. S.A.)	0.7%	1.0%	3.0%	2.8%	1.9%	-5.2%	4.6%	3.7%
CAPACITY USE	2015	2016	2017	2018	2019	2020	2021	2022
CAPACITY UTILIZATION RATE (%)	80.3	79.0	80.8	83.7	82.6	77.4	82.5	83.9
CURRENT ACCOUNT BALANCE	2015	2016	2017	2018	2019	2020	2021	2022
C.A. Balance (S.A., Bins $)	-69.6	-62.6	-60.0	-53.1	-47.0	-39.4	4.4	-31.0
PRODUCTIVITY	2015	2016	2017	2018	2019	2020	2021	2022
Labour Productivity (Y/Y Chg, S.A.)	-0.6%	-0.1%	2.0%	0.6%	1.0%	8.1%	-5.0%	#N/A
MONTHLY DATA (AVERAGES)	2015	2016	2017	2018	2019	2020	2021	2022
CIVILIAN UNEMPLOYMENT RATE	6.9%	7.1%	6.4%	5.9%	5.7%	9.6%	7.4%	5.9%
NONFARM PAYROLLS, (K)	17,797	17,916	18,285	18,569	18,979	18,005	18,871	19,546
CHANGE IN NONFARM PAYROLLS	105	232	465	225	333	-590	886	300
FACTORY PAYROLLS, (K)	1,701	1,700	1,729	1,737	1,741	1,673	1,737	1,788
OUTPUT BY INDUSTRY:	2015	2016	2017	2018	2019	2020	2021	2022
GDP BY INDUSTRY	NA	0.1%	0.3%	0.2%	0.2%	-0.2%	0.3%	0.2%
MANUFACTURING INVENTORIES	0.3%	-0.1%	0.6%	0.9%	0.3%	-0.2%	1.2%	0.2%
MANUFACTURING SHIPMENTS	-0.1%	0.4%	0.4%	0.1%	0.0%	0.4%	1.1%	1.0%
MANUFACTURING I/S RATIO	1.40	1.37	1.36	1.43	1.52	1.74	1.57	1.56
SPENDING/INCOME:	2015	2016	2017	2018	2019	2020	2021	2022
RETAIL SALES	NA	NA	0.5%	0.1%	0.2%	0.9%	0.4%	0.4%
RETAIL SALES EX-AUTO DEALERS	NA	NA	0.4%	0.1%	0.3%	0.5%	0.3%	0.3%
AUTO AND PARTS DEALERS	NA	NA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CANADA FOREIGN TRADE:	2015	2016	2017	2018	2019	2020	2021	2022
GOODS AND SERVICES TRADE BALANCE	-2.1	-2.1	-2.0	-1.8	-1.5	-3.3	1.0	3.5
EXPORTS	43.7	43.5	45.9	48.8	49.6	43.5	53.3	61.3
GROWTH	0.2%	0.3%	0.2%	-0.3%	0.7%	0.3%	1.9%	1.0%
GROWTH	0.3%	-0.1%	0.8%	0.2%	-0.3%	0.5%	1.1%	0.9%
HOUSING INDICATORS:	2015	2016	2017	2018	2019	2020	2021	2022
STARTS UNITS (K's, S.A.A.R)	193.6	198.2	220.0	213.6	208.3	219.0	280.1	240.8
PRICE INDICATORS -- Growth:	2015	2016	2017	2018	2019	2020	2021	2022
CPI -- NSA -- Y/Y	1.1%	1.4%	1.6%	2.3%	1.9%	0.7%	3.4%	4.7%
CPI -- NSA -- M/M	0.1%	0.1%	0.2%	0.2%	0.2%	0.1%	0.4%	0.4%

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March Starts Dip

Canada-wide housing starts in March dipped to 246,200 units seasonally adjusted at annual rate (SAAR), according to CMHC estimates. An increase in single-family starts was not enough to counter the decline in the apartment sector.

Regional highlights for March include:

- Atlantic Canada starts were higher in all provinces except Nova Scotia;
- Quebec starts rose with both the Montreal CMA and, to a lesser extent, the other areas of the province recording higher starts;
- Ontario starts were lower as the falloff in activity in the Toronto CMA more than offset higher starts in the remaining areas of the province;
- Starts slipped in both Manitoba and Saskatchewan;
- Alberta starts remained steady; and
- B.C. starts eased as the decline in the Vancouver CMA countered a small increase in the other areas of the province.

Housing Starts by Type and Area

	March 2021	February 2022	March 2022
	Total Starts (000s), SAAR		
Canada, Total	330.1	250.2	246.2
By Type of Unit			
Single-family	153.7	119.6	125.8
Apartment	176.4	130.7	120.5
By Area			
British Columbia	71.0	34.9	32.6
Vancouver CMA	*44.9*	*17.1*	*14.2*
Other Areas	*26.1*	*17.8*	*18.4*
Alberta	29.1	31.4	31.9
Saskatchewan	6.3	3.8	2.6
Manitoba	5.6	9.3	7.4
Ontario	130.7	103.2	88.0
Toronto CMA	*63.1*	*65.7*	*39.7*
Other Areas	*67.6*	*37.5*	*48.2*
Quebec	78.7	59.2	70.2
Montreal CMA	*30.6*	*16.1*	*23.5*
Other Areas	*48.1*	*43.1*	*46.7*
New Brunswick	1.3	1.5	5.8
Nova Scotia	4.6	3.8	2.8
Prince Edward Island	0.6	0.6	1.6
Newfoundland	2.2	2.4	3.4

Source: CMHC and estimates by Altus Group

Labour Force Indicators

	Employment Growth		Unemployment Rate	
	Jan-Mar 21-Jan-Mar 22-	Mar 21-Mar 22	Mar 2021	Mar 2022
	000s		*%*	
St. John's	6	9	9.5	7.4
Halifax	2	1	8.2	5.4
Quebec	3	6	4.9	2.7
Montreal	112	100	8.3	5.1
Ottawa	6	3	6.5	5.3
Toronto/ Oshawa	263	272	10.1	7.1
Kitchener-Waterloo	16	14	7.3	5.4
London	21	19	7.3	5.3
Winnipeg	27	22	7.8	5.1
Regina	8	10	8.5	5.2
Saskatoon	21	23	8.2	4.6
Calgary	31	42	10.1	7.7
Edmonton	45	26	11.1	7.1
Vancouver	63	53	8.0	5.4
Victoria	11	13	5.6	4.1

Based on seasonally adjusted 3 month averages
Source: Altus Group based on Statistics Canada data

Resale Housing Market Indicators

	MLS Sales*			Months of Inventory**	
	Mar 2021	Mar 2022	% Change	Mar 2021	Mar 2022
	Units				
St. John's	456	443	-3	n.a.	n.a.
Halifax	791	584	-26	n.a.	n.a.
Quebec	1,326	1,120	-16	2.6	2.1
Ottawa	2,312	2,041	-12	0.5	0.6
Toronto/ Oshawa	15,628	10,955	-30	0.7	0.9
Kitchener-Waterloo	575	725	26	0.8	0.6
London	1,296	1,049	-19	0.4	0.6
Winnipeg	1,740	1,306	-25	1.0	0.9
Regina	446	404	-9	3.1	3.0
Saskatoon	766	675	-12	n.a.	n.a.
Calgary	3,915	5,333	36	1.9	1.1
Edmonton	2,437	3,283	35	2.8	1.6
Vancouver	5,708	4,344	-24	1.6	1.8
Victoria	1,100	784	-29	0.9	0.9

* Multiple Listing Service (MLS) is a registered certification mark owned by The Canadian Real Estate Association
** Active listings at month end divided by sales during the month. A 5 months inventory of resale product is considered to be a "normal" market.
Source: Altus Group based on data from The Canadian Real Estate Association and local real estate boards

Description	Gross Dor	Gross Don	Real Gros	Implicit Pri	Consumer	Wages & Sa	Primary ho	Household	Population
Mnemonic	RYGDPO	RYGDPKC	RQTOO	RPYGDPC	RPCPIO	RWRO	RYHPIO	RYHDIO	RH15O
1961.01			124527.4		0.157703				4214.664
1961.02			124927.4		0.156855				4213.896
1961.03			124895.7		0.158002				4230.215
1961.04			122865.4		0.159307				4244.357
1962.01			131014.6		0.158654				4258.626
1962.02			131000		0.159117				4274.816
1962.03			132432.1		0.15998				4291.673
1962.04			131718.6		0.1604				4307.983
1963.01			135708		0.161069				4325.319
1963.02			138719.1		0.161657				4345.246
1963.03			138874		0.163091				4371.453
1963.04			141616.2		0.16287				4392.254
1964.01			146784.6		0.163941				4416.207
1964.02			147987.3		0.164676				4447.318
1964.03			148790.2		0.165658				4480.048
1964.04			151119.2		0.165427				4507.831
1965.01			156640.2		0.166607				4536.075
1965.02			157693.7		0.168018				4566.265
1965.03			158579.9		0.16949				4603.959
1965.04			161193.5		0.170505				4635.354
1966.01			167890.6		0.172872				4717.962
1966.02			167970		0.175509				4757.806
1966.03			168923.8		0.177561				4796.304
1966.04			172708.5		0.177906				4830.416
1967.01			169960.6		0.178055				4864.473
1967.02			173639		0.180127				4904
1967.03			177329.2		0.182394				4945.329
1967.04			179642.1		0.183219				4980.266
1968.01			180551.9		0.185462				5013.426
1968.02			185960.4		0.187257				5047.924
1968.03			188780.2		0.189435				5084.815
1968.04			190164.3		0.190628				5119.167
1969.01			196102		0.191584				5152.131
1969.02			195826.7		0.195105				5184.869
1969.03			194024.1		0.197694				5228.523
1969.04			195932		0.198802				5271.071
1970.01			197386.4		0.200577				5315.037
1970.02			199502.2		0.201641				5356.929
1970.03			200990.8		0.201774				5402.14
1970.04			199755		0.200541				5442.758
1971.01			204857.3		0.201437				5483.654
1971.02			207236.1		0.2049				5521.783
1971.03			210902.4		0.207632				5559.266
1971.04			212269.6		0.208367				5588.516
1972.01			216944.9		0.211391				5617.334
1972.02			219835.7		0.21358				5650.249
1972.03			221417.8		0.217698				5682.791
1972.04			227220.8		0.219818				5710.893
1973.01			234210.5		0.225066				5741.542

1973.02			236689.5		0.230077				5776.292
1973.03			237059.2		0.235878				5816.905
1973.04			242559		0.239618				5858.795
1974.01			243047.5		0.245818				5900.126
1974.02			244082.8		0.254091				5940.807
1974.03			246196.2		0.261228				5979.06
1974.04			247112.2		0.268181				6016.077
1975.01			240822.6		0.274509				6045.853
1975.02			243084.2		0.280265				6083.46
1975.03			246217.8		0.28881				6120.688
1975.04			247975		0.294041				6154.165
1976.01			253452.5		0.29928				6149.033
1976.02			257819		0.303009				6187.3
1976.03			259496.2		0.307345				6224.567
1976.04			259640.8		0.311195				6254.267
1977.01			262175.4		0.318291				6285.8
1977.02			263849.3		0.326386				6319.033
1977.03			264825.4		0.332167				6354.467
1977.04			267882.2		0.339619				6386.933
1978.01			269928.4		0.345684				6417.7
1978.02			270911.1		0.35291				6448.933
1978.03			270561.9		0.361557				6479.467
1978.04			274048.8		0.367667				6507.633
1979.01			276670.5		0.375667				6536.367
1979.02			275513.2		0.386				6565.4
1979.03			280833.7		0.393333				6593.8
1979.04			281907		0.403333				6624.433
1980.01			275606.3		0.413				6652.967
1980.02			275629.4		0.424333				6681.4
1980.03			280259		0.435333				6706.5
1980.04			284770		0.446333				6729.167
1981.01	128459	303736	284701.6	0.42293	0.460667	15.764793	94648	79540	6752.1
1981.02	133098	307062	286707	0.433456	0.475333	15.754412	97294	79109	6774.433
1981.03	134408	309332	285116.7	0.43451	0.489333	15.666683	99334	78956	6796.667
1981.04	134214	311874	281941.6	0.430347	0.501	15.565979	101011	79005	6823.3
1982.01	138018	304064	280761.8	0.453911	0.511667	16.420496	105809	83673	6853.933
1982.02	138822	299460	278711.1	0.463574	0.528667	17.066273	108569	86722	6882.3
1982.03	141155	293292	276436.1	0.481278	0.541	17.619382	109562	90641	6911.5
1982.04	142970	296091	272807.4	0.482858	0.550333	18.389762	110321	90964	6942.533
1983.01	149916	299508	281556.4	0.500541	0.554667	18.213765	112109	91399	6972.733
1983.02	153615	310608	287791	0.494562	0.56	18.41771	115509	92252	7000.9
1983.03	160026	320752	293820.6	0.498909	0.571667	18.282268	118973	99468	7029.633
1983.04	163611	322872	298318.8	0.506736	0.576667	18.320623	121493	99250	7061.367
1984.01	169940	329103	309018.3	0.516373	0.586	18.7309	123182	98941	7092.367
1984.02	174862	337819	311743.8	0.51762	0.590333	19.214572	127287	103765	7124.267
1984.03	178162	345315	315312.7	0.515941	0.597333	19.656794	131787	106299	7160.7
1984.04	181065	352175	319101.1	0.514134	0.602	20.173328	134592	108476	7191.5
1985.01	185991	353529	322304.4	0.526098	0.61	20.356547	136522	109811	7218.333
1985.02	190723	355143	325482.1	0.537032	0.615	20.52861	139510	114724	7249.267
1985.03	196764	360559	333292.9	0.545719	0.620333	20.750104	142094	115596	7287.133
1985.04	201975	364746	342096.8	0.553742	0.627	20.936178	144629	117432	7318.9

1986.01	205962	366951	341799.7	0.561279	0.635667	21.245524	147851	118904	7347.433
1986.02	210680	370842	344473.6	0.568113	0.640667	21.492888	150912	121600	7380.567
1986.03	216122	373516	346958.5	0.578615	0.649333	21.960551	152982	122629	7418.3
1986.04	220117	374887	348551.6	0.587156	0.657	22.414519	156406	123846	7452.233
1987.01	227341	380107	355063.6	0.598097	0.665	22.797502	160113	127774	7485.333
1987.02	232960	386509	357651	0.602729	0.675333	23.241475	163962	128291	7522.533
1987.03	238821	392877	366406.5	0.607877	0.684	23.45225	166726	134829	7567.567
1987.04	244751	398411	373618.4	0.614318	0.688	23.716917	171342	135938	7603.9
1988.01	252596	402267	377419.4	0.627931	0.693333	24.314166	175448	136536	7635.533
1988.02	257829	402542	381943	0.640502	0.705667	24.829378	180748	141712	7669.2
1988.03	263404	408436	383894.7	0.644909	0.716333	25.338061	186683	147664	7706.533
1988.04	269235	415447	386950.5	0.648061	0.723667	25.873714	191660	152196	7737.4
1989.01	276657	417674	392929.6	0.662375	0.733	26.112561	194484	154614	7770.3
1989.02	282745	420527	393797.3	0.672359	0.747667	26.723873	197664	159611	7805.033
1989.03	285632	421671	394948.2	0.677381	0.758667	26.947318	199335	157294	7843.067
1989.04	288118	422908	395423.8	0.681278	0.765	27.336446	203325	159571	7876.767
1990.01	291189	421077	397564.6	0.691534	0.776	27.066089	206486	163826	7906.533
1990.02	289360	417243	391849.1	0.693505	0.782667	27.305836	208804	158712	7942.033
1990.03	286028	410075	387794	0.697502	0.790333	27.409446	209064	163130	7979.433
1990.04	284712	407870	380559.8	0.698046	0.8	27.777995	208975	165628	8012.233
1991.01	284371	395724	376123.4	0.718609	0.816667	28.091248	209129	169305	8045.433
1991.02	286390	399130	380398	0.717536	0.823667	28.278566	209831	166512	8080.733
1991.03	292112	402837	382138.8	0.725137	0.829333	28.573926	210932	168874	8106.467
1991.04	291947	403081	381344.8	0.724289	0.825333	28.925948	211228	170301	8133.5
1992.01	292143	404212	380064.7	0.722747	0.826667	28.744149	212747	171402	8166.9
1992.02	294093	403596	382720.2	0.728682	0.831	29.062909	214116	173682	8199.633
1992.03	295014	402710	382570.8	0.732572	0.834333	29.25752	214823	178310	8226.167
1992.04	292762	411738	384280.4	0.71104	0.836667	29.368858	215349	176217	8250.8
1993.01	295195	408055	385516.2	0.72342	0.843	29.038609	216960	176936	8275.5
1993.02	300195	409534	385597.5	0.733016	0.844333	29.207955	217054	184557	8300.233
1993.03	304622	412547	386795.7	0.738393	0.848333	29.205424	217058	178921	8325.633
1993.04	310608	415324	388045.9	0.747869	0.852333	29.143251	216725	177204	8347.033
1994.01	313273	424541	393132.7	0.73791	0.846667	29.254494	217792	180408	8370.833
1994.02	317304	428780	402425.2	0.740016	0.843667	29.415074	221175	182326	8401.467
1994.03	322956	437311	407687.6	0.738504	0.848	29.334082	224904	182795	8432.6
1994.04	328067	444276	413840.6	0.738431	0.851333	29.441516	227821	185947	8459.5
1995.01	332421	444771	419628.1	0.747398	0.862667	29.512372	229788	186997	8487.9
1995.02	335099	445741	418687.9	0.75178	0.868667	29.706497	231959	188220	8520.367
1995.03	338785	448690	421022.9	0.755054	0.871	29.984316	233880	188165	8553.233
1995.04	345143	451738	420606.7	0.764034	0.871	29.93867	234837	190238	8580.867
1996.01	341316	450871	419985.1	0.757015	0.874333	29.810285	235459	190092	8616.4
1996.02	345020	453892	422119.4	0.760137	0.88	29.972254	237106	190206	8646.167
1996.03	351632	456977	427091.6	0.769474	0.881667	30.139285	240014	191506	8678.3
1996.04	355236	458400	430540.2	0.774948	0.89	30.651978	244349	195137	8705.767
1997.01	360987	462844	432747.9	0.779932	0.895	31.092328	247814	197012	8732.3
1997.02	365982	469189	439768.8	0.780031	0.897667	31.387752	251732	198573	8767.033
1997.03	373735	483874	449179.1	0.772381	0.9	31.621413	256440	204631	8802.633
1997.04	377356	492304	453159.9	0.76651	0.899667	31.708673	258862	207836	8835.133
1998.01	387823	497852	456814.2	0.778993	0.904333	32.270909	263498	210092	8864.967
1998.02	387333	498226	460562.3	0.777424	0.905	32.536712	266548	211645	8897.233
1998.03	388072	499164	462879.1	0.777444	0.907	32.57165	267731	215033	8928.8

1998.04	396212	499718	473839.2	0.792871	0.909333	32.956171	273075	220051	8956.9
1999.01	405436	513051	483680.4	0.790245	0.912333	33.247007	277140	219812	8985.9
1999.02	413733	526207	491041.3	0.786255	0.922667	33.603334	283569	224670	9021.6
1999.03	424887	540347	499704.9	0.786322	0.928667	34.00171	288362	227595	9062.467
1999.04	431468	553407	509009.8	0.779658	0.932333	34.653911	293866	232256	9099.367
2000.01	439491	558412	520493.8	0.787037	0.939333	35.445045	300228	236414	9136.233
2000.02	450672	566122	524037.2	0.796069	0.947	36.312238	306379	240352	9183.433
2000.03	459704	571530	533000.6	0.804339	0.955	36.594786	311140	244683	9233.467
2000.04	461776	572012	532220.5	0.807284	0.963333	36.503348	312695	247075	9278.067
2001.01	466011	572979	533338.6	0.813313	0.971	36.515728	313859	253277	9320.7
2001.02	470787	577329	535630.4	0.815457	0.985	36.358963	316162	248791	9373.4
2001.03	471226	576301	537210.5	0.817673	0.985667	36.358671	316917	254298	9427.1
2001.04	471328	582979	541634.5	0.808482	0.979333	36.408768	318710	256214	9468.9
2002.01	478753	590823	548087.1	0.810315	0.985333	36.542921	320515	259936	9514.1
2002.02	491118	592641	554184.1	0.828694	0.996	36.732335	321893	260557	9567.1
2002.03	502311	601479	557896.6	0.835126	1.009	36.838625	325118	264240	9616.133
2002.04	510378	603484	560451	0.845719	1.009667	36.942213	328554	264851	9650.633
2003.01	510984	606729	562877.5	0.842195	1.024667	36.799377	330140	269814	9683.467
2003.02	505895	603941	560196	0.837656	1.021	36.979655	331841	270088	9726.467
2003.03	510405	601119	558293	0.849091	1.029	37.123659	334430	269954	9768.667
2003.04	513815	603091	566149.5	0.851969	1.031333	37.325625	338385	273611	9805.7
2004.01	520830	606787	569798.3	0.858341	1.036667	37.695261	344068	276664	9841.3
2004.02	531670	618056	575477.3	0.860229	1.046333	38.206957	348364	282122	9882.833
2004.03	539970	627592	581539.6	0.860384	1.048	38.587796	352637	283630	9926.667
2004.04	543970	630245	584439.7	0.863109	1.052333	38.70061	354307	283475	9960.767
2005.01	546039	633488	591871.3	0.861956	1.057667	39.075265	358209	284685	9994.4
2005.02	552325	638396	594610.5	0.865176	1.066333	39.450101	363948	287793	10035.5
2005.03	562273	642962	598880.7	0.874504	1.075333	39.882398	368354	289692	10080.53
2005.04	568788	647610	601154.3	0.878288	1.076	40.277643	372198	294438	10115.1
2006.01	572817	653030	608051.3	0.877168	1.083	40.57387	376307	303922	10149.4
2006.02	577924	653446	607731.5	0.884425	1.093	40.652161	378255	302107	10187.43
2006.03	579810	651132	606009.3	0.890465	1.088667	41.318919	384837	308629	10225.1
2006.04	585278	652891	610383.1	0.896441	1.086	41.881557	391038	314559	10253.87
2007.01	592857	656346	606913.2	0.903269	1.097	42.027725	396155	315019	10279.43
2007.02	602919	658109	612389.7	0.916139	1.112667	42.648618	404183	317066	10308.3
2007.03	604888	658325	616052.3	0.918829	1.11	42.75375	406244	325675	10343.13
2007.04	608971	658152	618748.4	0.925274	1.110667	42.86526	409748	329609	10372.43
2008.01	607941	659661	614279.3	0.921596	1.113333	43.149463	413703	332916	10399.93
2008.02	614494	662712	615573.4	0.927241	1.134333	43.508708	416993	334671	10432.37
2008.03	615781	660541	614690.5	0.932237	1.15	43.614953	416676	336786	10469
2008.04	598288	647967	602593.6	0.923331	1.133333	43.391368	414244	336956	10497.83
2009.01	594134	638354	585953	0.930728	1.130667	43.373907	411443	343576	10523.2
2009.02	592536	631831	585188.9	0.937808	1.138	43.53743	410761	344670	10553.8
2009.03	596923	633204	594034.1	0.942703	1.137333	43.432406	413080	349395	10592.57
2009.04	610491	645802	601370	0.945322	1.142	43.734971	418688	355459	10626.37
2010.01	620809	652833	605065.8	0.950946	1.149667	44.012962	419537	356891	10655.93
2010.02	624840	654790	608644.5	0.95426	1.159667	43.951301	421677	369819	10692.5
2010.03	633467	658050	611570.6	0.962643	1.170333	44.453553	426195	363784	10737.23
2010.04	647428	658740	613800.3	0.982828	1.179	45.066039	432207	372459	10770
2011.01	653870	666050	619754.7	0.981713	1.184	45.419517	439937	373999	10796.43
2011.02	656384	665328	621621.4	0.986557	1.203333	45.273373	441583	372413	10827.97

2011.03	663698	676325	629078.3	0.98133	1.207333	45.549395	447579	375312	10862.1
2011.04	667792	680065	633293.3	0.981953	1.207667	45.922414	449986	378126	10893.77
2012.01	674557	680445	634433.7	0.991347	1.213333	46.207436	455486	380662	10921.7
2012.02	679985	680833	635704.1	0.998754	1.221333	46.596345	458764	381359	10953.87
2012.03	684669	680951	635519.4	1.00546	1.217333	46.908077	460660	382619	10987.33
2012.04	683953	680939	634120.1	1.004426	1.218	47.006001	464669	386032	11014.67
2013.01	691336	683932	637415.4	1.010826	1.224333	47.057999	469638	393210	11039.17
2013.02	693055	687874	642436.5	1.007532	1.230333	47.023128	471672	396153	11069.7
2013.03	697424	692205	646177.6	1.00754	1.234333	47.212938	474433	398685	11103.13
2013.04	702952	697089	649718.5	1.008411	1.232333	47.670129	479485	404912	11129.33
2014.01	711948	698257	649619.6	1.019607	1.243333	47.952722	482704	404379	11149.67
2014.02	721853	704116	657425	1.02519	1.264333	48.466086	488301	408315	11175.57
2014.03	735529	711432	665013.8	1.033871	1.265667	48.942979	493714	412973	11202.07
2014.04	738838	716551	667386.5	1.031103	1.261667	49.052272	496973	413853	11222.5
2015.01	745494	717720	671962.9	1.038698	1.262	50.021417	501695	416850	11238.57
2015.02	753442	721033	675529.5	1.044948	1.276	50.387636	510517	430200	11259.73
2015.03	766706	727524	680004.3	1.053857	1.280667	50.732412	515525	433815	11291.2
2015.04	776099	733507	682039.3	1.058066	1.277667	51.269241	522543	438565	11321.1
2016.01	782467	737520	691950.7	1.060943	1.283333	50.520672	516032	433061	11354.63
2016.02	785018	738068	688478.7	1.063612	1.300333	50.780598	519997	435250	11396.5
2016.03	793862	741094	693590	1.071203	1.301	50.932197	520911	439837	11446.53
2016.04	801649	743973	696463.8	1.077524	1.302667	51.048646	525004	443055	11489.97
2017.01	816711	753685	707914.9	1.083624	1.311333	51.71764	530484	445949	11531.4
2017.02	822168	759508	711185.9	1.082501	1.32	52.13168	536267	453439	11577.5
2017.03	824077	762698	710566.7	1.080476	1.32	52.646079	544756	462070	11633.13
2017.04	836960	768209	717112.9	1.089495	1.323333	53.251121	554496	469913	11684.3
2018.01	845056	773819	728284.8	1.092059	1.339333	54.374509	568686	482572	11739.97
2018.02	856657	784142	732863.2	1.092477	1.35	54.497804	566940	479741	11797.5
2018.03	868020	792681	739191.5	1.095043	1.357	54.768438	565508	474684	11860.3
2018.04	870683	797217	743405	1.092153	1.352333	55.40255	568802	474883	11913.13
2019.01	875844	797547	742809.7	1.098172	1.360667	55.209215	576191	484201	11964.03
2019.02	891543	803238	747408	1.109936	1.378333	55.51665	587844	498569	12020.53
2019.03	898688	805869	754599.5	1.115179	1.382667	56.07504	598169	508243	12084.03
2019.04	902828	805697	758354	1.120555	1.378	56.19192	608216	518259	12134.17
2020.01	888660	794551	742670.8	1.118443	1.382	56.31258	602049	521520	12170.93
2020.02	781718	700180	652121	1.116453	1.378	58.835267	558546	580860	12200.33
2020.03	879884	768713	724660.4	1.14462	1.385667	59.151317	594414	555473	12233.5
2020.04	917498	785212	734323.8	1.168472	1.389	59.240225	607699	549275	12266.1
2021.01	946265.5	792969	742530.2	1.19332	1.402333	60.482278	623735.6	566610.6	12289.13
2021.02	948522.5	783119	735230.1	1.211211	1.425	60.616183	629229.9	571525.9	12314.93
2021.03	973836.3	794432.8	744939.9	1.225826	1.440631	60.871523	646343.6	583501.6	12353.16
2021.04	995672.8	809510.8	751509.2	1.229969	1.458329	61.292886	658127.3	570894.8	12455.31
2022.01	1005892	810388.1	758080	1.241247	1.477346	61.426732	660124.6	564626.4	12489.47
2022.02	1017287	821913.2	768692.1	1.237706	1.495031	61.385143	663671.7	567880.6	12527.47
2022.03	1028984	830657.7	776858.4	1.238758	1.50325	61.503556	669821.2	573691.8	12565.03
2022.04	1041648	839062.6	784627.3	1.241442	1.5121	61.676552	676086.1	579640.7	12603.19
2023.01	1054245	846060.3	791025.8	1.246064	1.521167	61.919093	682711.7	582684.2	12643.95
2023.02	1065368	852632.6	797203.7	1.249504	1.529321	62.178457	689158.6	589713.3	12683.35
2023.03	1073681	855875.2	800273.7	1.254483	1.537513	62.451108	695963.5	596202.2	12722.81
2023.04	1081360	858449.9	802615.3	1.259665	1.545541	62.768287	702028.3	602272.4	12762.28
2024.01	1088970	860544.3	804558.5	1.265443	1.552435	63.102811	707975	607111.4	12801.41

2024.02	1098672	863954.9	807701.8	1.271677	1.56036	63.443111	714300.7	613460.5	12840.75
2024.03	1107241	866099.4	809717.5	1.278423	1.568274	63.786385	720776.7	619583.8	12880.12
2024.04	1115740	868455.2	811880.9	1.284741	1.57604	64.138405	727125.6	625689	12919.52
2025.01	1125542	872152.2	815330.4	1.290533	1.584218	64.51122	733643	630646	12959.12
2025.02	1135387	875881.7	818778	1.296279	1.592113	64.863146	739843.6	636248.4	12998.47
2025.03	1145102	879448.6	822075.7	1.302068	1.600065	65.224282	746137.8	642230.1	13037.75
2025.04	1155121	883097.5	825478.2	1.308033	1.608069	65.58408	752424.1	648146.9	13076.96
2026.01	1164868	886624.2	828758	1.313823	1.616109	65.977099	758977.9	653120	13116.09
2026.02	1175575	890430.4	832233.4	1.320233	1.62419	66.394189	765656.4	659337.8	13154.88
2026.03	1186440	894183.8	835650.9	1.326841	1.632311	66.814583	772388.5	665582.8	13193.75
2026.04	1197325	897859	839066	1.333533	1.640473	67.236991	779119.2	671818.5	13232.68

Labour Fo	Employme	Unemploy	Retail Sale	Housing S	Real Gros	Real Gros	Real Gros	Real Gros	Real Gros
RLO	RLEMO	RLURO	RRTO	RIHSO	RQCROP(	RQFLOG(	RQSAGF(	RQHUNT(	RQMINO
2464.422	2309.738	6.276685	6692.584		2240.413		192.0545	43.57041	19188.88
2468.405	2327.092	5.724871	6885.007		2297.619		185.8579	44.24948	17687.15
2463.567	2347.015	4.731026	7297.369		2370.148		181.1624	46.34839	15491.63
2470.027	2355.723	4.627642	6882.383		2348.486		176.9807	52.79072	12470.85
2471.977	2355.77	4.700974	7179.524		2221.863		165.3352	51.44626	15634.45
2493.461	2389.919	4.152541	7199.234		2141.642		163.5408	55.35025	13834.17
2493.771	2387.267	4.270801	7249.658		2115.136		163.4496	57.61294	12948.66
2494.385	2401.987	3.70424	7503.497		2217.59		165.6538	49.55705	12115.29
2512.932	2411.556	4.034172	7558.122		2113.845		167.6617	35.05981	13484.3
2530.171	2432.103	3.875944	7729.218		2125.475		169.7973	46.84359	13587.81
2547.708	2460.521	3.422174	7753.998		2154.213		171.5121	45.70377	12660.29
2584.738	2497.104	3.39044	7910.106		2208.779		172.8756	48.24017	12922.88
2603.214	2519.456	3.217484	8140.017		2360.315		176.1277	35.61679	14052.73
2621.131	2535.855	3.253405	8042.046		2256.679		176.7193	34.95339	13998.96
2636.689	2557.254	3.01268	8183.658		2371.255		179.999	34.42397	13547.69
2648.164	2567.342	3.052001	8176.741		2309.047		182.9122	33.53974	13370.48
2669.565	2605.29	2.407696	8344.353		2393.847		188.2132	42.56764	14282.79
2675.248	2603.827	2.669696	8842.125		2138.894		190.1585	38.722	13283.95
2694.262	2628.453	2.442561	8805.988		2278.789		195.3511	39.69902	12108.02
2708.652	2650.691	2.139847	9233.952		2251.59		198.932	45.15113	11344.55
2824.341	2757.51	2.366251	9985.623		2370.777		201.8844	42.20173	11886.66
2841.861	2779.967	2.177939	8967.241		2444.843		205.5138	46.45091	10890.21
2886.284	2805.777	2.789296	9374.743		2382.037		207.3243	52.51656	9740.396
2905.253	2829.615	2.603491	9520.911		2300.912		208.3522	57.2393	10790.94
2937.602	2851.274	2.938723	9697.534		2211.355		214.7135	86.92067	10555.1
2961.222	2872.612	2.992346	10039.8		2349.045		216.5009	79.8145	11482.86
2996.892	2904.268	3.090669	10048.51		2181.844		215.0532	78.07415	12770.64
2996.624	2893.845	3.429826	10183.35		2182.822		214.5167	38.02226	13807.85
3007.097	2901.635	3.507103	10470.62		2242.211		205.7113	48.01457	12441.14
3034.128	2927.221	3.523484	10675.4		2262.743		205.7203	62.2352	12764.41
3083.548	2974.561	3.534467	11043.01		2287.611		206.6777	65.91246	12961.59
3126.385	3022.445	3.324607	11238.41		2335.964		208.762	57.78944	12456.7
3154.132	3061.093	2.94975	11686.21		2273.495		209.5754	67.51596	13945.29
3160.602	3059.664	3.193632	11544.99		2298.254		211.8641	67.13659	13008.61
3163.991	3069.408	2.989357	11620		2206.9		212.5671	58.5243	9710.551
3177.565	3073.292	3.281538	11787.31		2200.899		213.7075	60.49275	10679.01
3200.934	3086.519	3.574425	11888.03		2366.337		221.1098	45.07803	12425.95
3273.575	3135.651	4.213253	11968.12		2446.826		223.196	45.25314	12729.08
3287.906	3131.104	4.769054	12145.88		2213.322		221.9466	49.09796	13316.99
3307.921	3148.687	4.813718	12046.81		2392.466		225.8853	42.83057	12536.52
3339.558	3159.513	5.391282	12486.4		3953.363		403.755	60.3894	11039.41
3350.699	3165.418	5.529622	13132.61		2932.238		283.0262	62.23731	11137.15
3393.15	3221.478	5.05937	13102.18		1937.486		163.5632	60.57075	11745.28
3443.884	3262.058	5.279678	13417.67		900.9265		51.14887	58.55986	11819.8
3466.002	3298.198	4.841428	13625.6		1527.709		179.2115	50.82307	12428.24
3481.107	3318.431	4.673111	14290.08		1736.329		202.2637	55.14749	11747.8
3521.39	3342.417	5.082453	14459.25		2176.751		246.0801	61.12323	10263.22
3549.581	3370.814	5.036285	14813.97		2833.285		311.419	72.78309	11701.65
3584.93	3435.562	4.166553	15512.18		2127.902		237.2623	60.25642	13433.34

3623.199	3476.27	4.055229	15763.33		2697.386	286.7363	60.5815	13424.78
3613.928	3462.841	4.180687	15983.29		3136.562	313.7723	64.8914	13161.18
3696.655	3534.865	4.376659	16551.3		3448.309	317.7023	71.61503	14094.12
3738.94	3578.81	4.282765	17439.38		2799.375	278.8494	56.73434	11599.33
3769.517	3623.852	3.864288	17915.39		2702.918	271.1348	57.75388	11652.75
3806.092	3639.506	4.376825	18827.79		2664.855	270.4535	62.02712	11856.17
3841.143	3654.813	4.8509	18634.1		2800.901	278.3638	54.31962	12294.15
3867.265	3627.508	6.199653	19808.79		3453.928	316.3634	52.22851	10797.42
3907.017	3669.953	6.067647	20515.52		3357.896	318.9992	60.87356	9974.012
3931.075	3685.656	6.243051	21306.18		2894.263	290.4379	50.08615	9311.504
3992.421	3733.545	6.484186	22787.07		2091.49	231.1445	53.83859	9260.358
3959.3	3716.4	6.134923	21729.98		2906.32	265.0402	52.879	10347.17
3970.2	3738.367	5.839336	23012.54		2181.064	209.3627	50.70578	9942.892
3993.9	3749.833	6.110986	23198.64		2329.182	215.6771	46.65821	10394.58
4019.8	3760.833	6.442277	23835.06		3344.569	283.3611	35.521	9553.529
4050.933	3773.1	6.858502	24542.2	74.30095	2722.173	238.9252	53.31481	9853.942
4071.433	3792.933	6.840343	24455.46	87.48123	3440.717	285.5111	66.76109	8709.976
4099.067	3810.6	7.037374	24877.51	80.37128	3492.304	291.7413	63.31064	9138.934
4132.567	3840.3	7.07228	25572.08	74.36655	2815.201	256.9944	54.62268	9452.519
4167.133	3873	7.058409	26667.01	83.5493	3046.202	295.6382	70.20012	9684.346
4202.733	3898.8	7.231802	27397.89	61.81458	2361.833	249.4883	60.74928	8758.425
4255.233	3942.267	7.354865	28314.14	74.30103	2294.245	238.9265	52.05935	6759.302
4298.833	3983.467	7.336099	28046.28	67.17509	2740.334	261.6249	46.55047	6698.175
4345.433	4047.367	6.859308	29342.47	53.16388	2498.422	273.513	52.00415	6461.108
4368.967	4077.467	6.672058	30268.04	55.12338	2781.39	298.3433	61.13195	5336.088
4392.9	4112.967	6.372404	31028.8	57.8536	2934.359	316.07	51.01358	8141.373
4423.1	4139.067	6.42159	31110.31	61.40714	3049.405	328.6801	54.59921	9220.949
4451.2	4150.1	6.764468	31871.48	47.33772	3138.847	339.9293	64.98254	6850.905
4467.567	4140.7	7.316436	31381.79	35.89538	3044.984	343.2368	74.50493	8661.117
4474.167	4166.3	6.880983	33196.86	35.4836	2877.621	345.4299	57.48867	10405.31
4485.767	4199.067	6.391327	34406.76	41.7913	2692.444	347.785	83.82291	10113.74
4545.5	4252.2	6.452535	37093.24	39.78632	3741.453	458.4835	73.31163	7758.997
4583.067	4294.433	6.297821	37816.65	62.74928	3179.775	422.5502	55.11385	7300.438
4600.233	4305.167	6.414167	37991.22	54.77728	2582.518	383.1052	65.49442	7088.386
4650.2	4316.4	7.178186	39593.19	43.33112	1981.691	340.4083	66.2089	6841.288
4634.033	4273.2	7.786593	38579.48	49.22159	2581.393	375.3971	58.0694	6717.673
4648.067	4235.6	8.87394	39931.72	26.66562	2745.753	386.5267	65.38998	6640.135
4666.467	4168.467	10.67189	40748.44	28.76686	2947.137	407.9715	76.66604	5143.46
4696	4125.133	12.15645	41430.77	49.37792	3094.136	437.338	85.43389	5660.352
4700.033	4154.7	11.60275	42610.14	63.86363	2549.096	388.4566	86.28873	5416.427
4736.367	4206.133	11.19494	43695.72	60.35122	2908.355	419.7364	78.77335	6278.205
4762.8	4301.067	9.694577	45644.29	46.55036	3053.739	436.3368	70.76567	7261.645
4771.8	4334.933	9.155176	46556.47	48.99079	3283.148	443.9416	55.41214	8117.221
4786.4	4348.667	9.145356	47723.61	49.79969	2791.465	418.4637	75.03259	7853.511
4833.967	4393.667	9.108462	48778.3	45.89587	2938.243	421.5299	62.30509	8961.375
4878.867	4439.567	9.00414	49565.16	50.70242	2853.385	419.7488	57.94303	9964.875
4887.267	4463.933	8.661965	50760.39	46.28603	2722.14	416.5038	70.3199	9451.164
4920.367	4507.667	8.387586	53277.18	42.74579	3117.147	462.8989	63.46934	8045.222
4957.967	4555.133	8.124971	54860.94	66.65268	2941.01	453.6664	61.50229	8400.619
4989.733	4598.8	7.834754	56179.49	70.68322	2748.807	441.6475	69.38024	8726.602
5011.5	4645.133	7.310519	58028.52	79.40231	2524.198	423.4616	94.79173	9732.25

5043.867	4683.767	7.139364	58725.2	71.14395	3400.825		493.8685	76.99116	7775.788
5092.8	4737.4	6.978479	59424.84	80.62068	2814.205		448.2047	84.10748	8530.646
5097.4	4739.667	7.017957	61702.36	82.79937	2389.636		409.2377	79.54032	8727.268
5115.8	4769.267	6.773786	62414.59	91.316	2109.277		399.223	61.59884	9744.961
5151.567	4815.533	6.522935	63681.49	114.709	1865.244		428.7071	85.21005	9728.948
5182.7	4856.233	6.299162	66613.34	107.4689	1909.294		441.0854	64.97238	9153.84
5222.9	4914.667	5.901574	67523.9	107.2487	3291.982		487.1174	59.74021	9673.957
5294.667	4996.933	5.623269	69913.48	91.42538	3203.307		441.9251	57.96291	9473.236
5333.1	5051.433	5.281481	69725.7	89.46206	2352.412		515.6188	72.93454	9944.849
5339.233	5078.3	4.887094	71642.8	103.1454	2964.511		517.6567	76.06494	9604.557
5359.1	5090.5	5.012036	73049.27	100.0488	3003.377		511.6056	75.32771	9568.523
5382.067	5112.567	5.00737	74203.34	107.0398	2981.124		513.032	90.67122	10574.57
5455.667	5184.067	4.97831	75220.2	112.8437	3886.704		553.1917	89.69598	9181.027
5450.2	5178.467	4.98575	75293.43	91.78529	3328.876		505.9098	83.44565	10323.09
5471.867	5207.367	4.833817	74933.48	81.60717	2480.785		464.9511	83.89362	10328.73
5502.567	5222.5	5.089746	74596.2	87.11189	1286.428		380.969	101.0668	9625.605
5541.167	5245.267	5.340031	76741.32	87.98899	3624.791		533.1275	98.78308	11493.09
5530.133	5228.767	5.449537	74613.44	65.63814	2904.01		489.7737	103.5195	10321.32
5536.3	5186.633	6.315891	74485.84	53.74215	2447.986		467.9858	103.2442	9293.303
5539.067	5116.3	7.632453	74208.02	43.22673	1990.349		416.4376	96.0471	7355.662
5527.8	5015.067	9.275541	68785.95	36.02016	2773.464		454.8205	83.73719	9391.151
5561.733	5021.6	9.711601	69997.59	51.87794	2735.387		455.0897	77.65116	9046.056
5555.7	5024.933	9.553552	69832.01	65.63291	2795.777		455.609	78.40734	9072.766
5534.533	5004.6	9.575032	69700.08	57.64498	2962.801		463.6927	81.26522	9150.688
5513.833	4965.867	9.938035	70301.05	61.18558	2491.939		458.8456	94.72276	8221.746
5527.133	4937.4	10.66979	71050.49	60.74866	2628.543		478.7801	82.48379	8608.742
5535.7	4915.967	11.19521	72057.54	51.84421	2691.194		465.5843	84.76491	8860.569
5541.433	4911.633	11.36529	72549.69	49.30955	2772.972		471.9615	75.95102	8703.394
5538.333	4957.333	10.49052	73569.1	42.73676	2814.29		449.0615	87.31749	8893.337
5544.5	4927.167	11.13416	73925.61	42.16059	2769.327		441.3705	94.00267	8921.16
5551.067	4936.2	11.07655	74655.62	43.89784	2754.962		433.8855	96.42321	8301.139
5543.367	4936.5	10.94762	75716.22	51.76482	2716.104		421.0332	88.11519	8427.161
5522.6	4939.467	10.55904	77827.81	42.02508	3026.893		475.0209	80.68658	6995.538
5537.9	4989.833	9.896652	79333.56	50.50118	3022.98		469.1	84.22788	7279.409
5563.6	5047.833	9.270376	80101.92	50.45697	3067.643		470.1444	73.38224	7614.946
5569.733	5075.3	8.877146	82889.54	43.59676	3056.415		467.1278	68.64816	8044.186
5579.9	5094.9	8.691912	83531.5	39.7518	3263.327		489.9123	66.59154	7124.457
5584.3	5093.333	8.791911	83107.17	32.82095	3240.799		491.4913	57.14252	7757.722
5595.433	5094.733	8.948369	84091.44	32.95419	3249.13		495.9725	56.80386	7909.958
5598.067	5116.133	8.608925	82334.08	37.74506	3345.303		501.9084	66.1003	7214.898
5643.367	5140.733	8.906622	83083.15	34.68527	3226.179		471.9837	92.4896	8222.556
5663.533	5146.533	9.128577	82879.11	42.74314	3149.5		472.5343	92.59698	7978.985
5694.667	5182.767	8.989113	83392.97	45.99738	3160.636		474.0681	96.81108	8180.095
5708	5191.967	9.040528	86017.66	48.82221	3217.19		473.1257	95.74935	8167.815
5720.533	5212.967	8.872716	87630.18	52.84097	3020.044	568.7401	301.2508	74.47167	7618.367
5746.133	5249.2	8.648134	89519.28	52.26544	3065.935	615.936	309.0647	69.05268	6610.705
5800.233	5333.8	8.041631	91407.11	55.43317	3118.977	632.9499	314.9453	65.97538	7953.839
5825.233	5363.6	7.924718	95240.11	55.74842	3155.044	656.374	319.9391	64.50499	7866.689
5848.167	5404.2	7.591553	95039.08	58.35938	3132.44	639.4371	350.4924	71.93123	7002.651
5852.767	5433.533	7.162994	97832.15	50.91707	3170.081	563.9783	346.9783	64.27628	7281.668
5880.8	5465.667	7.05913	98069.37	48.29501	3275.61	548.5251	355.3484	54.71046	7628.31

5925.2	5514.133	6.9376	99140.68	57.74855	3380.669	622.4595	371.9809	52.06266	7420.97
5961.033	5565.5	6.635315	102360.8	62.75803	3221.367	648.0462	397.6539	46.15967	7746.833
6027.567	5617.133	6.809271	103540.5	70.83915	3263.745	625.0217	399.6428	39.34005	7581.697
6038.3	5663.9	6.200421	105726.1	64.57683	3282.952	638.8108	403.0338	34.68913	7028.594
6042.833	5700	5.673387	106873.8	70.76599	3287.536	636.5213	403.2696	31.41116	7406.076
6101.6	5750.7	5.750951	109310.1	74.33913	3502.101	718.7274	345.4054	39.1558	8576.693
6132.6	5790.133	5.584363	110299.4	63.55392	3453.25	803.0253	348.3062	39.55789	8319.081
6190.367	5835.033	5.740102	113131.2	74.68774	3462.375	815.9931	350.1141	38.42266	8301.501
6267.467	5889.867	6.024763	113261.7	73.50321	3502.274	767.0541	349.3743	36.46365	7469.125
6270.4	5889.3	6.077762	113076.2	73.51603	3349.213	717.4679	341.2007	32.62326	7526.694
6316.067	5931.3	6.091872	114810.7	75.8245	3350.775	675.0809	337.7754	34.86492	7784.201
6342.433	5936.4	6.401854	112692.2	69.886	3332.342	713.0118	339.4113	35.15807	8662.467
6367.6	5930.767	6.860251	116598.2	73.90146	3246.071	749.2393	335.2126	34.95375	8622.638
6412	5944.567	7.289977	119595.9	89.81639	3399.586	669.3787	341.4259	35.89228	6434.255
6446.033	5991.1	7.05757	120318.2	79.66898	3402.86	753.0965	348.7253	35.24991	8337.462
6526.667	6064.033	7.088355	120824.3	82.7148	3461.427	745.5494	353.0064	35.83273	7999.675
6585.533	6129.7	6.921738	123229.7	82.18783	3574.528	821.1755	368.8424	36.62508	7474.608
6642.433	6193.067	6.765091	123953	91.92993	3780.231	817.0767	350.0962	93.50559	8430.448
6654.533	6187.933	7.011761	124581	77.18715	3868.897	756.4145	352.2287	13.70658	7235.857
6685.833	6207.8	7.149944	126814.5	84.665	3959.228	648.1752	350.865	8.095643	7091.878
6711.567	6257.4	6.766925	125141.3	86.93792	4075.244	620.7337	357.6101	7.092179	7472.617
6748.767	6297.433	6.687642	127266.5	82.33772	4130.093	659.6624	341.2715	27.43906	8102.382
6768.9	6308.2	6.806128	127315.6	86.18027	4233.774	619.9617	345.8302	30.21197	8073.356
6772.067	6321.367	6.65528	129082.5	87.72031	4304.645	652.7592	353.2166	29.96743	7688.874
6801.633	6336.367	6.840514	132002.1	84.2177	4304.688	648.0167	352.8817	28.38155	7433.388
6804.2	6342.367	6.787474	133942.5	71.86073	4658.664	638.9819	371.1401	39.55739	8254.175
6850.267	6379.7	6.869319	133214.8	87.08743	4691.819	682.7925	376.5321	36.52458	8089.701
6848.6	6395.6	6.614491	136111.4	80.27417	4722.601	745.1046	383.054	37.40914	8072.967
6842.633	6409.633	6.327973	137254.1	75.95767	4711.716	696.321	378.8738	40.50889	7721.158
6845.433	6407.867	6.392096	139267.2	80.78185	5011.981	609.5169	383.2494	37.37781	7183.461
6889.433	6467.7	6.121452	139683.4	75.45412	4978.464	617.6751	381.5205	35.11339	7375.885
6913.8	6460.8	6.552113	141569.5	70.17559	4941.094	607.4059	378.2727	32.04001	7107.911
6900.567	6460.3	6.380152	141867.2	67.25643	4849.661	562.2022	368.9574	33.46879	7732.743
6957	6501.967	6.540655	143045.2	63.72901	4929.409	558.0653	414.0314	35.2902	7308.713
6952.633	6497.767	6.542365	146474.1	67.1429	4764.885	537.8634	400.0938	32.2514	7659.523
6979.7	6538.333	6.323576	145553.8	73.73652	4809.501	500.4587	400.6379	34.49358	7211.638
7012.7	6565.167	6.381755	148838.3	67.88358	4943.404	432.8126	405.637	34.76481	6808.526
7034.833	6584.767	6.397688	151706.3	79.66459	4942.111	484.9528	364.055	26.24433	7827.331
7042.467	6593.5	6.375134	153691.4	77.34999	5154.461	452.3781	376.1147	28.14141	7856.32
7036.867	6581.933	6.464999	154670.5	74.71924	5251.596	473.9443	384.0773	29.95184	8213.168
7085.933	6583.8	7.08634	146719.4	68.57018	5268.232	476.3248	385.353	27.66242	8086.381
7065.033	6452.667	8.667569	145230.4	50.76298	5418.953	512.5081	404.3151	28.27956	5488.84
7041.233	6378.067	9.418331	146553.2	42.32912	5200.776	308.2465	375.5198	31.75015	5064.188
7063.567	6403.833	9.339946	149536.5	48.21657	5034.501	313.5227	364.5454	29.91339	5336.831
7084.633	6433.867	9.185608	151116.3	60.17134	4948.57	321.3227	359.2196	31.6569	5288.141
7094.8	6449.133	9.100562	153889.3	61.51257	5358.677	343.8328	402.1126	47.73877	5619.122
7141.233	6521.8	8.674039	155268.3	63.40443	5337.978	412.9964	405.5301	37.43116	5932.526
7170.3	6540.467	8.783919	156020.7	60.07794	5489.401	364.3778	412.7793	31.26531	5919.636
7142.333	6550.133	8.291408	159926.6	56.73706	5575.544	385.993	420.378	26.36477	6266.316
7193.8	6610.067	8.114395	160654	61.77281	5533.932	453.899	458.575	30.95605	7385.428
7228.3	6647	8.042002	161675.5	70.91419	5594.279	372.2969	456.9472	31.77718	7460.202

7208.633	6653.433	7.701876	161699.4	71.44168	5621.328	358.8147	457.9862	31.93668	7609.916
7208.7	6643.1	7.846075	163405.8	67.15532	5587.261	378.5894	456.8916	32.93008	7513.654
7208.067	6644.133	7.823642	165576.2	79.00436	5558.772	363.7183	460.9232	35.51197	7538.074
7231.667	6655.267	7.9705	164028.9	81.39391	5561.23	350.6528	460.0978	36.23401	7474.7
7244.133	6671.533	7.904327	163485.3	78.13777	5644.498	386.382	469.3588	31.99913	7188.821
7284.633	6697.067	8.065837	164578.8	68.43196	5889.5	340.0469	484.8202	34.25489	7414.804
7300.1	6735.067	7.740077	166113.3	56.81288	5971.809	322.2599	460.7381	30.53962	8047.761
7322.867	6766.067	7.60358	167082.6	58.47828	6175.543	312.9768	474.9723	32.22318	8120.999
7334.267	6782.167	7.527678	171382.4	65.2809	6408.129	356.6629	495.196	30.17414	7999.086
7335.167	6781.333	7.550385	170924.4	63.76794	6319.72	378.1004	490.2935	28.26305	8063.355
7330.167	6786.133	7.421841	171956.1	53.70279	6183.894	370.965	418.1644	25.77153	7446.594
7333.4	6790.767	7.399478	178008.1	64.27583	6126.501	343.8279	413.0395	27.78819	7834.139
7357.833	6817.7	7.340929	181340.1	58.71102	5990.264	377.7722	405.9053	32.88248	7914.606
7341.967	6833.433	6.926391	182577.8	59.84635	6163.342	376.6349	416.8908	29.5578	8081.061
7325.267	6821.267	6.880296	179865.6	56.09797	6337.186	325.5929	395.9393	30.61058	7356.867
7325	6841.5	6.600683	186935.6	68.50003	6515.331	388.611	410.5632	27.92224	7244.58
7360.2	6860.467	6.789671	191223.1	80.39303	6646.137	391.4572	418.0057	27.98748	7644.192
7359.167	6858.1	6.808742	193715.1	75.63297	6710.946	388.7388	421.4918	27.8797	7664.761
7399	6897.7	6.77524	198699.4	76.82214	6517.839	343.2562	420.0882	29.85847	7580.05
7415.767	6923.9	6.632715	197673.4	74.26945	6535.567	340.8904	421.3436	28.96455	7412.04
7402.367	6914.1	6.596089	200811.1	73.90101	6643.169	401.4548	431.2925	28.28909	7535.492
7430.1	6952.333	6.430151	206358.3	74.8154	6706.625	448.3986	437.2756	30.48789	7858.418
7479.9	7000.567	6.408285	212952.8	87.72727	6867.972	372.4805	450.0586	27.98065	7453.624
7479.2	7010.4	6.26805	216164.1	69.60554	6942.733	356.9417	454.0145	26.665	7270.923
7505.467	7068.5	5.821979	215961.5	84.95688	7014.278	361.0204	461.0373	26.60888	7480.758
7571.833	7131.7	5.812771	220191.9	74.2023	7051.017	354.3575	463.2896	25.94547	7533.895
7548.7	7120.467	5.672941	223121.8	87.2142	7031.274	371.6735	429.94	30.33189	7405.833
7604.633	7158.533	5.866161	225455	76.05517	7177.674	330.9771	442.1512	30.46329	7285.579
7630.667	7195.633	5.701118	227909.6	69.43148	7293.346	330.869	453.1041	29.03443	7436.6
7653.933	7216.7	5.712531	227903.2	82.26714	7356.107	363.2805	465.6047	29.77039	7430.389
7748.833	7294	5.869701	227291.4	62.61042	7443.859	383.8183	420.7116	29.03505	7011.787
7793.233	7355.667	5.6147	232453	68.30845	7832.874	368.6172	445.3039	28.12623	7120.97
7837.333	7399.5	5.586509	233333.2	78.86301	7982.221	329.3288	453.4949	27.58866	7052.449
7876.467	7450.8	5.404284	232481.8	66.15811	8150.247	316.6357	463.6896	27.65007	6961.995
7834.733	7361.133	6.044877	227850	68.8194	8153.936	341.958	410.8814	27.71827	6722.984
7411.667	6497.3	12.33686	187322.5	79.55766	8604.156	321.0788	441.9124	29.19302	5523.148
7841.333	7020.067	10.47356	235349.2	94.30138	8554.621	345.5504	438.7662	29.09468	6370.91
7984.967	7225.967	9.505362	238522.1	82.54155	8402.486	352.2128	462.44	29.59402	6582.957
7921.567	7213.133	8.943096	239890.3	101.398	8112.526	367.4934	412.7936	27.02972	7667.997
7939.5	7233.3	8.894767	229182.6	98.40192	8080.22	355.614	422.0826	28.95417	7775.229
8046.633	7432.967	7.626378	248205.9	102.7575	7693.021	317.9205	416.8876	30.59247	7475.357
8123.967	7597.733	6.477542	245840.8	95.70664	7747.471	298.4495	403.2725	31.37776	7225.491
8115.629	7551.293	6.953694	243932.4	97	7895.137	300.5382	406.0251	31.27503	7027.182
8110.142	7565.103	6.720461	243755.7	96	7966.247	306.8963	419.569	31.42068	6546.697
8123.701	7597.585	6.476313	243796.4	94.52639	8196.08	313.2311	424.2747	31.54747	6481.552
8144.43	7626.714	6.356682	244742.4	94.05279	8716.646	319.656	424.1365	31.69555	6524.543
8166.6	7656.75	6.243106	246436	93.2921	8778.988	321.721	424.9309	31.72341	6394.283
8187.764	7685.035	6.14	247996.9	92.53142	8807.062	325.7528	426.279	31.8137	6560.095
8209.089	7716.601	5.999295	249241.5	92.31294	8843.452	329.9018	427.8892	31.90741	6724.418
8230.239	7735.317	6.013461	250841.6	92.26114	8884.496	334.0632	429.58	32.03101	6823.423
8251.149	7756.738	5.992026	253093.6	92.20933	8880.289	337.8329	431.2364	32.0954	7004.875

8272.148	7779.354	5.957262	254988.1	92.15756	8914.271	342.019	432.8143	32.19018	7080.256
8293.062	7804.511	5.891073	256936.4	92.10574	8951.421	346.1732	434.4469	32.22271	7105.382
8313.992	7826.752	5.860478	258855.4	92.05395	8985.038	350.4114	436.0257	32.17591	7102.533
8335.011	7847.937	5.843715	260672.3	92.00215	9041.102	354.1169	437.1953	32.23911	7093.613
8355.659	7869.077	5.823379	262366.9	91.97994	9075.496	358.3902	438.7822	32.32488	7091.464
8376.206	7890.077	5.803693	264076.4	91.95773	9107.569	362.8098	440.2846	32.37544	7083.954
8396.639	7910.469	5.790057	265794	91.93552	9142.149	367.0753	441.8476	32.41975	7073.187
8416.995	7929.95	5.786457	267865	91.91331	9162.955	370.9585	443.1623	32.33399	7017.96
8437.111	7948.933	5.786078	269814.7	91.8911	9203.08	375.3016	444.8594	32.32337	7012.98
8457.247	7967.844	5.786792	271756.7	91.86889	9245.263	379.6464	446.5994	32.31256	7058.301
8477.402	7985.866	5.798189	273698.6	91.84668	9289.335	384.0888	448.3885	32.30165	7065.526

Real Gros	Real Gros	Real Gros	Real Gros	Real Gros	Real Gros	Real Gros	Real Gros	Real Gros	Real Gros
RQMANO	RQCONO	RQUTIO	RQGDO	RQTSCO	RQCULO	RQWRTO	RQFIRMO	RQCBCM	RQNCSO
19585.78	13290.48	2782.639	51253.83	5172.394	1140.97	8289.465		10876.24	15748.57
20071.19	12807.01	3011.23	50180.33	5485.625	1164.451	8365.646		10954.31	16173.87
21051.32	12995.75	3064.486	49386.09	5444.575	1171.983	8586.966		11087.84	16470.9
21412.28	12965.97	3024.017	46954.7	5353.569	1176.776	8503.7		11251.58	16770.1
22557.83	13559.6	3066.182	52824.36	5230.993	1194.106	8787.477		11350.5	16881.37
23532.72	13270	3131.394	51797.5	5203.894	1213.554	8859.08		11559.63	17115.76
24367.5	14011.92	3248.826	52517.53	5421.771	1225.679	8915.354		11601.03	17422.29
24500.68	13492.83	3212.495	51460.39	5423.693	1256.287	9012.181		11552.65	17818.14
24962.88	13294.95	3305.369	53582.2	5597.961	1266.713	9088.3		11604.67	18103.97
25833.39	13905.54	3300.428	55070.19	5789.46	1306.893	9232.935		11842.45	18395.91
25809.1	14052.81	3386.101	54435.96	5832.831	1339.614	9396.118		11861.3	18701.41
26997.18	14251.08	3542.01	56165.32	6098.408	1362.273	9565.693		11964.7	19094.05
28080.5	13921.52	3511.928	58733.04	6288.189	1375.238	9856.963		12096.84	19342.38
28302.62	13730.39	3563.728	58668.32	6292.117	1403.258	9807.435		12285.41	19637.24
28331.45	13790.04	3628.859	58503.13	6308.905	1429.402	10067.67		12498.8	19869.26
29060.35	14956.2	3773.836	60193	6365.913	1467.636	10199.97		12797.48	20209.57
30506.52	14788.61	3850.699	63572.7	6504.751	1487.84	10380.22		12963.02	20292.97
31646.69	14375.15	3860.868	63078.86	6574.785	1526.947	10586.15		13431.9	20489.86
32063.92	14548.73	4015.824	62809.41	6638.068	1559.288	10809.18		13624.51	20782.22
33688.7	14684.9	4172.105	63894.71	7044.712	1594.915	11182.79		13953.41	21292.74
34491.1	16118.15	4141.475	67554.18	6827.061	1643.63	11822.9		14064.68	21848.96
34153.94	15722.06	4328.913	66141.35	7076.048	1654.982	11629.74		14445.17	22247.03
34091.56	15911.7	4291.48	65059.22	7241.993	1708.258	12108.18		14532.34	22775
35964.71	16232.26	4413.672	68234.4	7574.805	1749.383	12337.57		14737.7	23082.19
35424.83	16217.97	4493.337	66779.25	7082.26	1819.513	12234.84		14843.05	24054.81
35665.36	15987.54	4616.072	67913.09	7505.601	1887.525	12362.3		15195.85	24772.81
36161.28	16163.78	4723.068	69723.18	7490.182	1936.256	12500.26		15117.27	25636.24
36352.36	16686.66	4774.593	71408.53	7519.511	1935.345	12598.88		14958.15	26253.04
35858.67	16858.44	4792.425	70224.55	7324.458	1961.125	12838.84		14846.22	27295.94
37748.5	18077.93	4872.28	73641.46	7662.192	2023.392	12871.53		14775.98	27718.88
38666.88	18022.33	5091.645	74906.89	7604.854	1999.217	13381.55		14684.84	28471.02
40108.77	17595.29	5194.471	75545.7	7839.525	2073.287	13439.15		15045.01	28955.31
41341.33	18029.32	5139.539	78890.53	8239.098	2077.508	13770.79		15338.74	29800.59
41504.58	17008.31	5248.004	77294.08	7952.392	2105.61	13699.2		15297.73	30362.45
41509.86	16801.87	5326.691	73895.97	8227.61	2111.444	13795.54		15607.16	30724.33
40658.17	16963.11	5560.641	74392.61	8644.749	2219.077	13994.11		15793.34	30931.79
40553.16	17864.3	5696.757	75647.21	8852.77	2255.054	14303.17		15832.51	32010.68
39797.94	18577.68	5843.218	76113	9231.057	2298.624	14518.57		15842.08	32499.76
39560.24	18288.06	5905.86	76009.59	9209.503	2329.206	15009.27		15907.07	33018.98
38386.55	18362.32	5980.101	74461.17	8781.719	2376.127	14916.56		16242.66	33402.35
37625.66	17293.63	6763.147	75418.48	8704.1	2369.432	14834.29		16559.59	33962.98
38363.7	17640.63	6806.214	75499.82	9069.983	2421.112	15320.56		16803.89	34386.17
39723.58	18089.89	6880.046	76835.83	9575.689	2477.783	15951.96		17111.96	34582.32
40275.22	18322.91	7034.674	76705.13	9283.194	2522.066	16505.42		17302.29	34936.27
40403.55	17848.7	7319.383	78659.23	9423.421	2579.784	16562.43		17026.07	35698.28
41965.64	18576.21	7564.7	80716.25	9709.271	2634.562	17172.81		17362.35	35545.54
42498.31	18253.29	7715.256	80108.04	9697.814	2713.742	17469.34		17652.57	36360.67
44578.41	17775.81	8069.091	84169.38	10224.84	2814.153	17747.23		17984.95	36868.92
47517.25	17917.73	7935.693	87717.4	10274.6	2778.358	17872.15		19550.63	37351.09

47609.53	18026.27	8148.572	88732.47	10028.2	2876.8	17904.65		20058.77	37476.03
47061.22	18391.96	8446.973	89057.44	9359.354	2940.711	17941.37		20575.94	37592.62
48234.18	18504.59	8455.384	91552.88	10425.28	3014.086	18409.22		20989.36	38078.6
50422.04	18607.32	8764.947	90413.09	10115.72	3074.014	19057.69		21471.93	38224.33
49579.52	18497.22	8919.056	89583.42	10374.72	3154.98	18737.86		21827.76	38746.49
49684.14	18226.97	9046.27	89696.25	10610.07	3266.54	18912.66		22122.34	39519.22
48605.32	18750.21	8972.887	89622.15	10496.54	3385.947	18608.31		22462.46	39877.55
44652.84	18434.73	8702.241	84255.33	10175.13	3547.929	18675.6		21852.41	40594.67
44889.27	18938.84	8875.513	84245.27	10870.32	3672.838	18974.77		22115.47	41002.53
46574.29	19771.78	8964.442	85637.17	10961.79	3787.526	19304.7		22589.16	41451.44
47040.75	21065.86	8849.517	86355.08	10367.02	3733.145	19999.91		23046.01	42022.73
46654.36	21103.64	8991.869	89635.67	10388.9	3892.504	19846.88		23183.43	41698.11
48803.04	22239.45	9352.269	92073.42	10541.57	4028.578	20511.39		23687.04	42025.71
49310.92	21053.09	9596.326	92250	10675.86	4115.796	20541.21		23997.44	42221.2
48593.02	20047.14	10112.04	91295.22	10556.32	4181.721	20672.62		23828.9	42560.3
50203.28	20766.83	9986.057	93558.1	10680.16	4181.147	20650.06		23718.66	42847.93
50265.26	22064.44	10036.62	94602.59	10794.76	4181.75	20168.29		23818.63	43014.6
49685.93	21905.3	10339.02	94659.16	10678.8	4271.716	20239.37		23999.56	43266.17
50435.91	22066.83	10534.8	95363.66	11002.22	4448.596	20299.59		24429.33	43527.51
50367.92	20683.03	10823.79	96087.18	10793.63	4458.325	20216.3		26102.2	43864.57
52088.19	20046.98	10478.24	95163.9	10974.23	4559.804	20697.88		26483.88	44090.16
52400.62	20113.87	10435.72	93412.19	11239.48	4678.632	20885.47		26859.49	44427.27
53866.27	20125.79	10690.23	95562.3	11758.61	4832.88	20921.37		27082.58	44547.56
56833.18	19350.14	10944.92	97652.86	12064.73	4754.086	21017.63		26928.26	44489.05
55806.66	18849.82	11261.2	95623.84	12003.41	4861.5	21421.77		26865.48	44554.5
55746.26	19263.53	11455.04	99160.75	12416.47	4945.593	21765.99		27332.95	44689.25
54215.02	20705.79	11202.38	100037.1	11739.57	5076.638	21489.65		28348.57	45076.82
52899.6	21502.03	11286.3	94695.48	11220.91	5041.86	21331.32		28198.24	44343.64
49983.81	19988.39	11140.47	91909.93	11245.28	5193.621	21297.7		28814.47	45880.01
50584.76	20907.1	11419.67	95198.62	11435.83	5329.908	21631.47		29161.37	46436.82
52861.03	21691.77	11655.4	97984.66	11415.23	5411.264	22183.93		30034.93	47317.55
54094.14	21578.75	10956.25	97932.8	11256.15	5602.251	22291.39	50601.02	31321.09	48384.8
55422.17	21740.81	11331.99	98703.18	11474.47	5798.479	22421.97	50497.43	31693.6	48767.55
54346.66	23170.41	11466.87	98345.14	11321.12	5837.763	21900.69	50076.5	31594.93	48499.6
51546.5	23283.25	11365.12	94703.23	11025.42	5863.718	21837.53	50256.13	31546.65	49023.69
51047.35	22301.01	11337.09	93351.12	11450.94	5877.068	22022.73	50329.57	32643.81	49064.73
49975.52	22385.1	10734.35	91886.3	11262.36	5798.501	21779.87	50040.14	32657.58	49002.22
48462.28	22858.8	10660.19	89565.79	10954.99	5774.094	21734.65	50446.75	32407.95	49154.57
45318.59	22199.68	10623.37	86516.9	9940.297	5741.26	21619.39	51241.32	31266.28	49874.04
46715.34	22006.11	10830.62	89803.2	11512.35	6009.94	22134.9	51403.62	32307.01	50415.45
48482.81	22341.28	11787.85	94193.99	11333.52	6137.31	22699.75	52270.96	32671.83	50612.97
51203.13	22290.55	11878.64	98165.62	12006.35	6172.307	23465.45	52614.84	32833.66	50649.18
54578.71	22394.44	11944.22	102862.5	12176.47	6205.57	23857.89	51908.13	32994.48	50492.46
57714.14	23136.88	11903.04	106374.9	13007.56	6298.214	24582.01	53572.94	32354.14	53365.99
59976.42	22730.61	11935.68	109564.8	12808.34	6411.36	25002.24	52462.77	34232.17	51630.85
61232.98	23936.06	11801.66	112858.5	12987.42	6488.131	25446.63	51730.07	35066.44	51113.82
61441.22	23889.57	11989.89	112567.5	13060.64	6611.723	26129.74	53513.11	36715.81	50764.13
63966.49	24120.68	11521.62	112916.5	13777.75	6744.075	26021.32	54038.67	36101.55	52226.15
64691.15	23614.91	11075.14	112850.2	13619.11	6759.136	26893.3	55456.7	35977.17	53345.28
66003.39	24935.67	11536.44	116087.8	13620.78	6844.417	27620.88	57777.93	36271.71	54470.68
66497.92	26528.11	12091.33	119532.5	14028.58	6955.985	30114.86	58137.49	37402.98	55178.54

66853.33	27850.29	12790.96	120092.6	14129.51	7303.047	29069.6	58571.76	37566.43	54254.12
66535.93	27345.02	12096.29	118750.5	14025.47	7268.245	29650.27	59924.7	39123.56	54914.36
65827.31	27856.25	11914.95	118168.8	14059.86	7264.405	30708.19	60929.84	39997.6	55096.28
66056.14	27677.43	12264.25	119226.9	14141.52	7214.341	31123.34	61641.1	40031.3	54252.91
65757.92	28634.94	12179.73	119181.7	14468.72	7481.181	31722.31	63551.01	41956.49	55902.48
65838.9	29595.72	12032.66	119594.5	15012.49	7692.193	32283.41	64076.7	41601.38	56511.89
67384.66	31334.05	12161.36	125136.3	15108.08	7961.617	32274.84	64758.08	42816.13	57351.57
69506.81	31894.2	12487.51	127974.2	15466.23	8157.33	32989.73	65700.17	43584.87	58640.36
71821.45	31688.68	12956.15	129950	16021.33	8361.164	33427.8	65112.56	46060.71	56504.06
72367.4	30998.3	13039.4	130330.3	15946.15	8512.635	34250.68	66440.96	47040.7	57057.88
72021.07	32210.52	13014.92	131270.2	15946.74	8695.733	34488.66	66480.95	46992.37	57446.63
72591.07	32409.2	13143.22	133154.9	15932.51	8851.562	35012.46	66708.36	46934.55	57694.67
74709.41	33628.39	12648.53	133642.3	16450.65	9384.846	36490.71	67815.15	47808.04	57955.87
74261.97	32966.85	12402.32	133056.7	16427.17	9489.114	36137.73	68354.28	48976.64	57943.47
73748.88	34365.42	11800.97	132348.8	16762.44	9631.694	36047.87	69174.63	49180.4	58166.51
74062.57	35137.98	11848.84	131418.5	16642.43	9744.445	35542.39	70087.77	49845.7	58472.79
73368.83	34839.37	11029.41	132446.7	16894.22	10134.82	36405.33	70224.75	49909.02	58816.82
73186.21	31852.9	11094.41	127389.9	17325.94	10218.19	35049.58	70425.73	49245.63	59266.25
71435.45	31413.71	11214.27	123717.1	17000.68	10286.08	34098.39	70982.07	49034.13	59461.3
68282.13	29220.94	12007.15	116987.2	16704.33	10270.08	33586.02	71536.66	48031.01	59866.7
64387.95	29213.56	12741.25	116522.9	15250.72	10047.17	32114.74	72701.57	46760.06	60346.71
65480.21	29515.31	12741.72	117476.8	15821.17	10180.51	33626.74	73725.43	46019.92	60743.71
66505.39	30089.76	12710.09	119081.9	15614.24	10275.92	33795.02	73323.49	45640.72	61814.81
65386.79	29336.02	12541.84	117398.8	15932.97	10373.2	33846.88	73608.45	44924.68	62337.23
63915.7	27393.32	12027.38	114759.2	16371.82	10277.95	33610.07	73940.26	44864.21	62072.62
65998.82	27394.51	12083.88	117396.3	16905.6	10402.43	33907.45	74250.5	44395.43	61323.48
65199.49	27423.15	11838.32	116830.6	16247.66	10394.85	34582.17	75023.17	43952.85	61504.19
66444.56	26691.79	12525.29	117874.5	16135.64	10286.72	34852.11	75047.66	44579.9	61310.29
70742.28	24804.9	12547.7	119763.6	16310.46	10016.82	34574.82	74402.15	44815.28	61830.67
70935.01	23947.58	12358.32	118897.3	16059.23	10152.15	34465.46	74745.34	45391.5	62181.16
71618.81	23259.36	12642.61	118508.2	16476.26	10184.77	35093.5	75314.1	45662.41	62164.83
71574.87	22844.77	12758.44	118247.7	16571.38	10142.82	35668.52	76513.35	45452.55	62146.28
73247.2	23720	13353.21	121099.1	16891.87	10240.7	35380.43	77981.65	46162.21	61485.4
77190.12	24014.02	12964.63	125244.7	17619.6	10391.66	36211.81	79229.72	47336.25	62602.16
79283.27	24250.59	12778.58	127738.6	17723.72	10506.63	36761.58	79906.67	48279.66	62875.23
82886.8	24241.13	12434.09	131385.4	18199.19	10647.04	37972.36	80381.37	48769.32	62666.09
83188.94	23348.28	13376.76	134260.9	18728.57	10939.92	38650.78	80572.6	49098.12	63423.98
80964.71	22818.51	13665.3	132403.7	18282.86	10977.54	38681.24	80904.92	50134.17	63274.81
81610.39	22593.74	14026.49	133372.2	18952.94	11023.02	38820.38	82058.34	50769.53	62458.92
81731.31	22914.9	13744.61	132892.9	18896.65	11181.64	38349.15	82494.58	51219.58	62342.51
81942	23145.5	13165.65	132139.5	18737.67	11126.33	39181.28	83396.54	51041.56	61364.02
83885.56	24212.79	12956.62	134636.7	19484.22	11136.5	39314.51	83593.39	50844.03	60710.38
84477.84	25308.23	12880.75	136478.5	19215.04	11162.44	39713.02	84681.09	51569.57	60862.43
83270.36	25829.76	13142.39	136105.7	19355.59	11151.43	40108.22	86667.91	52982.95	61138.53
80707.69	26174.27	13226.38	133329.4	16698.35	12156.83	38667.67	86202.16	57307.16	58821.81
82416.74	27115.43	13187.17	135049.4	18710.26	12543.95	39809.94	87430.58	58028.17	58496.28
84710.21	27733.15	12706.48	138943.7	19041.38	12784.86	41646.11	87990.87	59521.25	59294.79
85676.96	27571.55	12995.56	140027.1	18586.42	12838.76	43188.68	89136.4	59899.82	59123.12
87717.6	27266.22	12320.24	140807	18485.21	13033.14	42993.24	89536.58	62626.61	59568.62
87441.92	27346.4	12258.22	140779	18063.54	13142.6	44405.92	90701.16	63004.96	60187.06
87061.68	27450.83	12569.74	141258.1	17982.27	13607.14	44456.89	91013.38	64321.97	60046.5

92447.19	28360.15	12489.79	147561.9	19429.79	14080.72	45653.55	91764.48	65081.67	59798.63
92889.16	30163.49	11725.62	149175.3	19365.17	15398.99	46594.19	93308.5	68627.75	60349.3
94256.48	30986.42	11831.63	151355.1	19675.19	15650.5	46540.43	94868.36	70612.77	61065.29
97659.28	31560.67	12314.99	155356.8	20178.39	15903.21	47358.4	96513.12	71823.54	61568.44
99033.09	32634.22	11954.16	157859.3	20085.66	16112.9	48677.38	98858.41	73915.94	62001.78
102137.2	33017.26	11693.84	162839.3	20230.75	16924.54	49998.21	101215.3	75545.84	61717.3
102935.8	32113.12	11691.02	162506.4	20295.25	17349.41	51030.95	101034.2	77038.04	62238.58
104438.9	32500.36	11776.17	164521.8	20809.25	17646.85	51945.83	102401.3	79020.86	63398.26
103626.5	32666.87	12118.57	163354.1	20802.74	17891.19	51841.41	103081.7	79584.46	63077.45
100296.6	34717.06	11510.87	159885.3	21131.69	18450.52	52182.17	105747.2	79901.22	63556.88
100194.5	34585.73	11581.61	159938.5	21265.57	18779.96	52445.62	107187.8	79451.17	63386.25
97750.76	35459.49	11358.62	159037.4	20775.52	19184.37	53089.63	108526.8	79366.59	62994.32
97060.1	36579.72	11690.5	159710.4	20778.42	19752.75	52984.97	110291.1	79945.02	63346.95
102498.5	35666.49	11608.47	162372.8	21040.76	19694.53	54507.41	110521.3	81047.89	64431.96
103032.2	37082.53	12229.67	166989.4	20547.28	19938.38	55204.89	110899.8	81413.42	64301.33
103218.1	37653.33	12359.28	167600.3	20915.14	20295.13	55625.39	111327.8	81932.33	64824.85
100458.4	38316.06	12180.18	164976.7	20475.62	20636.76	56550.3	112154.8	83549.96	66178.26
102674.5	37717.54	12702.33	167908.1	21233.69	20063.11	57279.95	111673.9	81847.44	65851.59
101630.8	38134.95	12347.56	165664.8	19907.66	19922.47	57893.28	112408.8	81757.28	66010.43
100127.8	37851.4	12154.8	163499.3	19769.39	20015.09	57387.73	112829.9	81971.52	66908.18
103264.8	38952.51	12008.51	168103	20594.46	20198.53	58375.84	113233.7	82211.36	67507.8
101587	37389.05	12170.76	165588.4	20391.07	21456.03	59058.91	114975.4	83187.87	67985.32
102027.7	37688.03	11827.92	166030.6	21063.3	21974.64	59452.98	116371.4	84334.96	68876.71
103333.7	39246.12	12538.46	169355.4	21328.4	22294.48	59442.91	116752.5	84817.12	69638.55
103633.9	39429.2	13358.86	170404.4	21536.43	22468.05	60170	118045.8	84224.85	69239.82
104723.4	40199.19	12739.52	172604.3	21986.46	22587.41	62072.6	119332.4	84900.11	70500.71
103938.7	39910.36	13125	171826.7	22055.05	22746.53	62093.12	120737.1	84691.68	71603.8
103894.8	39495.5	13116.11	171440.5	22738.54	23031.33	62595.44	121952	86706.54	71118.86
102467.5	39058.55	12648.18	168680.2	22378.76	23245.53	63960.84	123512.9	87678.88	72233.82
104023.8	39806.25	12452.62	170199.7	22659.59	23434.94	65243.46	123570.7	88318.11	73683.35
101862.2	39712.91	12627.37	168274.7	22869.97	23566.45	65284.37	124988.6	88978.94	72905.25
99076.59	40085.03	12687.69	165588.7	22245.2	23762.55	65421.55	127142.3	87025.35	73140.24
97941.79	40905.81	12985.13	166054.4	22842.84	23655.66	65687.42	128477.6	87686.4	74024.36
96902.21	40173.71	12167.81	162695.7	22151.95	22997.79	66652.42	128604.7	88795.89	73056.63
95793.93	41030.66	12728.1	163154.4	22711.48	23012.21	67568.11	129229	89569.69	74807.76
94588.92	41918.71	12546.66	162216.9	23022.89	23053.36	67100.92	130574.5	91250.01	76792.08
92268.14	42765.71	13279.03	161142.6	22593.69	23166.64	67625.36	130899.9	91458	78286.74
89058.44	41616.23	12843.17	157237.2	23390.17	23231.65	67646.02	130851.9	90227.16	77951.45
88374.16	40901.36	14171.55	157389.2	23279.46	23226.29	67645.9	130489.1	90707.51	78223.83
87024.29	39471.56	14437.13	155359.5	23627.95	23354.05	67226.83	130507.1	91270.63	78309.33
83153.51	37233.66	13026.15	147727.4	23627.61	23170.42	64619.25	128979.1	91036.69	78067.79
72619.47	37016.17	13162.48	134407.1	20899.98	23305.6	61790.87	129936.3	89784.52	79550.36
69899.62	37936.04	13426.01	132002.6	22147.74	23033.27	62744.82	131308.6	87922.78	79284.87
72625.57	39711.58	13499.18	136667.7	23021.58	22886.06	64950.63	131417	88027.05	79677.74
73899.74	42934.21	13029.94	140557.8	22604.7	23059.47	66605.69	132469.7	87959.65	80397.43
75998.91	42407.53	12329.86	142319.5	22933.4	23346.02	67416.9	131983.2	87576.32	81038.23
77542.9	41873.7	12639.04	143991.6	23037.32	23441.04	67438.28	132947.1	88275.31	81145.21
78075.26	41001.67	13961.09	145063.6	23265.58	23683.64	67520.68	133680.6	88708.72	81250.53
77405.74	39717.1	13206.41	142814.9	23174.1	23953.3	68781.34	136046.7	88977.66	81317.63
79101.05	39961.27	13130.1	146052.8	24014.07	23835.99	70660.66	137072.5	88677.82	81369.08
77967.92	40922.61	13547.06	146350.7	23347.79	23836.01	69948.25	136789.3	89456.7	82356.08

79927.75	42576.14	13331.79	149913.2	24252.57	23814.3	70581.19	138822.2	89533.92	81891.8
80984.88	43435.18	12919.85	151306.8	24010.37	23842.1	71030.29	139234	91187.96	82692.64
81494.55	42610.23	12647.08	150709.3	23985.86	23943.65	72004.05	140619.8	91170.45	83123.4
82599.97	42842.47	13005.18	152330.9	24210.55	23997.77	71528.09	140651.8	91717.64	82530.89
81424.61	42676.37	12375.76	150198.2	23712.74	24158.11	71592	141539.3	92356.87	83254.78
78979.28	43358.12	12819.98	149321.2	23390.86	23893.67	72112.25	141813.1	91030.64	84024.14
79803.11	43668.93	12530.23	150799.7	24061.19	23582.42	73206.91	143594.6	91488.78	83154.36
80144.98	43541.36	12684.73	151451.9	24289.12	23612.33	74407.47	145385.3	92324.1	83169.89
80356.87	43026.4	12655.17	151291.9	24088.58	23709.74	75744.81	146026	93322.72	83450.46
81102.64	42443.31	12836.67	151626.5	24801.12	23947.11	76424.4	146513.6	94980.4	82901.29
81026.21	42608.11	13003.92	151075.5	25554.15	24600.59	75266.21	146258.8	95387.57	83266.02
83001.91	43846.96	13242.96	154828.8	26115.23	24796.3	75458.8	147173.4	97297.73	84256.23
83597.4	44706.03	13174.13	156190.6	25938.92	25106.11	76835.99	149428.5	98646.57	85416.83
83467.27	45371.3	13832.99	157730.6	26052.9	25278.61	76251.8	151100.1	98838.92	84908.11
82859.29	46408.95	13997.51	157648.2	26126.69	25227.32	74201.38	153529.3	100652.7	85689.75
83273.31	47840.1	13390.58	159026.7	26682.05	25324.01	76088.68	154140.8	100485.8	85329.75
85427.4	48271.04	12643.05	161404	27445.39	25549.57	76213.52	155845.6	100723.8	85487.06
86006.81	48606.3	12318.06	162079.5	27139.07	25825.9	77709.21	155691.9	100764.1	85144.25
86766.55	48666.92	13495.78	163774.4	27607.67	26214.5	78322.44	157825.4	103255.1	86488.9
84560.56	48082.67	13092.78	160429.8	26662.56	26397.9	77582.46	158124.3	102726.1	87076.19
85450.02	47072.66	13904.27	161421.4	28044.4	26826.08	78700.01	159601.7	103479.7	86664.15
84598.47	48669.35	13338.77	162042.4	27832.16	27000.31	78959.08	160462.2	103802.7	87293.56
86685.48	49911.96	13108.19	164770.6	29079.08	27630.89	80426.84	164204.6	104708.9	87462.29
86678.97	48892.05	13200.97	163716.8	28602.5	27843.55	80911.81	167019.9	105697.1	87781.87
83874.51	49261.01	13059.79	161434	28218.13	28013.42	81140.08	167119.3	106103.1	88313.99
85389.44	49708.58	13377.45	163797.4	29079.49	28226.94	82790.88	168435.4	106356.5	88179.85
87878.05	52009.17	13434.51	168467.9	29424.31	28887.34	82760.14	168387.9	109461.5	89257.15
88295.33	52940.17	13363.87	169742.4	28724.87	29214.71	83425.68	168448.7	110881.2	90227.55
89188.48	53708.89	13856.24	172171	29190.63	29671.49	84141.41	169682.9	110251.1	92146.35
88928.53	53460.17	13799.77	171708.4	29074.99	30040.86	84956.37	171394.5	111153.4	92813.34
88769.26	52276.67	13751.83	169853	29305.83	30701.19	84406.45	171106	112312.6	92506.08
88655.84	51925.79	13811.75	169955.2	29530.79	31062.59	84939.33	172602.9	113613.6	92835.87
87385.86	53159.66	13748.5	169905.1	29281.51	31461.67	86059.23	174695.8	115985	93378.36
86245.43	52844.28	13649.12	168427.1	29178.28	31937.35	86166.99	176504.2	117678.8	94256.1
83386.24	54955.19	13450.77	167229.8	26065.25	31536.19	86748.93	176050.3	110013.6	92447.41
66352.35	49060.04	13220.16	143363.5	18227.94	29490.04	70217.75	174270.1	87226.58	79318.68
81338.99	55160.79	13213.4	165234.8	22546.1	30576.71	87275.5	180224	98290.98	88636.87
82408.82	56001.58	13460.07	167479.9	22003.91	30955.46	88624.62	181645.2	102160	89917.44
81801.39	59142.86	12959.07	170279.7	22421.99	31169.29	87802.85	183238.6	102549.2	91981.11
80442.63	58749.83	13090.33	168733.4	22152.92	31384.66	83067.49	181405.9	102179.5	92709.97
80209.4	55847.68	13053.35	164832.7	22883.97	31910.21	86321.47	182454.8	107997.3	94341.01
81275.55	57173.64	12993.95	166937.7	23702.07	32111.52	85923.18	181361.6	112279.5	94742.13
82436.34	57156.96	12993.28	168035.2	24742.53	32216.78	85904.88	182545.5	114369.8	95581.21
84595.48	57964.24	13176.35	170795.4	26273.78	32510.17	86891.79	184096.9	116701.9	96528.71
86738.17	58635.01	13262.94	173871.3	27456.07	32648.89	87511.89	185022.5	118115.5	97286.14
88137.04	58961.76	13413.61	176317.6	28026.56	32870.5	88478.9	186724.9	119439.6	97814.66
89598.04	59258.98	13578.91	178176.1	28420.24	32993.39	89407.83	188434.8	120459.3	98123.75
90690.07	59730.46	13684.15	180044.2	28663.42	33153.22	90147.49	190114	121557.7	98424.87
91278.68	59998.35	13720.73	181143.8	28767.51	33205.32	90358.44	190909.8	121949.6	98751.22
91653.09	60058.29	13750.03	181753.5	28895.58	33280.21	90532.33	191509.2	122300.6	99085.61
91876.91	59941.79	13760.5	182054	29037.93	33364.78	90774.58	191983.9	122596.2	99475.92

92446.81	60013.16	13796.74	182846.8	29189.68	33479.62	91050.05	192834.9	123102.6	99869.08
92727.23	59981.61	13812.91	183179.9	29261.61	33552.71	91225.32	193473.5	123357.9	100263.7
92980.16	59982.32	13828.54	183485.7	29334.23	33629.29	91422.79	194219.3	123670.7	100663.2
93419.77	60248.64	13869.99	184285.2	29405.82	33699.83	91763.32	195440.1	124198.5	101067.8
93854.36	60539.91	13902.99	185082.2	29510.3	33772.97	92049.94	196652.6	124714.3	101477.6
94215.71	60812.87	13931.89	185776	29615.18	33838.35	92328.04	197855.2	125183.6	101894
94638.39	61086.82	13961.77	186532.2	29730.23	33904.29	92612.76	199086.9	125662.5	102316.6
95068.28	61365.36	13988.77	187238.3	29864.46	34002.92	93034.91	200058.7	126184	102696.6
95508.5	61739.79	14010.11	188115.4	30009.05	34104.59	93410.7	201089.4	126715.6	103062.8
95924.99	62071.35	14023.89	188970.9	30151.83	34199.52	93765.93	202100.2	127230.8	103448.7
96330.57	62361.8	14033.8	189734.3	30308.5	34298.69	94122.17	203154.6	127778.2	103828.3

Real Gros	Real Gros	Employme	Employme	Employme	Employme	Employme	Employme	Employme	Employme
RQPADO	RQSRO	RLEMCRC	RLEMOPF	RLEMUTI	RLEMMAI	RLEMCOI	RLEMWR	RLEMTSC	RLEMIFIO
15704.92	72328.82								
15826.05	73776.1								
15897.98	74524.29								
16206.77	74910.94								
16516.27	76208.93								
16601.67	77175.42								
16671.44	77872.2								
16728.29	78192								
16644.41	79517.49								
16882.81	80996.32								
16931.78	81751.06								
17168.31	82740.35								
17266.58	84657.02								
17444.93	85870.21								
17376.75	86796.2								
17512.34	87418.17								
17414.84	89315.32								
17325.75	90785.66								
17468.78	91884.71								
17564.02	93351.82								
18295.52	95992.11								
17996.05	97391.95								
18387.01	99311.61								
18287.21	99926.5								
18154.32	99632.73								
18646.73	102082.7								
19010.85	103906.3								
18955.82	104529.9								
19379.35	108021.6								
19438.7	110004.4								
19485.83	111530.5								
19524.05	112262.7								
19512.97	113117								
19652.44	114361.5								
19715.11	115846.3								
19983.9	117202.6								
19799.04	118992.8								
19866.13	120600.8								
20097.04	122147.5								
20239.33	122438								
20604.53	124768.2								
20972.28	126968.4								
21183.43	129214.3								
21653.99	130646.7								
22157.47	134113.9								
21565.75	134943.9								
22457.79	137043.1								
22248.54	138773.7								
22669.32	143132.8								

23208.02	144564.4									
22768.31	144610.8									
22968.12	147552.4									
23100.19	149795.4									
24046.76	151623.8									
24388.02	153586.1									
24874.85	154557.1									
24958.35	155803.5									
25298.79	158056.3									
25547.15	159792.3									
25336.4	160827.5									
25769.69	161522.4	111.1625	56.78779	42.07623	856.0478	233.7064	623.1076	176.4291	215.9585	
25758.61	163438.7	108.6686	61.76466	41.46659	862.6309	253.0447	604.2741	177.1958	225.0381	
26053.86	164911.5	109.854	64.5902	41.18626	881.9526	250.3006	581.6834	180.5845	227.2331	
26240.08	165979.2	117.5585	63.0084	41.88504	869.6136	239.6952	568.0655	183.5106	233.616	
26011.42	167919.5	114.2333	63.27717	42.45362	878.6928	236.6032	579.8641	178.5196	234.3289	
26033.5	168556.9	119.6252	62.59765	43.36797	870.3949	236.6138	581.0816	183.8997	231.4501	
26151.94	169465.6	118.3086	60.80881	44.83032	872.6697	233.5816	590.103	180.1314	237.5916	
26723.69	171799	113.566	63.03614	45.94615	886.1022	238.5301	592.6761	179.9335	239.0651	
26510.24	173763.3	112.3667	60.37769	47.41085	891.7202	238.9194	597.0189	190.2386	241.1123	
26517.11	175619.7	111.9166	55.09657	47.14373	910.6825	230.5901	613.6729	184.8285	243.2951	
26291.96	176959.4	117.7667	55.75353	46.5474	911.674	223.6508	620.0083	191.1387	248.6471	
26039.11	178330.4	121.5275	56.17909	47.04292	934.7009	227.3349	627.0406	192.0565	257.8939	
26181.55	180575.1	129.5372	50.96365	47.22275	958.1675	227.6564	630.9091	191.8421	262.1907	
26031.75	181387.1	133.8203	50.38824	46.25498	971.1607	232.9171	641.6678	189.643	262.7441	
25787.04	183255.1	128.6498	52.35825	46.28088	983.3493	239.8289	647.6526	189.8001	261.528	
25457.22	183474.5	130.7854	54.07099	44.37851	994.5494	241.7944	655.9061	187.7789	263.858	
25954.1	183093.7	129.4745	58.41404	44.93333	994.6935	232.0872	649.8582	191.7906	263.8391	
26100.6	185906.6	125.9186	63.80048	48.78337	989.3123	214.777	639.2588	197.8455	271.0376	
25961.46	187281.7	125.1551	69.17645	51.30878	989.708	220.0347	618.7315	202.1786	274.8255	
25910.22	189040.6	124.0145	70.74118	50.73245	995.8906	216.0921	615.5065	201.2174	283.2324	
24945.96	191159.5	123.9325	70.99258	52.31736	999.7521	229.3952	616.7059	194.8598	282.757	
25036.65	192425.5	127.5641	72.63476	52.21587	1011.209	234.0957	608.0537	201.2212	281.7152	
25181.72	191169	128.4977	68.35494	50.63205	1020.224	235.8561	626.6246	200.6061	280.9626	
25280.24	191583	126.9737	68.18754	49.80326	1007.057	234.2003	647.4456	208.1991	272.6306	
25478.37	193482.3	122.9334	65.2365	48.07688	974.9968	225.0543	639.903	205.5541	283.5676	
25686.65	192853.4	125.0663	53.88806	48.40775	951.365	218.6905	641.7836	200.5885	287.1428	
25753.31	192852.5	123.7518	43.29927	47.35918	921.6846	207.2804	641.9928	194.0557	284.5016	
25877.3	192197.5	128.7766	39.81447	47.76966	889.1532	203.9459	635.4865	193.6548	280.6753	
26038.5	196486.6	129.9283	44.52286	44.98726	894.0132	207.867	642.353	192.3097	277.4225	
26145.32	198502.3	128.9604	51.31988	44.15823	910.4167	207.21	648.4848	193.6698	276.9066	
26383.95	200718.8	133.901	52.86075	43.32668	941.7818	216.468	658.9905	194.7341	284.2498	
26458.2	200686.8	130.4969	52.69021	44.06925	949.2962	212.6323	657.5528	197.4557	299.0348	
26117.9	205835.6	123.6278	55.17341	45.1973	967.4806	211.6465	667.2911	202.5931	307.2506	
26378.69	205469.4	119.1828	56.85413	44.6347	972.251	225.7917	674.8834	202.2316	311.043	
26476.65	205845.8	108.8415	58.14294	45.20139	982.353	230.3297	684.8578	206.6314	320.2209	
26651.4	209914.8	104.4485	58.24605	43.4933	985.1303	230.388	695.1735	205.5706	311.9015	
26520.38	212099.8	105.6919	54.0327	44.09809	990.4051	238.7174	727.4649	215.0184	299.8285	
26675.38	215345.1	108.997	52.6876	43.82531	997.536	247.9492	733.866	219.0962	297.7121	
26842.52	219994.9	113.5749	54.41759	44.86711	1009.858	249.5709	732.5521	218.9398	299.952	
27156.99	225436	113.309	56.94082	45.84694	1024.251	254.2277	746.6018	222.9827	306.3333	

27328.25	224858.6	115.8333	57.17067	47.09212	1041.457	259.2559	743.059	222.7023	311.7548
27383.61	228866.1	113.6901	56.68532	49.00429	1045.359	265.1399	746.9786	222.9986	309.3865
27348.29	231934.5	111.7253	57.29312	48.98688	1025.509	265.1416	747.5415	223.9808	309.381
27565.18	232491.4	112.1158	59.41857	47.37177	1020.927	284.6141	728.7163	219.1327	323.1229
27201.82	238777.2	114.0548	55.28968	47.44094	1017.658	290.4864	729.1416	216.2914	328.8156
27328.12	240967.2	116.7249	56.36525	47.15288	1026.536	297.4414	748.3308	220.6713	337.3329
27602.24	244284.9	116.1751	61.44069	47.42182	1035.864	299.2006	763.9974	225.9117	342.8262
27837.19	248723	111.5362	58.50649	49.20356	1047.668	304.4073	783.1795	223.4709	342.0455
27886.08	249701.5	110.9086	59.04695	50.91626	1051.099	302.6151	799.5906	221.7131	349.463
28339.9	253855.6	109.9566	60.06439	51.93872	1056.488	296.768	803.1679	223.0632	360.8585
28579.89	254882.6	109.1852	63.00457	54.24417	1052.083	301.2594	805.0491	230.9499	357.6066
28714.89	256083	112.9496	62.25362	57.83026	1048.982	304.4366	800.7806	238.0547	356.1298
29095.74	261189.4	112.1168	64.06531	58.60278	1056.762	319.2833	804.9559	241.8213	359.45
29150.3	262645.8	110.6583	60.95205	61.65348	1042.094	321.8866	794.2177	238.4969	366.3892
29405.26	264508.8	114.8921	57.12537	64.28677	1048.309	327.8796	774.4548	233.9022	376.8635
29460.74	265915.7	115.5892	60.34155	63.80591	1030.994	327.3876	772.9106	231.4572	393.861
29476.11	267757.9	114.978	60.34733	62.07887	1021.976	332.0558	776.3736	231.6141	403.4429
29655.16	267093.5	110.1916	57.5562	62.01474	1010.823	331.2938	772.5716	238.0233	395.1366
29932.55	266708.2	108.4096	55.43951	62.53333	988.1646	326.7586	778.8831	235.5393	391.709
30284.44	266200	113.2781	53.46667	64.46667	953.1933	310.4412	775.5993	225.2757	392.35
30782.3	263575.5	114.5581	51.76968	64.63333	914.9312	289.9193	763.5993	224.8658	390.3016
31311.98	266945.1	114.1245	52.02272	63.11453	910.8994	289.4907	758.5712	223.0146	386.642
31111.14	267088.6	111.976	51.38018	61.9107	902.1414	289.7464	755.2034	216.6155	382.5748
31461.93	267983.5	113.2094	52.1237	63.46338	889.3349	277.8964	755.8661	219.4354	378.0253
31635.64	268446.1	113.7542	51.77931	63.56239	870.0044	266.294	755.1021	215.282	367.842
31651.44	268508.9	112.4139	49.57757	65.13148	858.921	266.7416	759.3106	208.5972	370.504
31546.79	268917.6	109.3417	49.24897	64.68522	850.3252	269.4017	768.8109	206.2027	366.2375
31736.74	269604	109.876	45.97339	61.00452	841.2408	277.8522	767.196	206.4667	369.8813
31834.45	269534.8	112.2999	46.42633	60.41012	835.1678	280.9026	767.9881	211.2866	376.2137
31747.7	270477.8	115.6465	44.38437	58.46812	814.2055	260.7417	766.437	213.2285	371.0725
31466.21	272072.2	119.0944	42.15608	55.97447	811.8961	253.833	776.8709	219.4951	363.1226
31410.08	273591.2	113.1993	44.8531	54.03333	819.8448	251.2057	772.5769	226.8786	351.3899
32024.85	276178	110.0598	42.54403	51.33423	823.3698	256.0706	772.7229	230.2511	353.5843
32111.16	281437.3	109.0248	45.73387	49.05184	838.9685	267.3307	766.5	227.2894	350.3964
32323.54	284271	112.0847	45.25425	49.60438	844.8558	272.1985	756.6133	233.6654	354.9587
32369.7	286861.6	115.1069	43.21656	49.19436	853.1527	278.5847	751.8224	236.9455	354.0695
32627.55	289927.5	111.0126	42.10946	49.00708	868.4416	271.7433	753.2263	241.0329	354.7
32650.83	290780.3	107.7239	44.76016	50.79479	877.5617	267.274	751.9217	242.471	360.1722
32242.73	292179.9	100.4382	47.61771	49.63383	878.1513	267.4265	760.6942	241.3451	364.6861
31888.93	292226.4	97.67729	46.07886	49.38662	894.3713	267.8643	764.6122	243.2486	360.7688
31112.32	292306.1	100.6028	46.75734	50.13241	891.2594	264.4814	775.6197	244.1857	367.1527
30573.88	292007	99.98144	45.91745	49.14381	898.0731	256.1318	779.0398	246.3128	367.6384
31682.71	295196.6	101.8786	45.9611	50.64836	917.358	263.4491	774.8406	241.6081	370.4332
31354.49	299021.6	103.8727	45.71787	50.8749	919.3158	262.6493	779.2124	238.3684	375.9304
31163.67	299946.1	100.7475	43.66302	51.65851	920.6286	272.5675	782.0512	234.6634	378.014
31319.96	305248.7	97.21363	40.47006	49.13852	930.8669	281.4258	797.3341	238.1548	374.7561
31622.79	310791.8	101.6095	38.55096	47.20322	950.4801	284.4201	809.9986	249.727	367.0717
32039.18	313691.8	101.8659	38.93333	46.3364	959.7947	284.6594	800.5499	253.1799	365.5148
31257.78	316578.2	101.1584	37.63431	45.36554	977.8291	286.4582	794.0331	258.5507	368.1221
31764.81	320336.1	101.9597	38.78699	47.66255	983.3862	281.8717	796.9796	259.1757	368.7897
31683.43	322172.3	104.6847	36.59545	50.25391	987.6042	284.763	800.7259	258.4558	369.6375

32042.77	326898.6	105.8192	36.84502	50.5521	994.0269	291.8923	821.254	258.8543	377.3074
32246.45	335069	112.7909	37.61826	49.45819	1022.329	283.5919	834.5259	255.1409	380.9704
32678.56	340257	114.5865	38.31475	49.54222	1031.331	292.9378	838.164	258.9863	376.3878
32453.56	344953.1	113.5704	37.08364	49.07676	1041.792	301.8481	846.4564	257.9697	380.9555
32969.83	351759.6	108.6822	34.97105	48.22433	1046.159	309.5313	847.9589	263.0857	381.0591
33291.26	358297.9	108.0878	33.85495	49.17563	1052.495	324.4138	856.6956	278.0818	377.0745
33796.88	362151.3	98.45232	32.43544	45.11692	1074.773	319.0757	872.065	272.6771	374.8379
34517.13	369095.4	92.10688	33.83269	43.1168	1071.586	319.3229	887.0127	271.2175	374.5329
33830.33	369464.5	91.65087	35.07526	46.20255	1088.991	318.972	901.9689	272.8913	387.3774
33552.48	374239.8	92.09917	33.50531	48.41864	1079.074	329.9063	912.1215	272.8692	386.822
34243.41	376475.8	86.26359	36.63777	49.28437	1065.523	342.2218	925.3663	280.2239	391.2707
35294.96	378946.3	80.03359	36.24188	51.09235	1060.271	336.4571	938.7116	284.0244	390.4802
35887.15	382697.6	76.32515	35.84969	50.84703	1054.648	338.0323	931.5554	278.9749	389.9377
35451.1	386488.5	70.93333	34.6624	50.91343	1070.819	341.6198	918.928	267.7907	388.796
35910.97	388008.7	72.24099	35.63333	53.26007	1083.384	339.9333	920.605	277.9	394.6853
36398.56	391110.2	78.49207	35.27547	53.15339	1107.867	342.6809	927.7667	283.9419	397.1293
36920.17	396254.2	79.51552	33.36249	51.22033	1115.167	353.1069	931.5924	287.7751	394.4376
38017.38	395810.2	80.60794	34.51256	51.03333	1108.435	360.8667	942.8409	290.0962	403.9815
37612.66	395355.9	80.57484	30.72961	52.22002	1096.948	366.2606	937.5461	287.2	409.8033
36877.1	395602.1	80.5168	28.96322	53.54716	1089.8	380.3863	933.0667	288.9456	413.07
36922.06	398885.7	81.83333	28.46667	58.49172	1087.233	380.2529	946.1207	295.721	417.3849
38136.33	405046.1	80.13333	31.97046	59.2	1105.482	364.7465	960.4872	304.2708	421.2
38354.92	410282.2	78.66667	34.35854	59.38947	1111.3	367.4537	948.4412	305.0917	423.3333
38914.11	413040.4	74.50965	34.8121	58.02924	1108.648	376.187	956.4412	300.1667	432.8483
39360.65	414897.2	75.85072	34.23333	52.46667	1098.183	380.3667	983.3593	292.542	439.585
38686.25	420103.8	81.53339	34.67437	47.53333	1085.669	386.1945	988.7409	292.3542	444.6635
39650.22	423615.6	92.87568	33.76667	48.61298	1072.167	399.5131	995.0057	291.3211	447.5
40087.58	428268.9	99.2	36.31536	47.82042	1056.233	396.8258	999.5926	293.503	450.2181
40237.16	433286.9	98.39047	35.18155	48.45347	1037.867	408.4408	984.2586	294.2755	449.3542
41412.84	438473	95.74809	32.46667	47.94041	1006.416	409.4051	987.1333	290.1455	456.7181
41326.89	440071	95.64826	38.1155	45.56667	1013.349	402.4667	1023.407	288.4667	481.1023
42136.82	441024.9	96.84281	41.00405	47.7	997.3682	398.3875	1022.926	300.5541	475.5028
42408.25	444934.7	98.48638	44.02911	51.88611	976.8156	407.6417	1022.867	303.4208	473.1484
42226.05	444689.9	98.95661	37.7297	54.75247	961.5359	411.8171	1017.839	304.2667	469.655
42606.17	449711.2	94.70973	36.81417	56.45734	935.9333	405.4759	1025.636	308.175	465.0037
42309.88	454312.6	93.65731	33.32678	56.74672	944.6333	403.3	1020.1	298.5969	464.0667
43842.7	458083.6	87.4	32.77309	55.81314	926.9867	400.5883	1011.067	297.0786	467.2891
44086.8	457354.8	83.7	35.9	58.85294	912.7022	422.7783	1009.833	314.0544	469.5854
44955.81	458497.4	83	35.70354	59.62777	906.9	433.2784	1008.275	314.3209	465.8959
45377.42	459642.8	81.33361	35.77375	62.15247	882.5	442.5667	1007.508	325.1587	469.0706
45698.78	455169.4	86.69117	35.00675	58.96061	856.4601	437.145	1019.959	328.4333	468.0482
46361.58	451472.7	83.85938	32.10329	58.51333	795.7667	425.6313	1011.654	316.5126	474.7069
46831.49	453116.6	82.1164	30.80332	52.68763	763.8854	411.0117	990.8	313.8	476.2032
47470.09	457291.7	80.32533	33.9297	53.47917	765.9147	409.1564	989.3541	312.3283	489.5849
47796.44	460733.4	77.4501	34.12964	55.84602	782.3298	417.4435	990.0749	312	487.2484
48543.28	462732.7	77.97516	35.06302	54.62057	771.563	422.2768	989.0041	303.4	478.8519
48459.13	464638.3	79.89109	37.5	53.77522	768.2149	440.6764	1007.154	305.5793	479.2333
48487.7	466492	78.6	37.2	54.95386	762.4481	437.2235	1014.854	304.825	479.585
48829.09	470973.4	80.44226	38.43333	53.18706	760.9	444.657	1003.367	311.1919	491.821
48110.58	473704.2	88.47618	41.02924	52.31267	775.6037	438.8102	1013.654	322.3128	491.5
49575.57	475273.1	87.67143	40.06276	52.96232	772.8186	439.1437	999.5459	322.8948	507.2178

50308.61	479167.6	91.04673	37.73333	51.7074	772.9483	448.6	1000.184	325.3081	499.6179
50028.85	481989.1	92.13673	35.8	51.21445	765.8517	451.7012	992.7209	318.7543	487.2306
48877.72	483727.2	91.26945	35.80331	50.56667	771.4	456.2749	989.9875	307.1879	490.6489
48736.88	483375.9	91.39003	36.06015	51.64003	779.1	459.8101	987.3458	302.1333	488.2179
48707.9	485324	89.3	33.84251	51.44057	786.3889	453.1333	983.5333	313.2879	492.8
48534.7	484801.7	85.02405	33.60306	51.96667	774.2186	447.6113	1003.396	323.3	494.1489
47553.46	486569.9	80.58393	34.3	49.82028	767.6962	448.5112	993.4418	331.8459	501.0686
47822.6	490938.4	81.37396	35.3699	51.78668	762.2296	454.7667	997.9209	338.1384	501
48570.11	494839.4	83.93333	38.12989	52.86667	750.848	454.4333	1003.633	336.5794	509.6667
48551.02	498045.5	81.38243	34.89373	54.17963	753.5	452.2555	1008.046	336.0793	508.5333
48258.82	498491.1	82.18231	33.76364	53.48733	746.4479	451.7333	1014.3	341.3667	506.9647
47547.03	502542.8	81.09119	30.56667	52.05394	735.9812	456.9893	1023.587	333.3209	496.5156
47499.43	508769.2	79.30875	28.96931	50.61527	734.2522	467.7562	1033.5	322.3	493.8333
47274.73	509601.8	80.76418	35.26667	52.354	739.9479	467.5	1034.813	314.8766	510.0859
48872.19	514279.4	76.82482	36.56667	52.18738	727.4477	479.0333	1038.079	315.0333	512.2
48435.98	516467.2	76.67546	43.89591	51.82878	737.4145	482	1034.267	317.1897	528.4162
47318.93	518563.9	77.44219	46.60432	50.64556	741.3667	487.6	1016.088	320.9883	545.6499
47668.9	519923.2	78.02459	43.46667	46	750.6145	487.0573	1017.192	328.5667	546.6166
48521.02	528117.8	80.2	40.83731	47.33333	761.5038	497.9454	1023.533	329.2788	543.2667
49538.56	527990.8	79.76667	36.23709	47.77636	752.3852	503.2031	1024.746	327.2212	549.0336
48912.22	532110	78.26462	33.44038	49.07015	763.6415	503.0878	1017.463	325.9214	542.5163
49131.39	534362.6	76.73333	35.2	49.44236	751.9037	513.5543	1007.412	328.0092	553.2
49911.02	543047.4	75.32462	35.62962	48.77868	756.5517	506.9455	1021.146	327.8333	564.2852
49894.11	547371.6	70.42512	36.35914	46.1	770.4518	504.9481	1052.113	338.1849	550.2
50507.56	549035.2	72.50837	35.37026	46.86667	774.8667	512.3212	1067.5	347.8545	555.3174
50531.3	553217.1	72.86667	36.00723	47.85057	784.3369	529.8333	1078.079	348.8058	559.5333
51760.08	559729.6	71.73333	34.19659	52.82778	783.5333	528.0878	1062.167	358.5914	556.7319
52320.26	563032.9	72.5418	35.96312	56.16067	769.611	525.4422	1049.387	369.0667	571.3674
52059.08	566931.5	70.53333	37.23692	60.06667	762.9	533.221	1057.616	378.554	575.3341
52387.37	571607.6	72.25836	33.30643	60.94679	768.989	534.5545	1057.687	387.5873	569.3015
52644.84	572835.8	73.94189	36.57368	56.96667	766.4854	532.7667	1078.92	393.4794	581.1836
52895.49	577332.2	75.37436	33.49673	57.09349	768.5	540.2368	1082.641	397.0873	586.1164
53863.17	584574.6	74.69226	34.67738	54.02026	760.7231	543.1177	1086.308	395.2175	591.783
54238.89	589809.1	75.63333	35.67044	54.3401	750.9145	543.0913	1093.972	395.9333	603.0837
53462.05	575317.3	75.78292	33.73333	52.86667	747.0712	560.5792	1072.546	392.7743	603.1163
50785.98	508647.3	71.44195	34.32944	48.79067	664.3044	471.9711	913.2459	345.087	601.3162
52734	559305.7	69.85808	37.99583	49.76939	753.8703	502.4633	1040.479	351.3416	601.366
52407.16	566722.4	70.56667	38.23736	50.9	785.2484	527.1793	1069.782	341.6977	622.4497
53935.19	572131.7	64.06667	34.9	51.25473	784.2	537.7124	1028.075	361.1247	634.5168
54443.96	566377.9	70.5424	34.93333	50.24306	768.1852	533.6543	1029.067	374.2617	624.9505
55046.13	579988.4	67.61837	35.46667	53.66667	774.1483	531.2	1078.933	376.1747	611.2156
55299.2	584452.7	67.26667	38.03333	57.36667	778.6	540.5333	1141.1	381.0667	634.2667
55531.76	589925.9	68.27438	34.58067	57.39157	770.2617	538.9937	1132.983	376.9387	625.944
55741.16	597777.9	69.43759	33.34296	57.85676	769.2924	541.3621	1125.152	379.693	620.3416
55793.78	602868.3	70.3666	32.40797	58.12869	770.0516	545.5889	1128.603	380.6947	617.6141
55802.35	608191	70.68549	31.80257	58.30385	771.7134	548.6486	1130.723	382.1146	616.4089
55858.13	612730.9	69.75658	32.04831	58.3137	775.4047	549.2212	1130.501	387.0138	619.1674
55946.52	617040.7	69.32613	31.92979	58.3635	777.0399	550.8705	1132.355	389.085	620.9912
56035.81	619011.1	69.02224	31.97679	58.44192	778.6485	553.1719	1134.652	391.1936	623.1892
56106.01	620743	68.75294	32.1432	58.47703	779.4015	555.419	1135.846	392.8349	625.0916
56118.77	622385.6	68.72487	33.11255	58.52129	778.7403	558.7745	1136.417	394.0199	627.0998

56176.78	624736.2	68.61347	33.3438	58.57624	779.321	561.5971	1137.68	395.6245	629.23
56250.5	626418.8	68.54531	33.48972	58.64559	780.1165	564.6419	1139.13	397.2561	631.4989
56303.45	628276.4	68.48172	33.51019	58.69028	780.7264	567.5759	1140.123	398.719	633.61
56317.58	630926.4	68.55799	33.16291	58.75312	781.579	570.3196	1140.551	399.7819	635.7262
56365.71	633576.9	68.49098	33.0635	58.7661	782.1226	573.2336	1141.384	401.1415	637.73
56433.14	636180.9	68.40957	32.96046	58.76522	782.6559	576.2509	1142.255	402.6066	639.7462
56480.48	638827.2	68.29999	32.8405	58.74325	783.1297	579.3047	1143.108	404.059	641.7235
56525.71	641400.9	68.16063	32.72046	58.69712	783.5004	582.3693	1143.874	405.5204	643.6318
56573.6	643999.2	67.99937	32.58859	58.63219	783.8079	585.4608	1144.644	407.0189	645.4408
56630.64	646561.2	67.81736	32.45121	58.55078	784.0542	588.6418	1145.472	408.5713	647.2306
56688.96	649212.9	67.6077	32.29289	58.44648	784.2517	591.8133	1146.22	410.134	648.9517

Employme RLEMCBS	Employme RLEMNCS	Employme RLEMPAD	Employme RLEMEDU	Employme RLEMHEA	Unemploy RLUO	Participatic RLPRO	Total Popu RHO	Net Provin RHNETMG	Inter-provi RINMIGO
					154.684	0.584726	6187		
					141.313	0.585777	6214		
					116.552	0.582374	6248	-1.137	23.682
					114.304	0.581956	6275	2.564	23.012
					116.207	0.580464	6303	1.366	15.489
					103.542	0.583291	6330	1.295	15.08
					106.504	0.581072	6362	1.954	25.772
					92.398	0.579015	6395	4.81	27.316
					101.376	0.580982	6427	3.6	16.321
					98.068	0.582285	6455	5.536	18.922
					87.187	0.582806	6497	4.247	30.157
					87.634	0.588476	6535	6.978	27.299
					83.758	0.589468	6572	2.677	17.141
					85.276	0.589373	6602	3.97	17.499
					79.435	0.58854	6646	6.386	32.553
					80.822	0.587459	6687	4.915	27.227
					64.275	0.588519	6723	7.089	22.836
					71.421	0.585872	6758	5.095	19.164
					65.809	0.585205	6803	7.563	33.427
					57.961	0.584346	6849	6.382	33.587
					66.831	0.598636	6888	6.239	22.094
					61.894	0.597305	6926	6.461	21.572
					80.507	0.601773	6977	9.991	38.357
					75.638	0.60145	7025	4.858	35.093
					86.328	0.603889	7063	3.37	19.718
					88.61	0.603838	7096	3.734	19.893
					92.624	0.606005	7142	5.656	32.719
					102.779	0.6017	7186	-0.324	30.056
					105.462	0.599809	7213	2.704	18.592
					106.907	0.601065	7238	5.275	20.309
					108.987	0.606423	7275	-0.461	22.852
					103.94	0.610721	7305	4.001	32.979
					93.039	0.612199	7338	4.777	20.984
					100.938	0.609582	7362	7.668	21.426
					94.583	0.60514	7399	13.777	35.566
					104.273	0.602831	7442	18.589	44.182
					114.415	0.602241	7488	13.983	30.132
					137.924	0.611092	7528	7.167	23.579
					156.802	0.60863	7566	15.926	30.976
					159.234	0.607766	7613	17.514	49.178
					180.045	0.609002	7656	6.433	25.703
					185.281	0.606815	7683	5.895	21.424
					171.672	0.610359	7849.027	1.878	34.028
					181.826	0.616243	7882.241	4.374	32.91
					167.804	0.617019	7906.337	0.155	18.74
					162.676	0.616098	7927.22	8.055	22.49
					178.973	0.619659	7963.117	1.665	30.8
					178.767	0.621546	7992.037	-1.648	25.012
					149.368	0.624385	8013.391	-1.214	20.169

					146.929	0.627253	8035.129	2.137	21.685
					151.087	0.62128	8075.547	-2.929	30.887
					161.79	0.630958	8107.108	-3.269	31.43
					160.13	0.633705	8139.808	1.69	21.554
					145.665	0.634513	8172.562	-5.294	16.813
					166.586	0.63657	8204.275	-7.844	27.231
					186.33	0.63848	8240.114	-10.715	23.902
					239.757	0.639656	8260.161	-5.541	19.251
					237.064	0.642236	8284.503	-4.094	14.791
					245.419	0.64226	8319.795	-5.494	25.109
					258.876	0.648735	8352.911	-9.928	21.786
594.1168	551.7705	255.2368	244.4773	307.2932	242.9	0.64389	8366.498	-0.857	18.113
597.4679	553.1578	253.6573	248.616	304.5419	231.8333	0.641669	8387.985	-2.653	16.709
613.3216	550.3466	248.7805	250.8686	299.478	244.0667	0.641635	8413.779	-7.394	30.923
633.1919	552.9564	257.7321	252.1564	300.8	258.9667	0.642729	8438.765	1.508	19.713
642.1256	552.3745	250.6271	252.9901	299.3844	277.8333	0.644458	8458.617	1.005	16.684
660.3528	549.1401	254.4097	255.54	293.6001	278.5	0.644313	8481.322	-1.521	18.867
670.7245	551.433	250.4175	252.9333	298.4997	288.4667	0.645069	8504.08	-1.74	35.172
676.3518	550.407	254.6859	257.3343	293.0727	292.2667	0.647035	8530.102	4.675	22.332
680.1794	553.9862	259.6699	261.1327	292.8534	294.1333	0.649319	8548.453	3.829	18.908
694.1118	548.7112	258.751	255.9257	292.7855	303.9333	0.651694	8569.298	1.746	21.413
724.2964	546.0852	256.6986	253.5565	292.5287	312.9667	0.656726	8590.144	-6.62	31.181
727.0355	546.6938	245.9611	253.3677	293.3261	315.3667	0.660583	8604.263	1.78	19.892
758.3947	545.5151	244.9677	250.2243	295.2908	298.0667	0.664809	8619.239	1.47	16.912
759.7791	551.0247	238.0667	249.5853	301.4394	291.5	0.665453	8638.099	-0.955	19.14
750.551	572.9687	239.9991	257.1445	315.8242	279.9333	0.666217	8662.088	-13.574	28.472
755.7906	579.282	230.8723	258.0161	321.2659	284.0333	0.667695	8674.941	-2.2	18.171
766.7969	576.0125	242.2	256.4137	319.5988	301.1	0.669055	8693.157	-1.711	15.444
767.6575	574.0067	248.3021	255.6342	318.3725	326.8667	0.668657	8715.218	-4.877	17.469
791.5846	568.2784	255.3183	257.0435	311.2349	307.8667	0.667139	8746.013	-18.244	27.308
805.7774	572.3487	263.5134	251.8556	320.4931	286.7	0.666615	8757.388	-4.511	17.622
828.7056	586.2365	266.5455	254.6348	331.6017	293.3	0.673198	8770.591	-3.437	15.123
855.1524	584.487	266.0849	249.0704	335.4166	288.6333	0.676524	8787.156	-7.055	17.037
855.4707	579.0882	258.8499	241.1608	337.9274	295.0667	0.676837	8812.286	-9.422	27.757
863.2458	582.0575	256.6	237.6333	344.4241	333.8	0.681518	8846.005	0.695	19.284
857.7431	590.2158	259.9184	238.3129	351.903	360.8333	0.676113	8865.774	4.3	18.765
854.8363	598.6881	255.1431	243.6854	355.0027	412.4667	0.675365	8892.646	-1.238	17.813
854.903	597.6107	252.0277	245.9051	351.7056	498	0.675174	8920.288	5.985	31.435
852.253	595.754	257.85	247.6557	348.0983	570.8667	0.67641	8957.042	8.36	20.122
857.9607	608.1393	255.1963	256.0333	352.106	545.3333	0.674059	8982.933	5.815	16.5
866.7155	621.7629	256.5285	267.3389	354.424	530.2333	0.676537	9010.994	3.425	18.828
876.9815	633.5111	264.2617	274.0439	359.4672	461.7333	0.677532	9039.564	8.917	31.032
884.26	636.8166	270.6286	278.8181	357.9985	436.8667	0.675762	9074.145	9.764	20.002
870.6111	627.0594	270.7357	269.501	357.5584	437.7333	0.674866	9100.59	7.014	16.442
880.7557	631.1399	274.8989	263.9526	367.1873	440.3	0.678521	9129.833	10.705	21.526
902.8631	632.8614	267.2634	258.6587	374.2027	439.3	0.681339	9167.484	13.494	34.147
928.0122	630.8239	270.7455	257.9546	372.8692	423.3333	0.679589	9210.346	4.772	16.812
920.5158	639.9581	271.9357	264.1177	375.8403	412.7	0.681649	9230.294	4.894	13.947
933.2778	645.8121	274.3739	263.244	382.5681	402.8333	0.683927	9256.175	10.725	21.818
938.3931	663.8587	272.8158	266.0798	397.7789	390.9333	0.684732	9294.657	13.564	34.998
940.1561	668.3945	266.0892	267.8057	400.5888	366.3667	0.684734	9338.435	4.778	17.305

951.3532	668.515	265.5736	272.5667	395.9483	360.1	0.68648	9362.036	5.076	14.498
975.7545	679.4205	272.9826	278.9813	400.4392	355.4	0.690028	9391.784	10.144	22.596
995.8716	683.1227	271.1128	279.1893	403.9334	357.7333	0.687139	9437.359	16.67	39.702
1015.432	675.2285	283.1869	274.8672	400.3613	346.5333	0.686479	9493.289	9.5	21.324
1060.469	676.4572	279.4292	272.9826	403.4746	336.0333	0.688221	9531.478	5.317	15.676
1046.229	685.9013	273.547	278.7822	407.1191	326.4667	0.688957	9577.947	11.114	24.341
1047.432	700.822	273.5757	285.1399	415.6821	308.2333	0.690169	9637.945	18.76	43.353
1066.57	736.2673	274.0789	300.5343	435.733	297.7333	0.696309	9702.789	6.102	21.632
1072.775	752.5972	280.7086	309.7773	442.8199	281.6667	0.698458	9735.171	3.127	15.035
1074.395	757.9695	283.6298	312.7571	445.2124	260.9333	0.696192	9774.964	7.226	22.746
1075.182	756.328	285.6089	313.3484	442.9796	268.6	0.695397	9838.62	5.59	36.454
1093.519	755.1143	282.5161	309.416	445.6983	269.5	0.695591	9917.21	0.877	18.389
1110.1	770.6047	286.305	315.4176	455.1871	271.6	0.702118	9969.308	-0.389	13.135
1126.752	765.8817	289.4848	316.2078	449.6739	271.7333	0.698293	10031.92	3.661	21.234
1137.138	772.1422	300.3734	315.9251	456.2171	264.5	0.697669	10103.31	1.892	36.061
1139.251	791.8473	295.0544	327.2349	464.6124	280.0667	0.698582	10167.64	-1.311	18.111
1145.084	793.9096	303.4064	322.1461	471.7635	295.9	0.700834	10189.99	-2.085	12.944
1132.284	804.724	314.1482	325.441	479.283	301.3667	0.696312	10238.88	-4.457	19.291
1118.745	803.5013	316.9503	324.2567	479.2446	349.6667	0.693821	10295.83	-5.503	30.173
1107.112	799.1513	321.9652	319.0147	480.1366	422.7667	0.691326	10344.68	-2.935	13.495
1084.664	798.5536	317.2704	318.9884	479.5652	512.7333	0.687073	10355.1	-0.199	11.514
1099.73	805.1946	318.7962	322.6156	482.579	540.1333	0.688271	10385.94	-2.99	17.741
1120.015	819.1973	314.1721	337.9715	481.2258	530.7667	0.685342	10431.32	-6.012	26.929
1108.984	828.0373	318.2238	344.145	483.8924	529.9333	0.680461	10465.56	-1.087	14.643
1108.911	831.8781	321.4573	347.948	483.9301	547.9667	0.675144	10488.02	-0.832	11.711
1106.714	821.104	318.3844	341.9831	479.1209	589.7333	0.674071	10528.35	-3.114	17.53
1088.721	824.5321	318.4602	341.7249	482.8072	619.7333	0.672938	10572.21	-7.555	25.116
1096.632	824.0516	311.4584	338.7346	485.3169	629.8	0.671624	10610.67	-2.029	13.633
1117.701	833.7589	315.178	345.2478	488.5111	581	0.669245	10629.99	-1.581	10.93
1123.43	843.5355	316.0172	352.6292	490.9063	617.3333	0.667993	10656.92	-3.024	16.706
1132.027	847.1664	314.5642	354.9734	492.1931	614.8667	0.666744	10690.04	-6.723	22.823
1133.321	851.707	317.4903	355.4411	496.2658	606.8667	0.664112	10728.74	-1.443	11.856
1139.401	850.2078	309.921	353.7	496.5078	583.1333	0.659743	10744.76	0.04	12.391
1162.902	863.4484	309.1872	361.1572	502.2912	548.0667	0.659159	10776.82	-1.294	17.555
1198.362	866.0634	314.1729	365.9661	500.0973	515.7667	0.659773	10819.15	-2.407	22.933
1210.894	869.3971	312.9166	363.5485	505.8486	494.4333	0.6584	10860.41	-0.866	13.129
1220.668	870.7125	312.2468	365.6424	505.07	485	0.657395	10875.31	0.36	12.969
1222.84	866.2943	301.5191	362.2233	504.071	490.9667	0.655406	10906.9	0.072	17.871
1231.972	854.7962	297.9721	345.2749	509.5213	500.7	0.654189	10950.12	0.129	24.04
1244.778	854.391	292.9567	350.3399	504.0511	481.9333	0.652389	10993.42	-2.325	13.62
1258.811	850.4032	291.3278	344.8499	505.5533	502.6333	0.654956	11009.31	0.058	13.423
1270.102	843.7189	290.4738	339.1361	504.5828	517	0.655034	11037.39	-0.684	17.976
1284.699	843.7764	288.1145	341.5908	502.1856	511.9	0.656196	11082.9	-0.37	23.25
1301.354	833.508	281.1625	339.9121	493.5959	516.0333	0.655657	11130.57	-0.71	12.336
1317.614	833.2805	278.0783	341.6711	491.6094	507.5667	0.6551	11146.27	0.802	14.316
1333.89	828.0226	277.9279	340.6029	487.4197	496.9333	0.655425	11179.96	2.255	20.076
1367.461	838.7911	278.4864	345.7922	492.9989	466.4333	0.65892	11227.65	3.836	25.697
1384.907	843.3644	284.4939	342.863	500.5015	461.6333	0.659326	11278.89	-0.07	11.044
1401.782	849.7162	283.5503	343.226	506.4902	443.9667	0.659694	11292.06	2.23	16.785
1406.768	860.7255	287.4277	344.5112	516.2142	419.2333	0.657819	11322.04	3.235	21.69
1427.829	863.6513	281.4656	343.8927	519.7585	415.1333	0.658633	11365.9	4.007	22.435

1428.384	870.2425	278.9557	348.6387	521.6038	411.0667	0.661524	11408.8	1.994	12.512
1444.513	855.3441	289.2177	354.1983	501.1458	395.5333	0.663376	11419.59	4.347	15.384
1456.4	870.1452	290.3371	359.4788	510.6663	410.4333	0.668126	11452.86	6.358	22.49
1466.764	885.1036	283.2796	368.6875	516.4162	374.4	0.666298	11504.76	5.511	23.946
1483.492	894.9175	281.9199	372.0188	522.8987	342.8333	0.664094	11559.46	2.208	12.414
1492.876	899.9819	277.9628	367.8989	532.083	350.9	0.667846	11576.99	6.371	18.609
1515.297	904.8878	280.5153	364.0127	540.8752	342.4667	0.667789	11621.26	8.279	23.934
1544.154	910.7861	287.3648	369.4598	541.3262	355.3333	0.670427	11683.29	6.066	25.327
1555.022	909.9958	281.7201	356.7465	553.2493	377.6	0.675514	11748.35	2.576	13.227
1549.087	913.7404	271.6568	354.002	559.7383	381.1	0.672739	11771.95	4.047	15.176
1554.363	918.0669	282.0784	354.5879	563.479	384.7667	0.673829	11827.35	5.934	20.786
1556.536	914.0095	288.5422	353.2351	560.7743	406.0333	0.672787	11897.53	1.644	22.56
1568.158	916.3044	290.1339	351.0711	565.2333	436.8333	0.672475	11961.79	-0.125	11.177
1571.526	931.312	297.2667	363.7333	567.5787	467.4333	0.673947	11980.36	3.13	14.788
1585.116	935.4	292.9419	359.388	576.012	454.9333	0.673771	12030.41	0.705	21.558
1590.411	952.4121	294.9042	368.3788	584.0333	462.6333	0.67872	12094.17	1.237	22.142
1616.523	965.0459	301.954	371.4912	593.5547	455.8333	0.682394	12146.05	-1.034	10.617
1634.054	973.785	312.8538	369.9759	603.8091	449.3667	0.685956	12156.75	0.485	12.584
1637.234	978.1242	311.2921	371.3242	606.8	466.6	0.684168	12195.5	-0.051	18.893
1634.371	994.5088	310.625	376.3123	618.1965	478.0333	0.684416	12245.04	-3.324	17.999
1641.596	1010.5	309.8	388.7209	621.7789	454.1667	0.684456	12291.67	-2.012	9.243
1643.364	1016.825	309.7542	391.0252	625.8	451.3333	0.68576	12305.32	-0.905	12.439
1646.661	1027.138	306.3667	397.9744	629.1636	460.7	0.684915	12341.66	-0.694	17.505
1654.457	1014.213	311.0542	389.1922	625.0212	450.7	0.68221	12391.42	-4.002	16.991
1636.71	1024.17	318.9	390.2125	633.9578	465.2667	0.682842	12437.66	-3.628	10.584
1629.423	1034.013	317.5667	401.5585	632.4544	461.8333	0.680801	12446.47	-1.748	12.285
1621.946	1047.712	329.2797	427.4333	620.2788	470.5667	0.682603	12477.97	-1.794	19.632
1637.997	1050.522	327.3724	431.6076	618.9143	453	0.679389	12528.66	-4.723	18.236
1668.416	1065.25	319.7462	447.2737	617.9762	433	0.676477	12578.93	-5.248	9.108
1696.737	1072.056	313.1	455.1799	616.8762	437.5667	0.674467	12587.53	-4.056	12.125
1704.611	1068.467	306.5	441.6333	626.8333	421.7333	0.676268	12618.44	-3.474	16.279
1686.538	1079.556	314.4208	441.1461	638.4096	453	0.67616	12661.88	-8.454	19.382
1690.051	1080.375	311.5793	440.1747	640.2	440.2667	0.672972	12700.99	-5.957	11.46
1735.49	1093.358	316.5667	443.0126	650.3454	455.0333	0.676788	12702.84	-2.185	12.144
1731.922	1114.019	323.6206	453.3615	660.6577	454.8667	0.674469	12726.73	-3.451	15.805
1764.186	1132.141	327.5793	466.9134	665.2271	441.3667	0.674815	12764.81	-4.202	20.76
1777.946	1157.918	350.3072	487.0058	670.9122	447.5333	0.67609	12807.21	-3.588	10.797
1772.869	1153.291	351.2	478.9333	674.3578	450.0667	0.676431	12814.45	-3.458	12.655
1775.586	1155.173	355.7395	474.0729	681.1	448.9667	0.675059	12840.27	-3.502	17.506
1769.323	1155.147	351.4	477.0803	678.0667	454.9333	0.672162	12883.58	-2.928	20.001
1784.388	1149.747	358.961	467.5801	682.1667	502.1333	0.67499	12927.15	-5.253	9.541
1756.581	1146.277	351.0613	456.1531	690.1238	612.3667	0.671377	12932.23	-4.157	12.767
1756.302	1147.324	353.1333	457.7475	689.5762	663.1667	0.667175	12956.33	-3.263	15.149
1759.096	1151.87	358.7946	444.2795	707.5909	659.7333	0.666842	12998.35	-1.288	18.343
1745.761	1178.15	353.4333	456.3927	721.7576	650.7667	0.666703	13047.49	-0.525	10.431
1767.437	1188.216	360.726	461.4738	726.7424	645.6667	0.665807	13058.44	-1.396	13.444
1801.893	1190.569	357.3129	459.1	731.4694	619.4333	0.667873	13088.11	-1.453	17.523
1820.013	1196.258	354.5052	465.0132	731.2452	629.8333	0.667798	13135.78	0.89	18.92
1823.835	1190.007	352.2924	456.1739	733.8333	592.2	0.663169	13189.34	-1.95	11.178
1828.941	1201.607	355.8205	462.9068	738.7	583.7333	0.666313	13198.65	-1.003	12.362
1835.196	1223.353	366.1333	470.62	752.7333	581.3	0.667558	13222	-1.944	15.857

1836.834	1217.334	372.12	456.7464	760.5878	555.2	0.66365	13261.38	-0.834	21.751
1843.317	1234.387	369.9867	461.5202	772.8667	565.6	0.661727	13308.66	-1.961	11.722
1852.506	1233.809	364.6799	463.2	770.609	563.9333	0.659977	13323.33	-3.342	13.99
1870	1220.689	368.8799	456.7587	763.9305	576.4	0.660193	13348.26	-4.474	18.469
1868.766	1230.767	368.2736	463.5794	767.188	572.6	0.659317	13390.63	-3.692	18.837
1858.62	1252.645	372.5333	480.6	772.0453	587.5667	0.661358	13434.94	-1.63	10.365
1879.059	1270.173	378.5667	483.3395	786.8333	565.0333	0.661291	13444.7	-4.571	11.865
1891.109	1277.844	374.5268	484.6868	793.1576	556.8	0.661523	13467.83	-4.008	20.64
1917.115	1264.808	370.1531	477.6201	787.1879	552.1	0.660558	13510.78	-2.062	19.031
1925.852	1258.079	368.5333	471.5333	786.5454	553.8333	0.659084	13558.53	-1.346	12.002
1931.832	1258.375	365.6802	472.787	785.588	544.0333	0.657434	13562.58	-4.341	12.726
1933.283	1283.964	363.4134	488.7734	795.1907	542.6333	0.656199	13582.75	-6.815	20.079
1927.757	1312.021	367.3866	510.9667	801.0546	540.1333	0.656828	13617.55	-1.299	19.289
1937.143	1302.623	358.06	500.88	801.7427	508.5333	0.654218	13661.31	-2.186	11.332
1926.086	1313.028	344.7796	515.5398	797.4882	504	0.651797	13657.74	-3.275	15.075
1918.787	1313.51	337.5155	517.9199	795.5901	483.5	0.650548	13669.86	-1.935	24.225
1921.175	1316.153	336.7542	523.6864	792.4667	499.7333	0.651853	13707.12	1.911	23.363
1913.528	1304.055	342.9792	497.4333	806.6216	501.0667	0.65004	13757.69	1.326	11.738
1917.544	1317.224	339.0333	499.6	817.6235	501.3	0.651628	13773.63	1.611	16.649
1930.605	1322.226	350.7	496.5931	825.6333	491.8667	0.650706	13816.55	4.229	26.128
1931.326	1322.19	347.1793	490.1	832.0904	488.2667	0.646691	13875.39	7.662	25.566
1943.748	1332.243	360.8873	492.1333	840.1093	477.7667	0.64666	13946.43	2.254	11.659
1943.692	1348.429	371.9514	486.7538	861.6756	479.3333	0.648655	13971.79	0.23	16.269
1916.731	1358.746	366.1411	494.5462	864.2	468.8	0.646012	14006.39	3.236	24.933
1947.35	1344.345	364.2	479.4	864.9454	436.9667	0.64518	14070.14	4.985	21.261
1974.578	1335.609	364.2	492.5538	843.0547	440.1333	0.648035	14150.78	2.492	13.392
1984.384	1332.301	355.9125	498.8129	833.4883	428.2333	0.642992	14186.83	1.779	16.582
2010.546	1340.347	358.1	508.3333	832.0134	446.1	0.644597	14235.64	0.688	25.192
1989.411	1376.885	353.8753	529.54	847.3451	435.0333	0.643379	14308.7	5.118	21.37
1987.058	1389.865	355.1457	528.3201	861.5452	437.2333	0.642479	14392.9	2.042	13.802
1994.084	1415.977	363.621	538.2866	877.6905	454.8333	0.647677	14426.82	0.074	14.474
2018.693	1427.94	368.4877	538.6066	889.3333	437.5667	0.648327	14467.55	-0.605	24.083
2031.574	1448.02	379.3667	532.6536	915.3667	437.8333	0.648569	14544.7	4.4	25.69
2048.727	1467.705	381.729	547.0931	920.6121	425.6667	0.649115	14638.25	0.822	14.113
2000.109	1434.661	387.8926	535.2401	899.4213	473.6	0.643725	14688.73	-1.61	18.292
1661.622	1308.266	376.9259	480.4872	827.7785	914.3667	0.607497	14729.32	-0.818	23.512
1845.201	1385.942	381.7796	512.3873	873.5548	821.2667	0.640972	14745.71	0.731	17.465
1923.392	1414.347	382.1667	532.0584	882.2881	759	0.650978	14740.7	-0.072	12.125
1875.929	1451.675	389.6793	545.9413	905.7333	708.4333	0.6446	14756.5	-1.77757	10.82523
1902.618	1442.212	402.6333	526.6333	915.5786	706.2	0.644705	14792.8	-2.0699	10.57071
2013.041	1479.522	411.9794	556.7461	922.7761	613.6667	0.651382	14825.63	-2.22845	11.07634
2058.5	1484.733	416.2667	557.4333	927.3	526.2333	0.652249	14914.63	-4.09794	16.05676
2053.144	1479.98	412.802	548.9448	931.0347	564.336	0.649798	14940.77	-0.6332	17.07511
2074.88	1481.716	412.0283	546.2223	935.4937	545.0389	0.647389	14969.56	0.232401	17.30062
2098.345	1484.293	411.4915	543.3238	940.9696	526.1163	0.646532	15001.17	0.865494	17.53857
2120.557	1484.843	410.9139	541.2388	943.604	517.7155	0.64622	15035.78	1.256079	17.77894
2140.999	1483.611	410.7136	540.9037	942.7073	509.8494	0.64589	15075.76	0.83463	18.18458
2158.446	1485.703	410.925	540.7883	944.9146	502.7287	0.645552	15118.18	0.948007	18.3447
2175.759	1489.096	411.4498	541.0433	948.0527	492.4874	0.645226	15162.37	1.056685	18.45211
2183.956	1491.704	411.6906	540.972	950.732	494.9222	0.644888	15207.6	1.140664	18.48682
2194.394	1494.974	411.9596	541.0249	953.9495	494.411	0.64455	15253.43	1.197908	18.28945

2204.073	1498.828	412.4678	541.1876	957.6401	492.7935	0.644211	15299.56	1.234979	18.2442
2214.632	1503.405	413.1514	541.4665	961.9381	488.5503	0.643865	15345.99	1.268644	18.21047
2224.014	1507.538	413.7639	541.5633	965.9743	487.2396	0.643522	15392.68	1.298905	18.18828
2233.336	1511.949	414.22	541.6444	970.3042	487.0743	0.643177	15439.59	1.317509	18.19897
2242.489	1516.013	414.6421	541.6606	974.3527	486.5817	0.642819	15486.74	1.34426	18.19131
2251.135	1520.216	415.0755	541.6915	978.5248	486.1293	0.642458	15534.1	1.370906	18.18665
2259.519	1524.258	415.4835	541.6836	982.5745	486.1702	0.642094	15581.68	1.397447	18.18498
2267.532	1528.112	415.8314	541.603	986.5093	487.0458	0.641731	15629.48	1.460563	18.19396
2274.651	1532.526	416.1628	541.495	991.031	488.1778	0.641367	15677.45	1.465216	18.18821
2281.637	1536.932	416.486	541.3759	995.5559	489.4033	0.641004	15725.57	1.462212	18.18952
2288.194	1541.18	416.7745	541.2052	999.9748	491.5358	0.640641	15773.83	1.45155	18.19788

Inter-provi	Net Interna	Natural Ra	Final cons	Household	Household	Household	Household	Household	Household
ROUTMIG	RHNIMGC	RHNATRC	RYCO	RCHO	RCHGOO	RCHDUO	RCHSDO	RCHNDO	RCHSEO
	-0.055	0.004157							
	5.854	0.004432							
24.819	1.846	0.004518							
20.448	0.984	0.004013							
14.123	0.527	0.00384							
13.785	5.599	0.004068							
23.818	2.999	0.0045							
22.506	1.865	0.003958							
12.721	0.826	0.003588							
13.386	8.891	0.004157							
25.91	6.04	0.004257							
20.321	4.935	0.00366							
14.464	3.247	0.003707							
13.529	11.943	0.004008							
26.167	7.53	0.003982							
22.312	7.136	0.003475							
15.747	5.033	0.003151							
14.069	14.962	0.003442							
25.864	12.221	0.0035							
27.205	11.321	0.002776							
15.855	11.615	0.002691							
15.111	24.743	0.0029							
28.366	21.283	0.002965							
30.235	19.092	0.002628							
16.348	16.006	0.002405							
16.159	26.445	0.002777							
27.063	22.56	0.002709							
30.38	15.52	0.002309							
15.888	10.171	0.002178							
15.034	17.203	0.002628							
23.313	15.381	0.002589							
28.978	15.946	0.002346							
16.207	6.888	0.002268							
13.758	12.102	0.002648							
21.789	13.148	0.002737							
25.593	12.948	0.002459							
16.149	10.411	0.002225							
16.412	14.805	0.002756							
15.05	13.274	0.002793							
31.664	10.98	0.00255							
19.27	7.734	0.002375							
15.529	9.445	0.002588							
32.15	15.047	0.002425							
28.536	11.256	0.002116							
18.585	9.39	0.001955							
14.435	13.702	0.00221							
29.135	12.484	0.00219							
26.66	15.576	0.001969							
21.383	12.115	0.001856							

19.548	21.709	0.002149							
33.816	20.2	0.002074							
34.699	29.566	0.001851							
19.864	20.816	0.001746							
22.107	27.3	0.00193							
35.075	28.084	0.002208							
34.617	23.717	0.001889							
24.792	19.49	0.001741							
18.885	22.14	0.002168							
30.603	23.368	0.00211							
31.714	17.051	0.001829							
18.97	12.681	0.001629							
19.362	18.062	0.001982							
38.317	16.46	0.002047							
18.205	11.349	0.001728							
15.679	10.348	0.001681							
20.388	13.202	0.001893							
36.912	12.06	0.002006							
17.657	7.181	0.001641							
15.079	7.173	0.001489							
19.667	8.681	0.001858							
37.801	5.68	0.001921							
18.112	5.887	0.001708							
15.442	5.994	0.001661							
20.095	8.66	0.001847							
42.046	11.22	0.001899							
20.371	14.621	0.001552							
17.155	13.661	0.001495							
22.346	15.457	0.00186							
45.552	13.27	0.001967							
22.133	11.765	0.001617							
18.56	9.774	0.001474	93556.5	67416.5	36856.25	8871.254	7567	20418	30560.25
24.092	11.644	0.001846	95831.51	68941.51	37748.26	8921.256	7498	21329	31193.25
37.179	11.693	0.001898	98258.49	69743.49	38382.24	8492.243	7485	22405	31361.25
18.589	10.992	0.001522	100413.5	71210.5	39629.25	8607.247	7470	23552	31581.25
14.465	9.574	0.001502	102202.8	72119	39752	8291	7452	24009	32367
19.051	12.315	0.001873	104380.8	73884	40472	8372	7707	24393	33412
25.45	8.136	0.001901	107093.7	75370	40785	8386	7895	24504	34585
11.762	8.8	0.001588	109274.7	76983	41135	8651	8114	24370	35848
10.685	7.297	0.001522	112623.5	80063.24	42966	9343	8458	25165	37097.24
15.403	6.682	0.001896	114754.5	81719.25	43989	9954	8471	25564	37730.25
22.115	5.127	0.001881	118370.5	84343.25	45716	10468	8628	26620	38627.25
10.238	6.73	0.001604	120427.5	85990.26	46741	10899	8687	27155	39249.26
9.428	5.794	0.001633	124149.8	89116	48218	11753	8994	27471	40898
10.821	8.388	0.001918	126610.8	90624	49148	11940	9353	27855	41476
20.653	7.912	0.00207	128889.7	91725	49444	12145	9414	27885	42281
12.04	6.731	0.001656	132037.7	94007	50722	12682	9635	28405	43285
9.053	6.219	0.001444	136725	97035.76	52620.76	13454	9929	29237.76	44415
11.093	7.204	0.001934	139225	99235.75	53734.75	14226	10094	29414.75	45501
21.434	7.718	0.002034	142361	102027.7	55449.75	14818	10344	30287.75	46578
12.527	7.881	0.001642	145105	103740.7	56750.74	15338	10605	30807.74	46990

9.422	7.529	0.001419	149234	107264	57812.75	15844	10870	31098.75	49451.24
12.452	9.229	0.002002	151656	109096	58461.75	16069	11243	31149.75	50634.25
23.032	7.879	0.002014	155599	111887	60249.75	16920	11515	31814.75	51637.25
11.824	11.47	0.001571	157455	113193	60283.75	16599	11672	32012.75	52909.26
10.359	15.694	0.001535	161789.5	116768.2	61476	17282	11929	32265	55292.24
13.227	20.887	0.00198	165508.5	119695.2	63533	17969	12165	33399	56162.25
24.593	18.332	0.001847	168886.5	121648.3	64497	18189	12343	33965	57151.25
15.53	16.625	0.001556	172699.5	124268.3	65826	18892	12671	34263	58442.26
11.908	16.124	0.001413	177376.8	127973.8	67722.76	19734	12770.76	35218	60251
15.52	21.851	0.001919	180926.8	131200.8	68758.75	20067	13056.75	35635	62442
30.864	21.383	0.001948	184483.7	133549.7	70055.75	20399	13327.75	36329	63494
17.512	18.387	0.001583	188232.7	136639.7	71298.74	20904	13652.74	36742	65341
13.524	20.658	0.001617	192785.2	139588.2	71890.25	20863	13769.25	37258	67698
17.573	25.73	0.00201	198451.3	143716.3	74213.25	21973	14084.25	38156	69503
34.169	23.859	0.002107	201350.3	144897.3	74114.25	21093	14179.25	38842	70783
19.422	22.316	0.001658	204565.3	146886.3	74710.25	21291	14115.25	39304	72176
15.029	20.783	0.001767	208400.5	149177.3	75110.25	21157	14352.25	39601	74067
23.748	30.493	0.002213	209126.5	148684.2	74553.25	20225	14152.25	40176	74131
35.676	29.07	0.002157	212459.5	150421.2	74860.25	20053	14180.25	40627	75561
16.43	23.427	0.001665	215405.5	151909.3	75136.25	19749	14203.25	41184	76773
11.713	24.366	0.001681	215323.5	151277.2	73527.25	18596	13688.25	41243	77750
20.731	25.69	0.002145	219412.5	153483.3	75033.25	19771	13892.25	41370	78450
32.941	21.469	0.002092	223807.5	156023.3	76156.25	19572	14012.25	42572	79867
15.73	9.533	0.001629	224972.5	156076.3	74843.25	18677	14007.25	42159	81233
12.543	26.498	0.001684	227947	154587.8	73425	18656	13468	41301	81162.76
20.644	28.061	0.002082	228123	156999.8	74535	19015	13793	41727	82464.75
32.671	27.897	0.002001	229573	160770.7	76830	19784	14311	42735	83940.75
15.662	7.739	0.00157	228025	162545.7	77702	19969	14536	43197	84843.74
12.511	15.514	0.001502	230894.7	163420.7	77730.5	19813.75	14379.75	43537	85690.25
19.73	18.819	0.001907	233811.7	164163.7	77290.5	19497.75	14328.75	43464	86873.25
29.546	28.433	0.001873	236961.8	164927.8	76857.5	19482.75	14288.75	43086	88070.25
13.299	4.826	0.001461	240367.8	166243.8	77053.5	19697.75	14182.75	43173	89190.26
12.351	20.587	0.00134	241224.3	168304.3	78078.51	20365	14378.76	43334.75	90225.75
18.849	26.885	0.001832	241858.3	170050.3	78591.5	20812	14899.75	42879.75	91458.75
25.34	26.533	0.001864	241890.2	171686.2	79270.5	21014	15215.75	43040.75	92415.75
13.995	3.534	0.001406	243747.2	174903.2	81311.49	22605	15541.74	43164.75	93591.75
12.609	19.777	0.001326	246475	176359	81937	22325	15775	43837	94422
17.799	26.936	0.001762	248102	177224	81621	21478	15639	44504	95603
23.911	26.386	0.00181	250596	179601	82440	22065	15472	44903	97161
15.945	6.923	0.001304	251099	178972	80890	21368	15094	44428	98082
13.365	17.319	0.001245	252142.3	181912.5	82049.76	21810.76	15221	45018	99862.75
18.66	30.419	0.001585	254086.3	183729.5	83002.76	21987.76	15330	45685	100726.8
23.62	30.539	0.00163	254827.2	186189.5	84013.75	22629.75	15710	45674	102175.7
13.046	5.347	0.001045	257804.2	189448.5	86329.74	23927.74	15975	46427	103118.7
13.514	22.972	0.000939	260994	192037.2	87200.49	24228	16134.24	46838.25	104836.8
17.821	30.257	0.001408	265312	195526.3	89027.5	25685	16424.25	46918.25	106498.8
21.861	32.217	0.001403	271338	199664.3	90815.51	26346	16736.25	47733.25	108848.7
11.114	2.313	0.001019	275464	203312.2	92024.5	27777	16741.25	47506.25	111287.7
14.555	18.528	0.000866	277868.3	203815	92054	26882	17456	47716	111761
18.455	25.122	0.001419	281787.3	207766	95039	28413	17588	49038	112727
18.428	23.254	0.001426	281964.3	208592	95294	28378	17822	49094	113298

10.518	-1.024	0.00091	282000.2	209599	95421	28231	18070	49120	114178
11.037	20.45	0.00079	288389.2	214093	98293.24	29753.24	18609.25	49930.76	115799.8
16.132	31.203	0.001301	294994.2	219053	101192.2	30575.24	19096.25	51520.75	117860.8
18.435	34.101	0.001361	302949.3	224935	104345.3	32464.26	19079.25	52801.75	120589.7
10.206	5.794	0.000873	306979.3	226895	104841.3	32575.26	18903.25	53362.74	122053.7
12.238	28.537	0.000856	311525.8	230852.8	106985	33043.75	19370.24	54571	123867.8
15.655	40.053	0.001227	317948.7	234370.7	108494	33117.75	19706.24	55670	125876.8
19.261	45.98	0.001162	325921.7	241096.7	112074	34386.74	20502.25	57185	129022.7
10.651	13.237	0.000711	327151.8	242731.8	112367	32983.75	20945.26	58438	130364.7
11.129	41.564	0.000879	329823.5	244562.5	113000.8	33861	20870.75	58269	131561.8
14.852	50.602	0.001213	334923.5	248020.5	115288.7	33538	21127.75	60623	132731.8
20.916	48.527	0.001253	337903.5	249203.5	114703.8	33159	20595.75	60949	134499.7
11.302	8.64	0.000909	342193.5	252313.5	116838.7	35362	21001.75	60475	135474.7
11.658	38.379	0.00078	345548.5	256468.5	119365.8	36108	21703	61554.76	137102.8
20.853	51.04	0.001067	352291.5	260731.5	120109.8	36592	21792	61725.76	140621.8
20.905	36.992	0.001197	359467.5	264837.5	122478.7	37054	21778	63646.75	142358.7
11.651	2.907	0.000794	367180.5	269566.5	125205.7	38070	22031	65104.74	144360.7
12.099	30.248	0.000726	369735.2	272360.5	127390.5	37835.25	22232.25	67323	144970
18.944	37.494	0.001058	370480.3	272786.5	126413.5	37928.25	22313.25	66172	146373
21.323	35.591	0.00124	377160.3	276578.5	128798.5	38778.26	22598.25	67422	147780
11.255	6.679	0.000798	376572.2	275954.5	126813.5	36430.24	22136.25	68247	149141
13.344	28.182	0.000802	383597	281129	129291	37097	22651	69543	151838
18.199	37.413	0.001123	387519	283709	129907	37048	22755	70104	153802
20.993	36.143	0.001204	392707	287334	131796	37759	23113	70924	155538
14.212	2.499	0.000864	398161	291508	134214	38900	23097	72217	157294
14.033	25.427	0.000693	403630.3	295301.8	135278.8	39090	22929.76	73259	160023
21.426	40.091	0.001059	409253.3	298890.8	136353.8	38539	23373.75	74441	162537
22.959	40.182	0.001248	413327.2	302717.8	138424.8	39439	23108.75	75877	164293
14.356	3.992	0.000849	419489.2	307937.7	141490.7	40392	24163.74	76935	166447
16.181	25.569	0.000811	424296.8	310485	142159	41262	24101	76796	168326
19.753	36.549	0.001071	430192.8	313292	142902	40227	24343	78332	170390
27.836	36.912	0.001276	434252.7	315117	142444	40366	24375	77703	172673
17.417	2.108	0.000881	440545.7	317766	140931	40221	24797	75913	176835
14.329	22.48	0.000707	446794.5	327722.8	143654.8	41000	25497	77157.76	184068
19.256	33.135	0.001087	450713.5	329355.7	146923.7	41515	25202	80206.75	182432
24.962	35.569	0.001296	451041.5	328589.8	145963.8	41610	24838	79515.75	182626
14.385	4.583	0.000917	458006.5	333579.7	151457.7	43631	25391	82435.74	182122
16.113	23.935	0.000842	465766.2	337471.2	152270.2	44107	25427.25	82736	185201
21.008	38.284	0.001088	474207.3	341814.3	152830.3	43030	25934.25	83866	188984
22.929	35.368	0.001291	481471.3	346904.3	154147.3	42249	25858.25	86040	192757
14.794	4.495	0.000878	477847.2	342478.2	148232.2	39938	25244.25	83050	194246
16.924	23.786	0.000762	478372.8	339925.8	147153	38849	25251	83053	192772.8
18.412	36.576	0.001092	478366.8	339721.8	147416	40101	24956	82359	192305.8
19.631	39.224	0.001285	481155.8	341820.8	149105	41752	25019	82334	192715.8
10.956	5.775	0.000859	485272.7	343851.7	149766	42106	24882	82778	194085.7
14.84	25.981	0.000802	493131	350584	152699	42172	25785	84742	197885
18.976	40.775	0.001054	498843	355260	154533	42615	25826	86092	200727
18.03	43.366	0.001127	507829	362200	157075	43229	25976	87870	205125
13.128	5.567	0.000849	517493	370668	161237	44444	26481	90312	209431
13.365	20.814	0.000676	522591.2	371759	161269	43456	26471.75	91341.25	210490
17.801	32.037	0.00101	524883.2	373740	161469	43447	26474.75	91547.25	212271

22.585	34.959	0.001222	528235.3	375669	161780	42676	26609.75	92494.25	213889
13.683	8.009	0.000878	529638.3	376804	161446	42857	26551.75	92037.25	215358
17.332	20.478	0.000812	537625.2	383513.5	165549.7	44541	27166.75	93842	217963.8
22.943	36.502	0.001001	537290.3	383171.5	163623.8	43725	26518.75	93380	219547.8
22.529	35.163	0.001187	539261.3	384268.5	164090.8	43399	26637.75	94054	220177.7
11.995	3.666	0.000802	540467.3	386082.5	165595.8	43451	26804.75	95340	220486.7
16.436	22.279	0.000625	549112.5	390986	166796	43239	26984	96573	224190
24.648	37.527	0.000925	552479.5	396106	169314	46007	27103	96204	226792
21.093	37.644	0.001127	558368.5	401492	172052	46597	27830	97625	229440
13.348	-1.854	0.00076	560579.5	404360	172322	45989	27943	98390	232038
17.067	18.958	0.000629	567877.3	408791.2	174326	46464	27878	99984	234465.2
26.894	32.87	0.000867	576394.3	416521.2	178968	48637	28651	101680	237553.2
20.588	33.332	0.001086	581660.3	421019.3	181161	50610	29053	101498	239858.3
13.518	-7.483	0.00067	585636.3	424088.3	182161	51549	29330	101282	241927.3
18.35	11.867	0.000477	590815.5	426889.8	182271	51256	29533	101482	244618.8
26.16	30.35	0.000868	596471.5	431529.8	183752	52433	29951	101368	247777.8
21.452	37.316	0.00105	603809.5	437895.7	187199	53970	30441	102788	250696.7
10.412	8.277	0.000683	611851.5	444988.7	191626	55613	31559	104454	253362.7
15.038	36.451	0.000572	614902.8	447153.8	192097.8	57558.75	31383	103156	255056
21.899	44.823	0.000803	617868.8	448243.8	191977.8	56671.75	31030	104276	256266
17.904	49.044	0.001033	620072.8	451044.8	192521.8	57274.75	30933	104314	258523
9.405	15.395	0.000552	627911.7	457225.7	196150.7	59190.74	31182	105778	261075
16.039	28.641	0.00041	637314.3	464299.8	200074.8	61671.76	31486	106917	264225
21.697	49.413	0.000793	647284.3	472156.8	204210.8	63074.75	32575	108561	267946
16.276	62.874	0.000909	653194.2	477337.7	205335.7	63454.75	33117	108764	272002
10.9	26.037	0.000531	662447.2	484509.7	208594.7	64938.74	33130	110526	275915
14.803	42.928	0.000289	669860.5	489696.2	211626	65573	33271	112782	278070.2
24.504	62.55	0.00069	676932.5	494561.2	213746	65939	33657	114150	280815.2
16.252	66.729	0.000864	686274.5	500662.3	217523	66763	34063	116697	283139.3
11.76	24.761	0.000494	691916.5	503440.3	218213	66953	34113	117147	285227.3
14.4	35.476	0.000359	695012.3	506249.5	218223.5	67700.75	34457.75	116065	288026
24.688	68.264	0.000656	701112.3	511733.5	219650.5	66847.75	34795.75	118007	292083
21.29	76.527	0.000868	707321.2	518089.5	221021.5	66771.75	35202.75	119047	297068
13.291	43.392	0.000428	712122.3	521007.5	220112.5	66563.75	34835.75	118713	300895
19.902	37.674	0.000309	701020	508527	215486	60817	31882	122787	293041
24.33	12.394	0.000327	616377	426462	190056	49997	25749	114310	236406
16.734	-15.003	0.000628	683220	485556	226984	71295	34442	121247	258572
12.197	17.428	9.3E-05	687093	484201	227013	69758	32746	124509	257188
12.6028	38.943	-0.00145	699630.8	489596.8	230956	70542	33359	127055	258640.8
12.64061	36.286	0.000141	701325.2	490927.2	229001	69663	32193	127145	261926.2
13.30479	17.42096	0.00119	734246.3	522140.3	241101	70180	38510	132411	281039.3
20.15471	16.6355	0.005126	748191.6	534256.4	239763.7	69571.18	38238.44	131954.1	294492.7
17.70831	20.47573	0.000422	753758.6	539448.7	239021.7	70066.87	37239.24	131715.6	300427
17.06822	21.90772	0.000444	765933.6	549732.7	238937.2	70265.57	37104.92	131566.7	310795.5
16.67307	23.8474	0.00046	779014.5	561218.2	238918.7	70344.9	37041.97	131531.8	322299.6
16.52286	26.29478	0.000469	788398.8	569374.8	239748.4	70615.53	37216.14	131916.7	329626.5
17.34995	32.15576	0.000463	796923.3	576475	241664.7	71229.93	37586.42	132848.4	334810.3
17.39669	34.45617	0.000465	803724.2	581687.7	243440.3	71810.69	37936.11	133693.5	338247.3
17.39542	36.10191	0.000464	809768.9	586206.5	245043.9	72355.43	38258.13	134430.4	341162.6
17.34616	37.09299	0.00046	815844.8	590872.4	246750.4	73082.94	38540.13	135127.3	344122
17.09154	37.76665	0.00045	823079.5	596825.4	248806.8	73687.66	38838.28	136280.8	348018.6

17.00922	38.10165	0.000444	829963.5	602338.6	250578.7	74206.71	39096.81	137275.1	351759.9
16.94183	38.41716	0.000439	836887.1	607907.4	252417.8	74745.18	39363.68	138309	355489.5
16.88938	38.71318	0.000434	843726.9	613405.1	254198.6	75266.82	39620.14	139311.7	359206.4
16.88146	38.96668	0.000429	850701.6	618784.8	255895.3	75749.13	39899.28	140246.9	362889.5
16.84705	39.2329	0.000424	857475.2	623914.6	257428.3	76174.97	40153.89	141099.4	366486.4
16.81574	39.48883	0.000419	864209	629004.8	258976.9	76609.89	40413.08	141954	370027.8
16.78753	39.73447	0.000414	871053.3	634166.5	260530.7	77045.37	40673.21	142812.2	373635.7
16.7334	39.95498	0.000409	878421.6	639847	262379.9	77571.37	40988.21	143820.3	377467.1
16.723	40.18597	0.000403	885654.2	645367.4	264111.5	78060.66	41285.88	144764.9	381256
16.72731	40.4126	0.000397	892876.1	650870.4	265839	78548.27	41582.81	145707.9	385031.5
16.74633	40.63487	0.000391	900122.3	656393.2	267562.9	79035.6	41880.64	146646.7	388830.3

Household RCHDWR	Household RCHOTSO	Non-profit RCNO	General go RCGO	Gross fixe RIO	Gross fixe RIBO	Gross fixe RIBRO	Gross fixe RIBNSO	Gross fixe RIBNMO	Gross fixe RIBIO

12204.06	18356.18	1796	24344	26023	22496	6769	5681	8764	1282
12620.36	18572.89	1770	25120	27709	23818	7504	5668	9321	1325
12827.73	18533.52	1761	26754	28689	24532	7854	5711	9599	1368
13212.65	18368.61	1761	27442	29679	25294	7409	5933	10544	1408
13332.16	19034.84	1783	28300.76	28295.75	23735	6653	5787	9798	1497
13803.99	19608.01	1826	28670.76	26413.75	21903	6056	5524	8805	1518
14316.01	20268.99	1896	29827.75	25926.76	21557	6290	5634	8127	1506
14701.44	21146.56	1947	30344.74	26660.75	22218	6713	5804	8138	1563
15359.94	21737.31	1959.247	30601	27096	22728	7389	5348	8478	1513
15610.33	22119.92	1949.246	31086	28231	23728	8184	5132	8856	1556
16106.48	22520.77	1979.25	32048	29575	24736	8888	4861	9376	1611
16306.45	22942.8	2032.257	32405	30549	25351	8767	5027	9862	1695
17117.86	23780.14	1999	33034.76	31382.52	26174	8876	5544	9956	1798
17434.94	24041.07	2088	33898.75	31322.51	26037	8696	5912	9600	1829
17868.05	24412.95	2137	35027.75	32213.49	26752	9483	6203	9190	1876
18091.16	25193.84	2176	35854.74	32870.48	27294	9653	6385	9379	1877
18274.94	26140.06	2286.25	37403	34216	28540	9739	6572	10255	1974
18707.95	26793.05	2295.251	37694	35673	29804	9810	6806	11060	2128
18967.52	27610.48	2251.246	38082	38149	32107	10896	7035	11935	2241
19351.98	27638.02	2315.253	39049	39864	33723	11903	7159	12409	2252

19976.53	29474.71	2379	39591	41112.49	34963	12049	7573	12929	2412
20439.63	30194.62	2385	40175	43013.5	36982	12621	8040	13885	2436
20842.59	30794.67	2476	41236	45128.5	39235	13965	8279	14519	2472
21326.06	31583.2	2492	41770	46568.5	40655	14650	8456	14904	2645
22045.18	33247.06	2508	42513.24	49131	42800	16354	8910	14916	2620
22428.01	33734.24	2592	43221.25	50909	44261	17105	9313	15060	2783
22886.89	34264.37	2591	44647.25	54288	47151	18902	9688	15643	2918
23516.72	34925.54	2753	45678.26	55870	48434	19299	10184	15933	3018
24168.89	36082.11	2809	46594	57914	50014	19298	10519	17138	3059
24877.88	37564.12	2796	46930	58022	49860	18979	10875	16852	3154
25608.64	37885.36	2811	48123	61708	53182	20390	11279	18236	3277
26392.19	38948.81	2948	48645	62550	53782	21054	11591	17910	3227
27227.15	40470.85	3057	50140	66362.25	57534	23769	12023	18497	3245
28047.33	41455.67	3177	51558	65248.25	56606	22080	12400	18849	3277
28851.99	41931.01	3256	53197	64896.25	56276	23193	12758	17042	3283
29313.93	42862.07	3246	54433	66296.25	57571	23890	13020	17207	3454
29973.66	44093.34	3350.243	55873	65382.24	55791	22708	12289	17259	3535
30482.35	43648.65	3437.25	57005	60285.24	50641	18098	12000	17073	3470
31187.52	44373.48	3488.253	58550	59204.26	49146	17055	11604	16827	3660
31704.08	45068.92	3496.254	60000	55835.26	45713	14558	11164	16308	3683
32529.77	45220.23	3550	60496.24	56280	46132	14561	11088	16730	3753
33062.69	45387.31	3598	62331.25	55559	45103	15517	10981	14930	3675
33443.35	46423.65	3647	64137.25	56456	46029	16360	10853	15149	3667
33876.99	47356.01	3677	65219.26	55945	45068	15410	10622	15362	3674
34490.6	46672.16	3706	69653.26	54730	44353	14681	10655	15395	3622
34952.92	47511.83	3778	67345.26	54640	43930	15305	9766	15154	3705
35450.77	48489.97	3820	64982.25	55274	44821	16613	9014	15319	3875
35896.51	48947.24	3860	61619.23	53367	43647	16670	8217	14781	3979
36565.12	49125.13	3881	63593	50850.25	41007	14739	7990	14222	4056
36976.32	49896.92	3895	65753	50559.25	40886	14578	7826	14248	4234
37359.4	50710.86	3913	68121	50342.25	40613	14346	7548	14377	4342
37719.16	51471.09	3919	70205	50711.25	40933	14568	7432	14309	4624
38767.68	51458.08	3917	69003	52833.78	42335	15152	6972	15275	4936
39274.72	52184.03	3984	67824	55792.76	45182	15638	6849	17597	5098
39666.23	52749.52	4032	66172	54939.74	43969	15278	6834	16620	5237
40084.97	53506.77	4091	64753	56517.72	45338	15088	6610	18427	5213
41038.74	53383.26	4084	66032	55775	44582	13862	6814	18637	5269
41296.14	54306.86	4129	66749	56351	45076	13295	6739	19816	5226
41593.49	55567.51	4178	66817	55236	43680	12919	6833	18572	5356
41898.04	56183.96	4213	67914	56274	44078	12784	6994	18739	5561
42153.53	57709.22	4292.755	65937	57262.74	45751	13038	7626	19316	5771
42575.72	58151.03	4336.752	66020	57604.76	47108	13902	8296	19188	5722
42999.89	59175.86	4399.749	64238	61441.75	50443	14913	8750	20940	5840
43148.46	59970.29	4490.744	63865	65461.75	54665	16023	9276	23275	6091
43485.89	61350.87	4699.755	64257	67090	56453	16517	9512	24461	5963
43894.99	62603.76	4772.751	65013	68732	57626	16969	9710	24958	5989
44342.03	64506.72	4800.749	66873	69244	58167	17104	9767	25319	5977
44753.49	66534.25	4874.745	67277	68974	58570	17426	9779	25338	6027
45194.48	66566.52	5031	69022.25	69364.76	59230	17260	9952	25720	6298
45443.63	67283.37	5032	68989.25	70685.75	60404	16942	10088	26833	6541
45744.73	67553.27	4994	68378.25	71979.75	61554	16798	10016	28084	6656

46231.56	67946.44	5019	67382.25	75792.74	64727	17256	10324	30319	6828
46560.38	69239.38	5068	69228.24	75949	64215	18222	10772	28668	6553
46915.28	70945.47	5430	70511.25	78837	66806	19770	11232	29180	6624
47391.7	73198.05	5796	72218.25	78180	66120	20213	11743	27376	6788
47979.84	74073.9	5986	74098.26	80013	67694	20330	12313	28240	6811
48463.74	75404.01	5627	75046	81552.24	68837	20728	11903	28600	7606
49027.93	76848.82	5756	77822	81846.24	69204	20732	11045	29431	7996
49596.34	79426.4	5930	78895	83003.25	69707	21924	10083	29169	8531
50011.98	80352.76	6015	78405	83862.26	70208	23093	9541	28627	8947
50649.17	80912.58	6130	79131	86673.76	72401	23683	10249	28809	9660
51156.64	81575.11	6279	80624	87455.76	73055	23689	10829	28705	9832
51702.58	82797.17	6412	82288	86541.75	72111	24564	11044	27292	9211
52374.4	83100.34	6479	83401	86689.74	71706	26160	11055	25822	8669
53067.87	84034.89	6643	82437	87463	72418	26823	11193	25612	8790
53752.12	86869.63	6876	84684	88900	73616	27935	11273	25514	8894
54561.56	87797.19	7084	87546	90396	74648	28607	11327	25369	9345
55329.65	89031.1	7285	90329	91580	75537	29420	11386	24912	9819
55676.93	89293.07	7248.746	90126	92251.27	75001	28561	11573	24893	9974
56330.38	90042.62	7091.751	90602	92196.27	74967	29090	11340	24623	9914
56960.48	90819.52	7031.753	93550	94832.25	77456	30385	11310	25560	10201
57428.61	91712.39	7111.75	93506	97224.21	79772	32156	11269	26256	10091
57995.84	93842.16	7173	95295	97231.24	79841	31642	11584	26001	10614
58739.1	95062.9	7416	96394	100152.2	82262	32937	11891	26230	11204
59392.03	96145.97	7524	97849	103427.3	84905	34782	12167	26131	11825
60051.83	97242.17	7695	98958	104844.3	85443	34739	12418	25954	12332
60428.62	99594.38	7782.761	100545.8	105915.2	86404	34900	12753	26636	12115
61059.16	101477.8	8055.752	102306.7	107754.2	87646	35518	12597	27373	12158
61713.94	102579.1	8259.746	102349.7	109683.3	89402	36064	12540	28588	12210
62421.48	104025.5	8445.74	103105.7	110234.3	89715	35594	12889	29272	11960
62854.25	105471.7	8527.756	105284	113975	92721	37765	13666	29308	11982
63915.69	106474.3	8677.752	108223	114133	92450	37087	14341	28974	12048
64831.47	107841.5	8792.748	110343	114985	93094	36856	14991	29040	12207
65824.59	111010.4	8941.744	113838	117599	95383	37556	15595	29589	12643
66115.24	117952.8	8903	110168.8	118925	96709	39303	15585	30198	11623
66866.48	115565.5	8899	112458.8	119527	96994	39693	16148	29299	11854
67855.51	114770.5	9054	113397.7	121305	98167	41001	16731	28198	12237
69173.18	112948.8	9144	115282.7	120490	96233	42902	16788	24237	12306
69369.85	115831.2	9637	118658	122248.8	97514	41351	17286	25510	13367
70206.63	118777.4	9865	122528	124371.8	99460	41844	17093	27111	13412
70801.92	121955.1	10146	124421	124404.7	100374	40689	16342	29722	13621
71391.21	122854.8	10440	124929	120394.7	97040	36757	15303	31333	13647
71182.6	121590.1	9817	128630	113197	88644	35601	15206	25469	12368
72072.28	120233.5	9564	129081	113008	87155	36610	15033	23384	12128
72922.24	119793.5	9223	130112	116949	88667	38139	15579	22792	12157
73728.87	120356.9	9112	132309	123314	91638	42446	16462	20227	12503
74274.34	123610.7	8986.242	133560.8	126194	93366	43692	16386	20478	12810
75168.2	125558.8	9198.247	134384.8	127027	94203	43223	16009	22046	12925
75982.31	129142.7	9355.252	136273.7	127601	95116	41873	16011	24182	13050
76675.54	132755.5	9628.259	137196.7	127870	95411	41663	16091	24594	13063
77968.34	132521.7	9858	140974.2	127741.7	96972	42530	18047	23423	12972
78672.65	133598.4	10098	141045.2	130271.7	100518	44571	19206	23578	13163

79277.34	134611.7	10291	142275.3	133437.8	104253	47808	21060	21978	13407
79389.27	135968.7	10521	142313.3	136575.8	107596	49010	22735	22309	13542
81143.88	136819.9	10647.75	143464	137935	109149	51211	21658	22327	13953
82012.66	137535.1	10425.75	143693	136992	108215	50002	22263	23229	12721
82221.12	137956.6	10460.75	144532	135430	106871	49019	22500	22536	12816
82309.14	138177.6	10401.75	143983	137667	109193	50168	23043	22948	13034
83902.96	140287	10700.25	147426.3	135600.3	107512	50498	22176	21801	13037
84698.99	142093	10559.25	145814.2	133915.3	106134	50469	21818	20826	13021
86130.75	143309.3	10802.25	146074.3	132629.2	104549	50026	21653	19850	13020
87456.5	144581.5	10990.26	145229.2	130381.2	102667	49823	21309	18292	13243
87281.77	147183.5	11008.25	148077.8	134789.2	107059	49445	22897	20925	13792
88936.02	148617.2	10926.25	148946.8	141637.3	113889	52173	24306	23353	14057
89691.63	150166.6	10930.25	149710.7	147544.3	119824	53972	25671	25695	14486
90057.38	151869.9	10879.25	150668.7	152043.3	124202	54326	26965	27747	15164
90498.89	154119.9	11138	152787.8	154938.8	126976	56231	27520	28588	14637
92467.08	155310.7	11536	153405.8	157504.8	129204	58274	28171	27805	14954
93310.47	157386.3	11883	154030.7	160797.7	132171	59430	28690	28796	15255
94435.56	158927.2	12515	154347.7	162709.7	133916	61065	28751	28683	15417
95381.76	159674.2	12358	155391	163792	134966	64213	27336	27804	15613
96608.35	159657.7	12959	156666	162612	134173	65431	26190	26774	15778
96238.42	162284.6	12940	156088	161371	132776	67514	26237	23382	15643
97300.67	163774.3	12999	157687	162826	133746	69914	25257	22881	15694
98353.99	165871	13301.75	159712.8	173995.2	144351	77685	25815	24785	16066
99506.98	168439	13299.75	161827.8	171289.2	140693	71162	26309	26764	16458
100880.6	171121.4	13310.75	162545.7	171117.3	139277	68139	27363	26680	17095
102293.3	173621.7	13323.75	164613.7	176500.3	143249	69475	27869	28124	17781
103321.9	174748.3	13752.24	166412	180025	146495	69473	29308	29121	18593
104566.6	176248.6	13911.25	168460	181365	148579	69575	30625	29370	19009
104830.4	178308.8	14220.25	171392	184871	151987	71860	32206	28503	19418
105691	179536.3	14632.26	173844	184216	152664	70152	33401	28967	20144
107697.7	180328.3	14660	174102.8	183698	151012	67809	32156	31632	19415
110063.6	182019.4	14804	174574.8	183192	151186	69472	32292	29870	19552
112503.2	184564.8	14801	174430.8	188314	156334	74980	32751	29095	19508
113397.1	187497.9	14987	176127.7	188671	157299	75971	33068	29159	19101
113908.3	179132.7	14903	177590	192979	160403	76601	35389	29031	19382
113117.3	123288.7	13174	176741	166069	134336	63213	31421	20923	18779
115023.6	143548.4	14412	183252	202274	168729	91141	32022	25541	20025
116366.5	140821.5	15091	187801	215380	180497	96465	32716	30169	21147
116981.8	141659	15012	195022	234964.2	199080.2	116164.2	33414	27716	21786
118442.3	143483.9	15231	195167	237078.8	201288.8	114937.8	35135	29390	21826
120477.2	160562.2	15653	196453	231388.7	194181.7	106187.7	36311	29982	21701
122254.8	172237.9	15697.58	198237.6	232945.2	194215.6	112009.9	31092.67	29146.12	21966.84
123766.1	176660.8	15848.21	198461.7	235637.5	196001.3	112018.4	31964.44	29735.21	22283.25
124826.1	185969.4	16103.66	200097.2	236079.1	195662	110424	32336.45	30293.81	22607.73
125819.7	196479.8	16297.05	201499.2	236512.6	195609.9	109363.4	32543.33	30546.64	23156.45
126847.8	202778.6	16500.75	202523.2	236157.8	195111.5	107888.5	32799.79	30839.16	23583.99
128507.6	206302.7	16689.7	203758.6	236869.5	195722	107652	33148.49	31066.12	23855.39
130072.9	208174.5	16879.4	205157.1	238725.5	197318.8	108581.1	33485.36	31128.26	24124.03
131602.8	209559.8	17066.41	206496	240498	198793.3	109459.6	33690.89	31237.15	24405.65
133055.9	211066.1	17250.5	207722	242133.7	200362.7	110436.3	34021.6	31252.5	24652.24
134771	213247.6	17423.06	208831.1	243815.3	201884.1	111459.8	34322.22	31195.23	24906.83

136483.3	215276.7	17590.47	210034.5	245507.7	203437.1	112375.4	34791.69	31127.27	25142.8
138197.2	217292.3	17750.35	211229.4	246998.1	204792.6	113252.8	35276.72	30916.57	25346.51
139923.6	219282.8	17909.1	212412.8	248677.3	206338.7	114124.7	35745.88	30945.86	25522.28
141536.1	221353.4	18053.44	213863.3	250782.5	208267	115220.1	36234.66	31089.64	25722.53
143166	223320.3	18196.4	215364.1	253104	210381	116311.8	36781.79	31343.62	25943.79
144756.8	225271.1	18340.59	216863.6	255140.9	212205.7	117267.8	37356.96	31432.97	26147.92
146369.8	227265.9	18484.91	218401.9	257231.1	214077.8	118308.8	37896.81	31510.01	26362.19
147957.9	229509.2	18629.39	219945.2	259430.7	216057.6	119844.6	38048.23	31567.68	26597.05
149561	231694.9	18793.44	221493.4	261996.4	218397.3	121361.4	38578.73	31619.16	26837.97
151176.5	233854.9	18959	223046.6	264511.3	220682.3	122896	39055.27	31656.37	27074.67
152810.4	236019.9	19124.13	224605	267065.3	223003.6	124425.2	39419.52	31849.38	27309.51

Gross fixe	Gross fixe	Investmen	Exports of	Exports To	Exports of	Exports of	Exports To	Exports of	Exports of
RINO	RIGO	RNO	RXO	RXIO	RXIGO	RXISO	RXPO	RXPGO	RXPSO

175	3352	1953	75633	35178	31790.71	3387.292	40455	25028.66	15426.34
185	3706	1878	76952	37804	34163.85	3640.15	39148	24220.05	14927.95
196	3961	-754	77324	39381	35589	3792	37943	23474.54	14468.46
212	4173	-3945	77587	40093	36232.44	3860.558	37494	23196.75	14297.25
218	4342.745	-1688	77479	40195	36302.45	3892.547	37284	21850.97	15433.03
211	4299.748	-6015	77743	40157	36268.13	3888.867	37586	22027.96	15558.04
202	4167.755	-5234	78342	40117	36232.01	3884.994	38225	22402.46	15822.54
209	4233.752	-7623	79388	40371	36461.41	3909.591	39017	22866.62	16150.38
223	4145	-1930	81252	41123	37147.54	3975.465	40129	23202.61	16926.39
234	4269	-2546	84470	43452	39251.38	4200.615	41018	23716.63	17301.37
232	4607	57	88066	46535	42036.34	4498.657	41531	24013.25	17517.75
231	4967	407	92104	50409	45535.83	4873.166	41695	24108.08	17586.92
233.7662	4974.758	2474	96370	54851	50187.93	4663.075	41519	24274.14	17244.86
247.7522	5037.755	3896	100052	58547	53569.72	4977.285	41505	24265.95	17239.05
257.7423	5203.747	3280	103143	61239	56032.86	5206.141	41904	24499.23	17404.77
260.7393	5315.741	1338	105393	62644	57318.42	5325.585	42749	24993.26	17755.74
253	5423	998.8861	107547	63581	57752.39	5828.611	43966	25606.38	18359.62
260	5609	1520.827	109390	64184	58300.11	5883.889	45206	26328.57	18877.43
268	5774	3423.61	111214	64927	58975	5952.001	46287	26958.16	19328.84
279	5862	2824.678	113189	66056	60000.5	6055.499	47133	27450.88	19682.12

275.7511	5873.743	1798	115025	67313	60018.34	7294.659	47712	26583.12	21128.88
278.7484	5752.749	811	116921	68718	61271.08	7446.917	48203	26856.68	21346.32
276.7502	5616.755	-487	118628	69930	62351.74	7578.261	48698	27132.47	21565.53
276.7502	5636.754	-470	119034	69763	62202.84	7560.163	49271	27451.73	21819.27
276	6055	-240	120025	69988	61771	8217	50037	27387.94	22649.06
292	6356	-308	121492	70477	62202.59	8274.411	51015	27923.25	23091.75
308	6829	-828	123869	71583	63178.74	8404.262	52286	28618.94	23667.06
316	7120	1192	126602	72776	64231.67	8544.327	53826	29461.87	24364.14
313	7587	1583	130610	75132	66082.23	9049.772	55478	29445.23	26032.77
314	7848	3310	132837	75682	66565.98	9116.02	57155	30335.3	26819.7
328	8198	2105	135563	76807	67555.47	9251.528	58756	31185.04	27570.96
341	8427	1862	137945	77762	68395.44	9366.56	60183	31942.43	28240.57
342	8486.254	1189.186	140024	78669	69140.72	9528.279	61355	31770.15	29584.85
347	8295.248	2764.432	141110	78924	69364.84	9559.164	62186	32200.45	29985.55
348	8272.248	2195.343	142194	79580	69941.38	9638.618	62614	32422.07	30191.93
367	8358.25	251.0392	142967	80366	70632.18	9733.817	62601	32415.34	30185.66
372	9219.243	-859	143349	81183	70907.85	10275.15	62166	30258.97	31907.03
367	9277.244	17	143697	82342	71920.16	10421.84	61355	29864.22	31490.78
349	9709.256	-6010	142450	82264	71852.03	10411.97	60186	29295.21	30890.79
328	9794.258	-6096	140829	82068	71680.84	10387.16	58761	28601.6	30159.4
319	9829	-2159.12	136378	79110	68841.94	10268.06	57268	26163.33	31104.67
321	10135	-6708.38	138005	82132	71471.7	10660.3	55873	25526.02	30346.98
343	10084	-5526.32	140675	85958	74801.11	11156.89	54717	24997.89	29719.11
361	10516	-3078.18	134329	80456	70013.24	10442.76	53873	24612.3	29260.7
338	10039	-5470	137627	84296	73684.62	10611.38	53331	24398.14	28932.86
331	10379	-3919	142329	89325	78080.56	11244.44	53004	24248.54	28755.46
325	10128	-4623	143980	91142	79668.83	11473.17	52838	24172.6	28665.4
326	9394	-5124	150740	97893	85570	12323	52847	24176.72	28670.28
326	9517.252	-3406.42	153974	100914	88864.99	12049.01	53060	23040.6	30019.4
329	9344.248	-1835.23	159689	106099	93430.9	12668.1	53590	23270.75	30319.25
331	9398.249	-447.055	162188	107674	94817.85	12856.15	54514	23671.98	30842.02
338	9440.25	-2447.3	170928	115133	101386.3	13746.74	55795	24228.24	31566.76
351.7801	10147	-96	170009	112703	100072.6	12630.42	57306	28062.48	29243.52
385.7589	10225	-1398	183764	124919	110919.6	13999.44	58845	28816.13	30028.87
418.7383	10552	987	187967	127686	113376.5	14309.53	60281	29519.33	30761.67
443.7227	10736	955	201011	139492	123859.4	15632.61	61519	30125.57	31393.43
450	10743	2225.843	208990	146503	130937.7	15565.29	62487	31006.02	31480.98
427	10848	5552.608	203215	139982	125109.5	14872.46	63233	31376.19	31856.81
404	11152	5498.611	207532	143763	128488.8	15274.18	63769	31642.15	32126.85
379	11817	874.9382	220259	156092	139507.9	16584.08	64167	31839.64	32327.36
406	11105.74	-2557	219882	155286	137480.1	17805.95	64596	30329.26	34266.74
442	10054.76	-7339	224414	159207	140951.4	18255.55	65207	30616.14	34590.86
477	10521.75	-1327	227783	161627	143094	18533.04	66156	31061.72	35094.28
495	10301.75	6175	215965	148584	131546.5	17037.46	67381	31636.88	35744.12
466	10171	2225	229084	163150	143497.6	19652.4	65934	29834.23	36099.77
442	10664	5158	236787	169116	148745	20371.04	67671	30620.2	37050.8
417	10660	2349	246671	175851	154668.7	21182.31	70820	32045.08	38774.92
359	10045	4384	247501	174323	153324.7	20998.25	73178	33112.04	40065.96
334	9800.758	10234.33	252508	180849	159236	21612.96	71659	30085.34	41573.66
327	9954.755	3467.774	254243	184528	162475.4	22052.63	69715	29269.17	40445.83
329	10096.75	-902.941	259880	191724	168811.4	22912.62	68156	28614.63	39541.37

362	10703.74	2540.834	277574	209608	184558.1	25049.9	67966	28534.86	39431.14
366	11368	-1122	281442	211033	187320.9	23712.06	70409	28557.97	41851.03
387	11644	-838	281997	209150	185649.5	23500.48	72847	29546.82	43300.18
376	11684	-1067	295681	219838	195136.6	24701.4	75843	30762	45081
355	11964	-665	299900	220627	195836.9	24790.06	79273	32153.21	47119.79
379	12336.24	-846	311422	230709	204074.2	26634.82	80713	32185	48528
413	12229.24	2611	315599	233843	206846.4	26996.63	81756	32600.91	49155.09
451	12845.25	5737	320132	237189	209806.1	27382.92	82943	33074.23	49868.77
489	13165.26	6406	325832	242584	214578.2	28005.76	83248	33195.86	50052.14
492.757	13780	1538	320488	236234	207704.4	28529.57	84254	35125.7	49128.3
495.7555	13905	29	319259	234400	206091.9	28308.08	84859	35377.92	49481.08
508.7491	13922	-1221	308790	223721	196702.6	27018.4	85069	35465.47	49603.53
530.7383	14453	-4554	304823	219693	193161.1	26531.94	85130	35490.9	49639.1
570	14475	-4289	315010	228366	198872.9	29493.09	86644	37478.94	49165.06
580	14704	2183	319841	231610	201698	29912.05	88231	38165.42	50065.58
579	15169	1375	327988	238857	208009	30847.99	89131	38554.72	50576.28
571	15472	6327	322842	232623	202580.1	30042.88	90219	39025.35	51193.65
564.2739	16686	8143	317260	226722	196162.9	30559.12	90538	39396.02	51141.98
550.2671	16679	3671	304962	214401	185502.6	28898.41	90561	39406.03	51154.97
509.2472	16867	-4330	305795	214064	185211	28852.99	91731	39915.14	51815.86
436.2118	17016	600	310516	217986	188604.4	29381.62	92530	40262.81	52267.19
320	17070.24	-1968	315840	221566	191424.9	30141.14	94274	39933.67	54340.33
285	17605.25	-4128	332744	237338	205051.3	32286.71	95406	40413.18	54992.82
329	18193.25	5805	330075	233490	201726.8	31763.24	96585	40912.59	55672.41
466	18935.26	9863	321512	223946	193481.1	30464.91	97566	41328.14	56237.86
659.2055	18852	6023	322457	224152	193302.2	30849.76	98305	39145.78	59159.22
796.2482	19312	3725	327134	228180	196775.9	31404.13	98954	39404.22	59549.78
864.2694	19417	2635	332338	233096	201015.3	32080.71	99242	39518.91	59723.09
888.2769	19631	97	339323	239960	206934.6	33025.4	99363	39567.09	59795.91
940	20314	1468.094	335166	233498	200623.6	32874.36	101668	40172.55	61495.45
934	20749	7129.456	328830	225062	193375.4	31686.65	103768	41002.33	62765.67
892	20999	5916.379	329750	224301	192721.5	31579.51	105449	41666.55	63782.45
834	21382	1110.071	341058	234131	201167.5	32963.48	106927	42250.56	64676.44
625	21591	759	348809	242374	208946.3	33427.74	106435	42498.99	63936.01
606	21927	-592	345539	236947	204267.7	32679.26	108592	43360.27	65231.73
652	22486	9590	333449	223857	192983.1	30873.91	109592	43759.56	65832.44
769	23488	9931	328232	218095	188015.8	30079.23	110137	43977.18	66159.82
980.7813	23754	2224	330347	218429	185271.5	33157.51	111918	42909.93	69008.07
1097.755	23814	7203	335769	222730	188919.6	33810.4	113039	43339.73	69699.27
1194.734	22836	8497	337287	225575	191332.7	34242.28	111712	42830.95	68881.05
1210.73	22144	6972	316286	210842	178836.2	32005.81	105444	40427.77	65016.23
870	23683	940.7441	286367	183496	148341	35155.04	102871	37919.06	64951.94
875	24978	841.771	274715	170599	137914.8	32684.17	104116	38377.98	65738.02
864	27418	996.7289	282838	176735	142875.3	33859.73	106103	39110.4	66992.6
963	30713	896.7561	294712	186346	150644.9	35701.06	108366	39944.56	68421.44
853.7647	31974.25	3591	302215	190795	152978.3	37816.7	111420	38029.84	73390.16
884.7561	31939.25	752	308612	196385	157460.3	38924.68	112227	38305.28	73921.72
900.7517	31584.25	4969	310254	198359	159043.1	39315.93	111895	38191.96	73703.04
988.7275	31470.25	-2824	321480	209090	167647.1	41442.88	112390	38360.92	74029.08
987	29782.74	2760.117	325161	208246	166768.4	41477.6	116915	39770.4	77144.6
952	28801.75	10155.43	326220	206978	165753	41225.05	119242	40561.96	78680.04

952	28232.75	4942.209	340297	222020	177798.9	44221.05	118277	40233.7	78043.3
933	28046.76	5830.246	345481	225851	180866.9	44984.1	119630	40693.94	78936.06
954	27832	4588	344465	224599	179334.9	45264.07	119866	38618.34	81247.66
1052	27725	4784	348574	228849	182728.4	46120.58	119725	38572.91	81152.09
1127	27432	3842	343423	224072	178914.1	45157.86	119351	38452.41	80898.59
1243	27231	-2474	339866	220180	175806.5	44373.49	119686	38560.34	81125.66
1270.255	26818	344	348193	224250	175198.5	49051.47	123943	40018.26	83924.74
1272.255	26509	-762	359312	231935	181202.6	50732.45	127377	41127.01	86249.99
1230.247	26850	1826	360024	227310	177589.2	49720.8	132714	42850.2	89863.8
1215.244	26499	6444	367439	230357	179969.7	50387.29	137082	44260.53	92821.47
1229.248	26501	8290	370643	234296	187227.2	47068.76	136347	40197.2	96149.8
1240.25	26508	5952	376066	241891	193296.5	48594.55	134175	39556.86	94618.14
1246.251	26474	4824	385172	256272	204788.4	51483.61	128900	38001.71	90898.29
1240.25	26601	10646	384080	259485	207355.9	52129.08	124595	36732.53	87862.47
1192	26770.75	11292.16	388231	261378	209994.3	51383.7	126853	35482.2	91370.8
1210	27090.75	5172.991	395123	265709	213473.9	52235.12	129414	36198.54	93215.46
1220	27406.75	-3171.61	417705	286420	230113.4	56306.65	131285	36721.88	94563.12
1206	27587.75	-8073.55	424798	291670	234331.3	57338.73	133128	37237.39	95890.61
1078.711	27747.25	-5391.54	429926	298528	237565.6	60962.43	131398	35476.29	95921.71
982.737	27456.25	-887.959	412899	282885	225117	57767.98	130014	35102.62	94911.38
888.7621	27706.25	3827.891	417083	287629	228892.3	58736.75	129454	34951.42	94502.58
785.7897	28294.25	2159.604	414680	285514	227209.2	58304.84	129166	34873.67	94292.33
853	28791.24	6569.79	421017	288598	228282.8	60315.16	132419	34310.03	98108.97
951	29645.24	6809.782	431995	297196	235083.9	62112.09	134799	34926.69	99872.31
1040	30800.25	10292.67	411166	274146	216851.2	57294.78	137020	35502.16	101517.8
1140	32111.26	7615.757	419872	279615	221177.2	58437.77	140257	36340.87	103916.1
1047	32483	7817.29	424138	283981	217729.6	66251.39	140157	37526.29	102630.7
1015	31771	8381.311	440820	299368	229526.9	69841.1	141452	37873.02	103579
972	31912	4100.152	447813	304231	233255.4	70975.61	143582	38443.32	105138.7
934	30618	6685.248	448347	306325	234860.9	71464.13	142022	38025.64	103996.4
961	31725	9603	450859	307156	233511.8	73644.16	143703	37885.35	105817.7
906	31100	9520	458209	313578	238394.1	75183.9	144631	38130	106501
857	31123	3581	460095	315303	239705.5	75597.49	144792	38172.45	106619.6
824	30548	5788	451574	306615	233100.6	73514.45	144959	38216.47	106742.5
864	31712	2002	442562	297685	225240.7	72444.26	144877	39173.97	105703
923	30810	-15125	362221	233001	176298.2	56702.84	129220	34940.4	94279.6
1037	32508	-17178	446222	301228	227921.5	73306.48	144994	39205.6	105788.4
1112	33771	865	456055	305830	231403.6	74426.42	150225	40620.04	109605
1061	34823	-5522	460688	308906	233731	75174.99	151782	41041.04	110741
1031	34759	2970	449406	295155	223326.4	71828.56	154251	41708.65	112542.4
1087	36120	-3257	465629	305478	231137.2	74340.76	160151	43303.97	116847
1116.205	37613.47	796.4977	460325.4	307268.9	237526.6	69742.3	153056.5	40973.7	112082.8
1132.392	38503.75	713.9913	468830.3	313234.1	243457.7	69776.43	155596.1	41113.18	114483
1143.813	39273.31	3225.856	481275.1	322517.2	250062.6	72454.57	158757.9	41126.53	117631.4
1151.569	39751.17	4573.906	493727.9	332996.4	257969.1	75027.37	160731.5	40936.13	119795.4
1161.461	39884.86	7743.478	502923.4	340502.7	263357.3	77145.37	162420.7	40830.29	121590.4
1169.311	39978.25	8703.548	511720.5	346901	268159.6	78741.41	164819.5	41012.26	123807.3
1176.286	40230.41	9730.959	518665.2	351999.2	271675.4	80323.81	166666	41127.06	125538.9
1182.633	40522.07	8520.909	525440.6	356888.8	275202.8	81686.07	168551.8	41278.21	127273.6
1189.97	40581.05	7625.992	530991	360877.2	277994.1	82883.06	170113.8	41351.73	128762.1
1199.393	40731.86	6049.072	536086.9	364969.8	280881.8	84087.94	171117.1	41511.77	129605.3

1210.782	40859.8	5699.465	542275.4	369548.2	284510	85038.19	172727.2	41704.03	131023.2
1222.81	40982.72	4544.398	547833.8	373668.4	287644.9	86023.53	174165.4	41857.24	132308.2
1235.648	41102.93	3728.271	553227	377526.8	290466.6	87060.18	175700.2	42040.97	133659.3
1246.847	41268.71	3866.402	558854.1	381454.5	293513.9	87940.65	177399.6	42202.27	135197.4
1259.237	41463.8	4006.1	564549.1	385459.5	296620.8	88838.62	179089.6	42356.54	136733.1
1271.687	41663.53	4138.905	570000.3	389259.2	299514.9	89744.3	180741.2	42508.11	138233
1284.779	41868.46	4281.027	575703	393302.1	302652.1	90650.07	182400.9	42667.77	139733.1
1297.304	42075.81	4400.634	580917.6	396783.1	305198.5	91584.62	184134.5	42853.6	141280.9
1310.007	42289.07	4587.906	586744.6	400934.4	308414.1	92520.25	185810.2	43014.42	142795.8
1322.776	42506.15	4750.889	592473.8	405046.4	311612.3	93434.09	187427.3	43175.6	144251.7
1335.603	42726.09	4869.49	598255.9	409183.2	314783	94400.19	189072.7	43334.37	145738.3

Imports of RMO	Imports To RMIO	Imports of RMIGO	Imports of RMISO	Imports To RMPO	Imports of RMPGO	Imports of RMPSO	Statistical RSO	Final dome RYFDDO	Final cons RYCKO

70820	42509	36564.57	5944.428	28311	19668.23	8642.77	2113	119579.5	232491.2
69094	42553	36602.42	5950.58	26541	18438.57	8102.425	-178	123540.5	235872.2
67895	42486	36544.79	5941.211	25409	17652.15	7756.849	-1211	126947.5	239586.3
67499	42676	36708.22	5967.781	24823	17245.04	7577.955	-2023	130092.5	244078.3
66164	40957	34627.07	6329.93	25207	16793.2	8413.803	-2110	130498.5	238846.3
64792	38916	32901.51	6014.492	25876	17238.89	8637.107	1093	130794.5	236512.3
64516	37782	31942.77	5839.231	26734	17810.5	8923.498	-458	133020.5	234659.2
65077	37401	31620.65	5780.348	27676	18438.07	9237.926	348	135935.5	232810.2
67293	38965	33364.76	5600.244	28328	19435.65	8892.351	-1832	139719.5	235367.2
70719	41879	35859.94	6019.058	28840	19786.93	9053.072	-575	142985.5	240342.2
74571	45448	38915.99	6532.013	29123	19981.09	9141.907	-1471	147945.5	244987.3
78736	49515	42398.46	7116.542	29221	20048.33	9172.67	-1142	150976.5	248047.3
82579	53128	46490.4	6637.602	29451	20116.05	9334.945	-1857	155532.3	249898.2
86041	56135	49121.71	7013.285	29906	20426.84	9479.165	-979	157933.3	251815.2
88956	58178	50909.47	7268.53	30778	21022.44	9755.558	-406	161103.2	252737.3
91272	59299	51890.42	7408.583	31973	21838.67	10134.33	698	164908.2	257193.3
94389	61378	53567.98	7810.016	33011	21982.32	11028.68	892	170941	261015.2
96264	62702	54723.51	7978.488	33562	22349.24	11212.76	1178	174898	263912.2
97810	64552	56338.11	8213.89	33258	22146.8	11111.2	-574	180510	267128.3
99031	66875	58365.52	8509.479	32156	21412.97	10743.03	23	184969	271784.3

100307	69400	59921.33	9478.672	30907	18827.24	12079.76	-900	190346.5	272591
101114	71135	61419.36	9715.639	29979	18261.95	11717.05	-608	194669.5	275018
101848	71956	62128.23	9827.771	29892	18208.95	11683.05	-897	200727.5	279784
102736	72001	62167.08	9833.918	30735	18722.47	12012.53	266	204023.5	280107
103404	71398	61269.59	10128.41	32006	19800.42	12205.58	38	210920.5	282979
105292	71949	61742.43	10206.57	33343	20627.55	12715.45	650	216417.5	287619
107769	73422	63006.47	10415.53	34347	21248.67	13098.33	376	223174.5	289467
111057	76170	65364.65	10805.35	34887	21582.74	13304.26	-556	228569.5	293831
114496	79297	68634.5	10662.5	35199	21777.22	13421.78	-392	235290.8	296763.2
117857	82381	71303.82	11077.18	35476	21948.6	13527.4	590	238948.8	300662.2
120556	84620	73241.76	11378.24	35936	22233.19	13702.81	99	246191.7	302585.3
122519	85898	74347.92	11550.08	36621	22656.99	13964.01	1167	250782.7	305589.3
124238	86874	74105.84	12768.16	37364	22832.14	14531.86	533	259147.5	307837.2
125086	87049	74255.12	12793.88	38037	23243.39	14793.61	256	263699.5	312884.3
125467	86961	74180.05	12780.95	38506	23529.99	14976.01	462	266246.5	313629.3
125966	87288	74458.99	12829.01	38678	23635.09	15042.91	5	270861.5	315417.3
125851	87269	72652.81	14616.19	38582	22764.53	15817.47	766	273782.7	319861
124829	86667	72151.64	14515.36	38162	22516.72	15645.28	1063	269411.7	315800
123381	85979	71578.87	14400.13	37402	22068.29	15333.71	1305	271663.8	317414
121361	84978	70745.52	14232.48	36383	21467.05	14915.95	97	271240.8	316785
118099	82815	68272.75	14542.25	35284	19600.84	15683.16	-3352	271603.5	312874
119382	85081	70140.84	14940.16	34301	19054.77	15246.23	-495	274971.5	318104
122093	88499	72958.64	15540.36	33594	18662.02	14931.98	-1206	280263.5	318344
120612	87364	72022.95	15341.05	33248	18469.81	14778.19	390	280917.5	320718
123833	90633	75910.48	14722.52	33200	18294.26	14905.74	1144	282677	320452
127670	94231	78924.02	15306.98	33439	18425.96	15013.04	592	282763	321069
130629	96710	81000.33	15709.67	33919	18690.45	15228.55	1438	284847	321523
136015	101482	84997.16	16484.84	34533	19028.78	15504.22	1770	281392	322716
138804	103681	86966.25	16714.75	35123	19578.09	15544.91	1686	281745	324275
143845	108351	90883.38	17467.62	35494	19784.89	15709.11	1816	284371	324185
145977	110487	92675.03	17811.97	35490	19782.66	15707.34	1554	287304	324397
149537	114393	95951.33	18441.67	35144	19589.8	15554.2	584	291079	325239
151235	116531	100519.7	16011.29	34704	19621.52	15082.48	538	294058	327956
162930	128499	110843.3	17655.68	34431	19467.17	14963.83	217	297651	329691
164381	129812	111975.9	17836.09	34569	19545.19	15023.81	1551	296830	331507
175560	140387	121097.9	19289.08	35173	19886.69	15286.31	1394	300265	334170
181150	145081	125922.1	19158.94	36069	20561.2	15507.8	105	302250	334223.8
178139	141049	122422.5	18626.48	37090	21143.23	15946.77	15	304453	335489.8
179149	141061	122432.9	18628.07	38088	21712.14	16375.86	-927	305832	337231.7
182333	143321	124394.5	18926.52	39012	22238.87	16773.13	-1029	307373	336438.8
185137	145239	124354.5	20884.48	39898	24105.7	15792.3	-279	309405	338506
183148	142284	121824.4	20459.57	40864	24689.34	16174.66	-598	311691	338096
190052	148055	126765.6	21289.41	41997	25373.88	16623.12	-1042	316269	337275
190828	147590	126367.5	21222.54	43238	26123.67	17114.33	660	323266	340979
200250	156297	134584.6	21712.4	43953	25686.73	18266.27	1844	328084	344514
211581	166818	143644	23173.95	44763	26160.1	18602.9	1573	334044	348711
215542	170133	146498.5	23634.46	45409	26537.64	18871.36	-325	340582	354624
219187	173104	149056.8	24047.19	46083	26931.53	19151.47	220	344438	359687
221440	176143	151124.4	25018.56	45297	24449.9	20847.1	-713	347233	360787
223456	178560	153198.1	25361.86	44896	24233.45	20662.55	606	352473	363187
224841	180016	154447.3	25568.66	44825	24195.13	20629.87	-9	353944	362809

241300	195521	167750.1	27770.92	45779	24710.07	21068.93	-396	357793	362449
239911	192574	164987.8	27586.19	47337	26196.05	21140.95	688	364338.2	369318
242812	193534	165810.3	27723.71	49278	27270.19	22007.81	1555	373831.2	375129
250888	199623	171027	28595.95	51265	28369.78	22895.22	33	381129.3	381715
256120	203045	173958.8	29086.15	53075	29371.43	23703.57	1360	386992.3	387354
265939	210881	181049.3	29831.67	55058	31382.83	23675.17	1776	393078	390419
269261	212121	182113.9	30007.09	57140	32569.56	24570.44	1929	399795	393925
276149	216439	185821.1	30617.92	59710	34034.45	25675.55	1060	408925	398349
280952	219532	188476.5	31055.46	61420	35009.15	26410.85	-525	411014	399547
272867	211796	180230	31566.05	61071	35143.82	25927.18	355	416497.3	402845.2
272566	210890	179459	31431.02	61676	35491.98	26184.02	1688	422379.3	404887.2
260140	199800	170021.8	29778.17	60340	34723.16	25616.84	-649	424445.3	406613.3
258312	199067	169398.1	29668.92	59245	34093.04	25151.96	487	428883.2	410654.3
265028	203863	173178.7	30684.26	61165	35151.65	26013.35	48	433011.5	411514
273932	211570	179725.7	31844.28	62362	35839.57	26522.43	1836	441191.5	419060
277840	214403	182132.3	32270.68	63437	36457.37	26979.63	923	449863.5	423957
277972	213912	181715.2	32196.78	64060	36815.41	27244.59	421	458760.5	431509
274548	209344	175581.6	33762.4	65204	38986.83	26217.17	-1856	461986.5	432089.2
266758	200967	168555.6	32411.38	65791	39337.81	26453.19	1342	462676.5	433545.3
264549	197566	165703.1	31862.87	66983	40050.53	26932.47	1497	471992.5	434284.3
272005	202951	170219.6	32731.35	69054	41288.83	27765.17	908	473796.5	434293.3
275944	206941	174901	32039.96	69003	41553.75	27449.25	2072	480828.2	440233.8
286611	217116	183500.7	33615.32	69495	41850.03	27644.97	1993	487671.2	443290.8
291455	221138	186900	34238.03	70317	42345.04	27971.96	-591	496134.3	448954.7
287779	217577	183890.3	33686.69	70202	42275.79	27926.21	-2631	503005.3	452804.7
290297	219046	185998.3	33047.65	71251	42141.51	29109.49	-1690	509545.5	456634.8
296539	224102	190291.5	33810.46	72437	42842.97	29594.03	996	517007.5	459197.8
297884	223895	190115.8	33779.23	73989	43760.9	30228.1	2173	523010.5	461117.8
302828	227497	193174.3	34322.66	75331	44554.63	30776.37	2473	529723.5	464405.7
301295	225803	191351.6	34451.38	75492	43542.5	31949.5	-793	538271.8	470257.8
301544	224846	190540.6	34305.37	76698	44238.1	32459.9	-819	544325.8	474580.8
305588	227347	192660.1	34686.95	78241	45128.08	33112.92	493	549237.7	478762.7
316166	235824	199843.7	35980.31	80342	46339.9	34002.1	1130	558144.7	482758.7
321986	241512	204513.3	36998.68	80474	46678.21	33795.79	-445	565719.5	478448
311310	229933	194708.2	35224.82	81377	47201.99	34175.01	-957	570240.5	485304
310821	228283	193311	34972.05	82538	47875.42	34662.58	322	572346.5	492588
307211	223168	188979.5	34188.45	84043	48748.38	35294.62	-477	578496.5	502452
312613	227580	193218.2	34361.82	85033	49453.18	35579.82	-32	588015	506025.3
326460	238158	202199	35958.97	88302	51354.36	36947.64	-595	598579	508582.3
335229	245314	208274.6	37039.44	89915	52292.44	37622.56	-650	605876	506816.3
324862	244336	207444.2	36891.77	80526	46832.02	33693.98	1649	598242	500168.2
284193	208254	169022.6	39231.45	75939	40760.34	35178.66	-550	591569.8	502757.8
273110	194662	157991.1	36670.95	78448	42107.05	36340.95	-1286	591374.8	504761.8
285042	200861	163022.3	37838.73	84181	45184.25	38996.75	24	598104.8	509839.7
293887	203431	165108.1	38322.88	90456	48552.36	41903.64	184	608586.7	513864.7
304144	214758	173218	41540.04	89386	49233.3	40152.7	-178	619325	519613
311225	223792	180504.5	43287.46	87433	48157.6	39275.4	831	625870	522587
316614	231064	186369.9	44694.07	85550	47120.45	38429.55	-571	635430	525645
314817	230218	185687.6	44530.43	84599	46596.65	38002.35	-1774	645363	530995
325151	237085	194507.5	42577.47	88066	47676.88	40389.12	766	650333	531538
334758	243975	200160.2	43814.82	90783	49147.8	41635.2	-388	655155	533297

342068	250048	205142.5	44905.46	92020	49817.49	42202.51	-1147	661673	533237
349451	257024	210865.7	46158.26	92427	50037.83	42389.17	-283	666214	532868
349710	258475	211202.1	47272.92	91235	48732.65	42502.35	-345	675560.2	538757
346901	254251	207750.6	46500.39	92650	49488.46	43161.54	-756	674282.3	537606
336418	244572	199841.8	44730.18	91846	49059.01	42786.99	-869	674691.3	538676
332604	241655	197458.3	44196.69	90949	48579.88	42369.12	1030	678134.3	539605
341910	247843	201020.8	46822.2	94067	52349.81	41717.19	-4	684712.8	541592.2
350459	254151	206137.1	48013.9	96308	53596.96	42711.04	-1429	686394.8	545309.3
355272	256560	208091	48469	98712	54934.83	43777.17	-152	690997.7	548113.3
362620	261695	212255.9	49439.1	100925	56166.4	44758.6	729	690960.7	549385.3
369081	263303	214643.9	48659.14	105778	57334.07	48443.93	-571	702666.5	551085.8
378876	277397	226133.3	51263.75	101479	55003.91	46475.09	680	718031.5	556606.8
382888	283036	230730.2	52305.85	99852	54122.04	45729.96	-783	729204.5	559855.7
392259	297155	242239.9	54915.08	95104	51548.52	43555.48	-1309	737679.5	563083.7
399545	302292	246734.1	55557.9	97253	49549.12	47703.88	-237	745754.3	567548.8
401946	302854	247192.8	55661.19	99092	50486.07	48605.93	1116	753976.3	571127.8
411356	310132	253133.2	56998.81	101224	51572.29	49651.71	-1080	764607.2	574283.8
413573	309954	252987.9	56966.09	103619	52792.52	50826.48	-1615	774561.2	579983.7
416801	315144	254125.6	61018.36	101657	50617.56	51039.44	-3942	778694.7	581935
408785	308721	248946.3	59774.73	100064	49824.37	50239.63	1312	780480.7	586014
409745	311652	251309.8	60342.23	98093	48842.96	49250.04	1241	781443.8	586532
408826	312491	251986.3	60504.68	96335	47967.61	48367.39	2888	790737.8	590679
422088	322031	262582.3	59448.65	100057	50865.85	49191.15	-97	811309.5	597909
433769	330626	269590.7	61035.34	103143	52434.67	50708.33	-1442	818573.5	604549
422314	317671	259027.2	58643.78	104643	53197.23	51445.77	621	824311.5	610599
429046	321293	261980.6	59312.42	107753	54778.25	52974.75	-430	838947.5	615027
438114	329736	267674.9	62061.06	108378	55200.4	53177.6	1332	849885.5	618657
450877	340994	276814	64179.97	109883	55966.94	53916.06	37	858297.5	623987
456174	345972	280855.1	65116.91	110202	56129.42	54072.58	1136	871145.5	629416
457864	351270	285155.9	66114.06	106594	54291.75	52302.25	-2618	876132.5	633392
464075	355751	285350.6	70400.45	108324	55093.33	53230.67	747	878710.3	634093
460903	350063	280788.2	69274.84	110840	56372.96	54467.04	413	884304.3	634144
458966	347145	278447.6	68697.38	111821	56871.89	54949.11	-1657	895635.2	637103
455053	342426	274662.5	67763.53	112627	57281.82	55345.18	-272	900793.3	637720
447745	338310	271191.6	67118.38	109435	56382.04	53052.96	-2157	893999	626283
348820	257138	206123.6	51014.41	91682	47235.51	44446.49	995	782446	550532
433575	330740	265123.5	65616.55	102835	52981.66	49853.34	-1077	885494	609463
443332	341376	273649.3	67726.66	101956	52528.79	49427.21	1437	902473	609969
443295	336045	269376	66669.02	107250	55256.31	51993.69	-200.5	934595	614560
442056.9	332929	266878.2	66050.83	109127.9	55688.06	53439.82	-200.5	938403.9	614450
453970.3	340602	273028.9	67573.1	113368.3	57851.94	55516.34	-200.5	965635.1	637294
446385.4	332594.7	267198.1	65396.62	113790.7	57632.19	56158.52	-200.5	981136.8	645373.2
452848	336356.3	271806.8	64549.47	116491.8	58657.86	57833.91	-200.5	989396	648093.7
469025.9	348099.3	281219	66880.26	120926.7	60691.93	60234.73	-200.5	1002013	656246.7
484644.2	359897.6	289514.1	70383.49	124746.6	62318	62428.63	-200.5	1015527	664822.7
493375.3	366222.2	293080.5	73141.71	127153.1	63277.07	63876.03	-200.5	1024557	670268.5
499771.3	371432.1	296331.6	75100.51	128339.2	63757.26	64581.97	-200.5	1033793	674947.8
505277.8	375711	299307.6	76403.35	129566.9	64286.96	65279.91	-200.5	1042450	678253.5
510347.3	379330.5	301935	77395.49	131016.9	64928.97	66087.88	-200.5	1050267	680862.5
515035.5	382679.5	304297.8	78381.72	132356	65511.05	66844.96	-200.5	1057979	683366.2
519860.4	386504	307119.3	79384.66	133356.4	65952.53	67403.91	-200.5	1066895	686670.1

524573.7	389828.8	309478.9	80349.9	134744.8	66591.53	68153.29	-200.5	1075471	689441.7
528821.8	392875.9	311598.2	81277.66	135945.9	67134.46	68811.48	-200.5	1083885	692308.1
533418.7	396257	314023.7	82233.28	137161.7	67683.08	69478.62	-200.5	1092404	695042.4
538462.5	399940.2	316698.3	83241.95	138522.3	68445.26	70077.03	-200.5	1101484	697813.7
543546.8	403707.5	319446.8	84260.65	139839.3	69189.15	70650.18	-200.5	1110579	700361.2
548186.6	407054.2	321825.2	85228.97	141132.4	69924.43	71207.96	-200.5	1119350	702938.9
552946.9	410546	324311.4	86234.58	142400.9	70649.73	71751.15	-200.5	1128284	705498.8
558102.3	414428.7	327151.8	87276.85	143673.6	71385.81	72287.8	-200.5	1137852	708515.2
563207.1	418248.5	329928.7	88319.77	144958.7	72126.55	72832.1	-200.5	1147651	711293.8
567971.3	421748.4	332418.4	89330.06	146222.9	72864.9	73357.99	-200.5	1157387	714091
572787.9	425328.2	334990.2	90337.97	147459.7	73589.09	73870.62	-200.5	1167188	716879.2

Household	Household	Household	Household	Household	Investmen	Household	Household	Household	Non-profit
RCHKO	RCHGOK(	RCHDUK(	RCHSDK(	RCHNDK(	RNKO	RCHSEK(	RCHDWR	RCHOTSK	RCNKO

151781.2	73107.67	12384.26	10887	53562	354	79691	32038.33	47652.67	3385
157563.2	74561.58	12022.26	10364	57194	1280	82205	32171.59	50033.41	3185
162317.3	75780.76	11341.24	10073	60806	11	85143	32430.42	52712.58	2999
169358.3	78135.55	11120.24	9748	65214	-1829	87905	32498.06	55406.94	2811
162373.3	75703.25	10688	9518	63210.27	-2813	85923	32569	53354	2783.243
159072.3	73291.92	10620	9730	59627.25	-5878	84304	32736.89	51567.11	2811.245
156703.2	72287.73	10587	10127	57597.24	-8374	82679	32902	49777	2891.252
151339.2	71573.71	10977	10593	55117.23	-8847	79850	33215.71	46634.29	2970.259
158150	73725.16	11503	10570	57024	-2090	84739	33891.58	50847.42	2938
159140	76064.66	12239	10508	58874	-1989	82607	34019.01	48587.99	2868
166613	77082.19	12955	10466	58986	-620	86765	34266.25	52498.75	2844
168021	79009	13431	10404	60784	75	87069	34278.76	52790.24	2814
168505.8	78705.59	13742	10718	59237	3900	86952	35104.31	51847.69	2707.762
169279.8	79792.98	14230	11027	59224	5252	87711	35245.8	52465.2	2798.754
171111.7	80822.08	14881	11333	58877	4036	89830	35392.19	54437.81	2872.747
172578.7	81833.3	15567	11598	58550	3136	90343	35498.9	54844.1	2980.738
177239	83247.59	16121	11691.75	59264	2939.243	92139	35246.84	56892.16	3188.25
177695	85194.77	16805	11822.75	60371	2456.203	91011	35456.73	55554.27	3219.252
180529	87082.83	17334	11967.75	61642	4292.355	92017	35714.76	56302.24	3146.247
182593	88069.59	17848	12093.75	61807	2416.2	91953	35958.48	55994.52	3198.251

186242	88521.4	18111	12405	61394	1441.842	95924	36475.08	59448.92	3221.256
187644	89815.62	18158	12653	62556	540.1913	96658	36826.69	59831.31	3141.25
189959	90479.74	18471	12896	62435	-464.305	96768	37164	59604	3161.251
190931	90879.64	18720	13050	62247	-849.728	98386	37353.43	61032.57	3052.243
194770	91661.78	19121.24	13132	62418.75	87	101477	38487.16	62989.84	2999.242
197592	92567.97	19641.25	13224	62528.75	67	102549	38545.31	64003.69	3064.247
198772	93715.31	20016.25	13294	63241.75	245	103573	38905.07	64667.93	3052.246
200634	95143.46	20445.26	13318	64306.75	1017	104417	39512.47	64904.53	3272.264
205170	96665.66	20974	13437.75	65150	2995.26	107579	40352.09	67226.91	3314
207240	97079.5	21250	13425.75	65229	2650.23	108608	40692.1	67915.9	3244
208993	97754.49	21528	13548.75	65406	2893.251	109270	41059.93	68210.08	3184
210101	98495.3	21660	13615.75	66019	2969.258	109511	41454.69	68056.31	3230
213525	98819.94	21532	13663.25	66578	1008.878	112843	42431.74	70411.26	3267
215496	99035.59	21767	13793.25	66217	3060.629	114767	42933.35	71833.65	3343
214984	98386.37	21135	13743.25	66558	3592.565	115835	43327.63	72507.37	3418
217515	98628.01	21142	13672.25	66983	589.9285	118563	43529.68	75033.32	3432
216627	98242.59	21067	13728.25	66516	-697.952	117920	44018.54	73901.46	3719
215102	97128.71	20154	13724.25	66629	-2921.8	118089	44638.91	73450.09	3972
215838	96721.38	19889	13489.25	66955	-5230.64	118498	45462.92	73035.08	4170
216241	95156.8	19746	13302.25	65528	-5821.6	119341	46020.43	73320.57	4319
209672.2	92695.52	18786	12477	65369	-4337	117088	46092.52	70995.48	4438.242
212081.3	94205.24	20349	12619	64599	-7201	117841	46516.06	71324.94	4547.248
213488.3	93860.36	19531	12531	65573	-5210	119000	46702.93	72297.07	4652.253
214474.3	92823.87	18370	12529	66095	-5420	121007	47004.48	74002.52	4730.258
211068	91563.2	18711	12049	64807.75	-4827	119456.8	47034.5	72422.26	4656.754
213648	92516.82	18697	12450	65331.75	-3740	120707.8	47551.39	73156.36	4725.75
216977	95030.95	19580	12907	66309.75	-3918	121664.7	47994.19	73670.56	4745.749
218747	96582.88	20104	13214	66910.75	-6527	122226.7	48425.12	73801.62	4763.748
218761	96206.3	19886.26	13044	67065.75	-5425.41	122692.8	48396.05	74296.7	4767.252
218216	95141.92	19391.25	12991	66591.75	-4029.56	123077.8	48930.14	74147.61	4746.251
217618	93894.21	19140.25	12798	65751.75	323.965	123571.7	49268.11	74303.64	4719.25
217817	93651.91	19038.25	12607	65934.75	-124.986	123845.7	49581.69	74264.06	4667.247
221415	96229.37	19666	12781	67884.25	125	124941	49914.56	75026.44	4712.238
223489	97752.82	20024	13287	68343.25	339	125576	50220.77	75355.23	4867.246
224584	98420.4	20199	13565	68412.25	833	126085	50510.4	75574.6	5022.253
227828	100584.8	21555	13923	68300.25	907	127094	50925.07	76168.93	5218.263
228557	100681.5	21139.26	14120	68766.75	3005	127690.8	51216.19	76474.57	5134
228335	99886.98	20308.25	14157	69062.75	5526	128310.8	51429.63	76881.12	5118
230578	100592.7	20653.25	13965	69719.75	4108	129858.7	51713.81	78144.94	5133
229198	98832	19943.24	13566	69346.75	3101	130355.7	51937.57	78418.18	5127
231954	100042.2	20344	13725	69947.25	890.3858	131914.2	52057.72	79856.53	5335.769
233204	100651.3	20495	13689	70534.25	-3837.66	132565.2	52345.64	80219.61	5561.759
235441	101562.9	20988	14099	70172.25	-432.187	133859.3	52698.3	81160.95	5875.745
237437	103486.6	22225	14355	70142.25	1071.464	133793.3	52987.94	80805.31	6282.728
239789.2	104525.8	22435	14505	70857.75	664	135179.2	53356.71	81822.53	6779
243735.2	106309.2	23571	14545	71180.75	2990	137309.2	53525.35	83783.9	6892
248878.3	108502.7	24302	14822	72285.75	5350	140266.3	53901.72	86364.53	6805
252045.3	109944.8	25592	14756	72107.75	6740	141957.3	54242.62	87714.64	6648
252132.2	109638	24708	15331.25	72183	10461.44	142400.3	54535.55	87864.7	6661.745
256264.3	113295.2	26055	15635.25	74085	4324.767	142733.3	55000.23	87733.02	6539.75
255734.3	113494.6	26161	15721.25	74017	208.9887	142010.2	55086.15	86924.1	6436.754

255605.3	112833.1	25976	15800.25	73347	3548.809	142580.3	55347.68	87232.57	6501.751
260862	116005.5	27361.76	16118	74562	-1422	144620	55630.87	88989.13	6709
264586	117798	27836.76	16392	75587	-213	146531	55997.42	90533.58	7329
270341	120864.7	29405.74	16380	76943	-1104	149140	56384.42	92755.58	7917
272279	121480.4	29591.74	16586	77072	491	150469	56901.69	93567.31	8245
275268	122967.7	30134	16743	77808	3894.249	151909.8	57126.52	94783.23	7739.242
277851	124400.1	30369	17180	78499	4044.258	153107.8	57626.2	95481.55	7904.247
283622	127254.2	31663	17678	79224	5357.342	155959.7	58304.15	97655.6	8127.254
282631	126170.7	30194	17975	79629	2360.151	156314.7	58459.53	97855.22	8261.258
284413	126664	31264.25	17754	78997.25	-108.975	157361	58661.52	98699.48	8168
285923	127318.4	30799.25	18209	79747.25	412.9064	158263	59732.85	98530.15	8300
286660	126820.7	30173.24	17832	80632.25	-1459.67	159799	60009.36	99789.64	8427
290384	129901.2	32183.26	18117	80951.25	-3256.26	160201	59953.87	100247.1	8553
294380	133016.8	33078	18952	82096	-2808.43	160922.2	60583.08	100339.2	8754.241
296806	132333.8	33311	18790	81189	1143.177	164172.3	61569.07	102603.2	9110.251
298578	132914.6	33569	18625	81760	2379.368	165450.3	61763.48	103686.8	9189.253
303588	136569.3	34842	19161	83479	5745.889	166735.3	63156.77	103578.5	9290.256
304522	137053.1	34502	19446	84102	4077.796	167065.8	63224.9	103840.9	8905
306684	137491.5	34552	19673	84218	3587.7	168868.8	63946.22	104922.5	8616
308668	138435.6	35437	19904	83767	-2021.39	169819.7	63944.76	105875	8379
308246	136969	33325	19369	85713	-520.102	171217.7	64507.72	106710	8196
312128	138811.8	34138	19811.24	86112	-1609	173193	65236.33	107956.7	8253
312723	138384.6	33852	20013.25	85721	-3629	174203	65786.87	108416.1	8351
316987	140353.7	34738	20559.25	86044	6243	176370	66310.31	110059.7	8518
320242	141585	35732	20504.25	86215	9895	178274	67091.69	111182.3	8698
323280.8	142106.8	35955	20655	86315	3831	180859.8	67290.65	113569.1	8809
325688.8	143013.7	35654	21060	87185	2073	182538.8	67911.1	114627.7	9036
327880.8	144035.6	36320	20843	87764	2384	183776.7	68614.94	115161.8	9232
332401.7	147252.9	37239	21758	89012	1312	185032.7	69327.72	115705	9463
333810.8	146351.7	37607	22163	87044.75	2396	187517	68989.53	118527.5	9531.248
335209.8	147046.1	37137	22477	87999.75	6473	188541	69819.98	118721	9604.25
338374.8	148694.7	38095	22804	88239.75	4472	190158	70998.24	119159.8	9607.25
344036.7	149292.1	38713	23104	87779.75	495	193396	71931.45	121464.6	9725.253
348221.2	149614.8	38492	23431	87993.76	2190	194448	71401.28	123046.7	9600
350584.3	152057.4	38955	23437	90090.75	-814	196866	71963.91	124902.1	9349
351098.3	152752.7	39302	23778	90020.75	8166	199170	72974.6	126195.4	9357
353772.3	157119.3	41307	24230	91814.74	11614	201332	73841.82	127490.2	9370
357160	158653.1	42649	24404.25	91694.25	7635	202018	73778.09	128239.9	9843
360323	158503.3	42128	25096.25	91335.25	5990	202870	74725.41	128144.6	10086
360677	157079.5	41899	24553.25	90707.25	6836	201986	74751.14	127234.9	10409
359840	155131.2	40504	24382.25	90367.25	2491	201530	74871.75	126658.2	10754
357315.8	154757.8	39641	24171	91145.25	-944	201601	75289.59	126311.4	10060.74
358141.8	155713.8	40400	24010	91505.25	-2495	202180	76079.78	126100.2	9959.744
360717.7	157648.4	42158	24281	91291.25	422	203541	76636.48	126904.5	9500.756
361256.7	157796.6	42649	24338	90846.25	4941	204114	77119.35	126994.6	9422.758
366866	160004.2	42286.75	25445	92304	4848	206905.2	78063.6	128841.6	9345
370435	160819.9	42385.75	25406	93087	2256	209339.2	77844.24	131495	9689
373635	161720.9	43116.75	25676	92940	2594	211568.3	78078.04	133490.2	9675
378764	164814.1	44282.74	25969	94569	-6634	214467.3	78633.72	135833.5	9963
378907	164059.7	43379.75	26134	94567	3011.139	214892.2	79254.26	135639.2	10162.75
378484	162520.7	43585.75	25846	93096	6081.281	216171.3	79725.95	136347.3	10340.75

378811	162296.5	42633.75	26018	93656	5429.251	216584.3	80145.34	136308.5	10178.75
378534	161598.1	42724.75	26322	92549	7126.329	216604.3	80751.25	136080.1	10253.75
382865	164337.3	44194	26539.25	93601.25	4287.601	218399	81437.58	136972.3	10216.76
383184	163752.5	43775	26375.25	93601.25	3642.661	219214	81422.49	137513.9	10447.75
384629	164735.8	43370	27028.25	94339.25	3941.633	220068	82048.81	138011.6	10523.75
386358	166035.4	43777	27185.25	95074.25	-1131.89	220495	82777.92	137991.5	10771.74
388054.8	166473	43372	27364	95734	2251.873	221593.2	83183.23	138420	11033
391677.8	169062.5	45771	27434	95857	1553.912	222621.2	83914.93	138894.2	10775
394495.7	170493.2	46081	28067	96352	4415.75	224011.3	84241.37	139722.9	10833
396047.7	171130.6	46112	28459	96573	9442.465	224926.3	84869.67	139905.6	10795
397443	171789	46260	28193	97335.25	9978.284	225664	86165.76	139932.1	10915
401670	173542.6	48364	28629	96609.25	7897.225	228120	85460.47	142354.9	10827
405176	176043.8	50078	28908	97151.25	6555.187	229137	86246.5	142733.4	10867
407875	177967.1	50686	29134	98240.25	10693.3	229931	86766.47	143192.5	10799
410344.2	178643.8	50017.76	29376	99340.75	10942.01	231705.8	87991.82	144087.1	11089
412915.2	179049.5	50971.75	29742	98431.75	5964.549	233837.8	88402.42	145391.9	11295
416040.3	181520.2	52371.75	29918	99324.75	-871.08	234553.7	88699.74	145747.8	11498
421228.3	185253.1	53854.74	31040	100466.7	-5171.48	236078.7	89440.43	146414.9	11790
422087	185611.3	55198	31188	99338	-4427	236559	90529.74	145968.9	12006.76
424131	185273.6	54065	30620	100696	676	238889	90607.06	147862.7	12558.75
425620	186471.4	54735	30497	101337	5204	239197	91011.01	148472.2	12710.75
428774	188210.2	56222	30959	101121	4159	240611	91642.58	149161.8	13039.74
434577.2	191643.1	58021	31568	102141	6806	243018.2	92325.37	150932.8	12793
441171.2	196243.6	59642	32941	103778	7090	245097.2	92928.92	152193.8	12830
446279.3	197188.4	60167	33253	103892	11000	249211.3	94133.79	155002.7	12699
449888.3	198536.6	61210	33230	104205	6808	251465.3	94932.33	156342.3	12622
451932.8	200067.9	61291	33484	105402	9555.558	252011	94914.88	157085.4	12708.25
454843.8	201540.5	61899	33847	105914	6831.093	253446	95747.3	157520.3	12782.25
458262.7	204188.8	62647	34141	107509	2825.113	254273	96398.72	157981.7	12764.25
460060.7	205425.7	62779	34288	108459	8504.237	254858	96997.1	157942.7	12929.25
461485.2	205568.2	63312	34640	107746.8	12086.17	256132	97726.25	158516.7	13084
461816.2	204258.6	62143	34828	107440.8	9682.334	257692	97937.13	159613.6	13205
465209.3	205069.3	61841	34951	108419.7	5710.121	260238	98299.56	161744	13255
466025.3	203546.4	61700	34449	107524.8	8209.377	262474	98917.46	163781.3	13512
454981	200023	56285	31461	112135	2407	255053	99777.94	155275.1	13424
385965	180079.2	46311	26055	107424	-10812	206827	99090.11	107736.9	11785
436101	211557.4	64872	34480	111998	-13872	225953	100059.2	125893.8	12823
433460	210144.8	63487	32855	113487	-1227	224611	100594.4	124016.6	13201
435701	210714	62882	33315	114240	-3102	226263	101034.8	125228.2	12982
433659	206921.8	61525	32131	112934	4178	227886	101291.4	126594.6	13069
455704	213929.8	60993	38389	114216	-2192	242923	102405.9	140517.1	13339
462615	212364.7	60540.31	38020.41	113472.3	1025.91	251399.1	103094	148305.1	13403.73
465149.9	211115.5	60812.36	36963.48	113007.9	895.2564	255183.2	103674.9	151508.3	13531.93
472385.1	210594.8	60833.66	36736.5	112692.9	3569.664	262939	104102.6	158836.4	13657.79
480687.4	210223.8	60781.3	36606.38	112504.4	4941.217	271612.4	104491.8	167120.5	13781.02
486194.9	210609.5	60954.22	36719.22	112604.2	8491.305	276734.2	104959.3	171774.9	13898.6
490745.3	211955.2	61503.6	37012.58	113107.2	9643.135	279938.9	105904.7	174034.2	13971.91
493759.7	213187.8	62026.8	37282.53	113546.7	10772.75	281720.6	106764.3	174956.4	14044.13
496111.7	214151.5	62452.96	37497.71	113869.1	9402.087	283108.9	107556.6	175552.3	14112.41
498491.9	215073.3	62959.85	37661.1	114120.6	8411.286	284567.4	108300.4	176267	14176.65
501820.1	216308	63344.26	37913.39	114718.6	6640.34	286660.9	109173.4	177487.5	14229.86

504510.5	217131.8	63602.29	38100.33	115097.5	6247.261	288527.5	110026.8	178500.7	14277.4
507300.4	218025.8	63881.8	38298.9	115513.4	4949.933	290423.4	110878.8	179544.6	14317.46
510006.8	218882.4	64152.81	38490.37	115907.5	4033.146	292273.1	111730.3	180542.8	14355.35
512562	219597.9	64344.67	38697.15	116224.3	4187.543	294112.9	112494.2	181618.7	14422.08
514823.3	220175.9	64491.16	38883.22	116469.8	4343.751	295796.1	113251.4	182544.7	14486.94
517096.4	220779	64645.36	39074.42	116727.5	4492.239	297466.1	113971	183495.2	14552.02
519355.7	221370.8	64795.92	39264.35	116978.7	4651.166	299133.7	114695.6	184438.1	14616.44
522104.7	222237.6	65022.21	39509.97	117373.7	4784.649	301015.9	115403	185612.9	14680.25
524615.1	222971	65209.33	39734.43	117695.4	4994.157	302793	116105.5	186687.4	14743.06
527143.7	223708.1	65397.35	39960.31	118018.6	5176.36	304584.4	116815.1	187769.3	14806.06
529664.9	224435.3	65582.38	40185.39	118335.7	5308.728	306378.4	117530.1	188848.4	14867.74

General g	Gross fixe	Business ç	Business ç	Business ç	Business ç	Business ç	Gross fixe	Gross fixe	Exports of
RCGKO	RIKO	RIBKO	RIBRKO	RIBNSKO	RIBNMKO	RIBIKO	RINKO	RIGKO	RXKO

68691.78	47157	39266.24	20952	13378	6057	1901	290	5512.216	119327
73735.76	48379	41069.25	24171	14008	6061	2190	343	6144.241	122553
79526.74	47236	40588.25	26100	14609	6115	2464	397	6734.264	120576
85529.72	46660	40768.25	26409	15506	6455	2736	470	7157.28	122781
82545	45322	38903	22621	14451	5613	2701	443.7111	7016	118841
79560	42295	35434	19532	13295	5020	2476	414.73	6704	117488
76923	40553	33126	19416	12882	5152	2217	354.769	6374	116402
73668	41538	33585	20236	12520	5098	2102	322.7899	6414	109065
75936	42405	34719.77	22471	11952	5140	2177	365	6187	113559
77645	44363	36892.75	24876	11933	5264	2340	403	6432	121220
80117	45858	38519.74	26418	11772	5693	2505	433	7059	123774
81610	47302	40047.73	26607	12371	5890	2742	479	7750	135047
81816.25	47897.75	40282	26862	13032	6037	2785	480	7676.255	138622
82269.25	48276.75	40324	26216	13683	5796	2761	477	7539.25	138900
82994.25	49110.75	40753	27262	13981	5547	2744	459	7567.251	140487
82388.25	49642.75	40877	27080	14164	5664	2614	432	7365.244	143531
84687	51727.77	42899	27248	14571	6206	2793	436	7640	150509
85373	54852.75	45916	27333	15272	6834	2992	460	8041	147317
86119	57376.74	48409	30813	15802	7438	3147	495	8513	147239
87125	58746.74	50036	33047	16067	7943	3188	525	8578	147479

86878	61305.24	52520.24	31831	17175	8343	3466	500	8719	153847
86434	63046.25	54132.25	32437	17812	8756	3396	484	8563	153504
88218	64616.25	55652.25	34038	18265	9032	3418	465	8124	154196
87874	66844.26	57647.26	34149	18316	9245	3612	447	7730	155345
88825	67921.76	58388.76	36948	19131	9400	3592	433	8453	159592
88116	70536.75	60660.75	36916	19519	9543	3718	455	8882	156023
90292	73732.74	63718.74	40154	19710	9918	3953	470	9587	155355
91307	74288.74	64099.74	39958	19916	10155	3989	486	9878	163366
92372.25	76222	65327.24	38863	20129	11076	4018	469	10406	171348
91595.25	77461	66003.25	37257	20971	10950	4199	470	10677	173016
92653.25	80202	68423.26	39864	21913	11692	4250	471	11164	166657
92659.25	79791	67498.25	40997	22191	11278	4257	486	11345	171939
94293	82965	70797	43854	22615	11743	4289	475.2491	11379	176577
94539	82173	70337	40941	22919	12101	4320	470.2465	11077	173139
97299	81622	69911	42580	23247	10774	4278	468.2454	10900	177773
97209	84284	72515	44036	23527	10986	4574	494.259	11136	181851
98469.75	81501	69131.28	41568	21747	10869	4613	497	12214	180463
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102710.7	69787	55826.22	28402	19927	10533	4665	438	13047	168469
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103445	71255.75	56768	28546	20248	9926	4677	450	13808.25	170931
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105656.7	66861	52588	27731	19162	10609	4691	479	14050	172914
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104528.8	61323	48246	27232	13368	9443	6362	471.7442	13563	201914
104490	64572	50930.23	28106	12350	10130	6556	486.2222	14273	201253
104434	68862	54708.25	28671	11995	11688	6736	529.2419	14081	209126
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103180	74443	58698.27	27144	11480	12437	6794	604.2762	14186	227975
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104731.7	71137	55802.25	24081	11667	13109	6967	571	14547.24	221767
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102962.8	69832	54126.24	23482	11962	12609	7561	522	16201.27	239029
101896	72726.76	57349	24041	12904	13210	7971	563	15228	238357
101269	74190.76	59334	25235	13778	13320	7883	615	13668	245681
98238	78358.75	63592	27094	14422	14399	7847	642	14289	248181
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97630	83372.76	69468.76	28890	15689	16723	7773	650	13628	250656
98078	85436.75	71095.75	29660	15695	17231	7756	588	14105	257260
101020	87618.75	72832.75	30558	15827	17853	7821	542	14025	269395
102328	87351.75	72642.75	30957	15625	17689	7682	464	13186	270561
104052.7	87392.25	73001.76	29916	15772	17502	7932	425.2619	12596	275697
102502.7	88151.25	74107.75	29315	16025	18155	8401	396.244	12970	275859
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98456.76	90500.26	76738.74	29698	16376	20942	9067	412.2539	14418	293536
101269	92114.24	77520	31225	16869	19707	8237	436	15154	302391
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104636	98229.25	81827	33737	18179	19724	8656	478	15205	320314
107889	101276.3	84405	33977	19051	20704	8530	468	15336	326360
108447	101607	84884.25	34149	18010	21043	9164	486	15706.76	336558
107037	100839	84253.25	33826	16294	21653	9679	510	15755.76	337212
107525	101861	84718.25	35958	14680	21621	10519	543	16557.74	340971
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112848	102715	83556.76	40969	15866	18873	9850	629.2618	18342.74	322218
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118334	110338	89366.75	42473	15577	19427	11360	632	20481	331756
117374	109360	88018.75	42895	15292	20336	11190	588	20835	333297
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122909	115068.8	92977.75	44361	15254	21191	12703	324	21191.25	354890
123456	117761.7	96185.75	47054	15313	21689	13154	372	21563.25	354113
123225	121581.7	99726.74	46673	15339	22312	13768	525	22217.26	353289
123427.2	121896.2	99379.25	46729	15784	22917	13527	745	22357.25	352580
123973.3	123246.2	99747.25	46476	15545	23468	13832	897	22738.25	355020
123991.3	124676.3	100528.3	46209	15370	24981	13910	990	22786.25	363509
124208.3	125001.3	100529.3	45117	15636	25875	13528	1012	23006.25	367907
126869	128105	103412.8	47589	16433	25954	13552	1052	23361.76	366490
128772	129181	104591.8	46306	17170	26272	13389	1029	23784.75	361327
130329	129516	104752.8	45812	17770	26436	13344	974	23960.75	358328
130910	131166	105798.7	46417	18371	26866	14031	901	24244.75	362794
129192	127469	103334	47443	18326	27620	12827	677	23401	358102
129049	128196	101679	47054	18467	26882	13060	649	24298	363233
129009	133385	109768	47597	18671	26495	13408	691	24832	367619
129458	136682	109911	48691	19108	23656	13365	807	25621	363474
132218.8	138022	110695.7	46986	19204	25533	14554	972	26166.27	353376
135449.8	134030	108051.7	47568	18185	25925	14518	1095	24927.26	349170
136684.7	128730	104237.8	45733	17202	27339	14410	1211	23561.24	339714
137882.7	119606	96090.77	41445	15996	27215	14386	1238	22009.23	317152
137657.8	113606	88734	40042	15957	21809	12819	876.7618	23909	289057
137762.8	116936	89929	41190	15971	20757	12589	897.756	26060	283983
139056.7	123889	93638	42676	16879	20385	12979	899.7555	29305	297229
140478.7	130977	97255	46956	17589	18242	12882	1005.727	32698	308460
141707.2	133353	98646	47872	17316	19250	13345	898	33215	314424
142896.3	133200	98839	47245	16725	21156	13428	923	33508	319810
142889.3	133247	98978	45375	16682	23619	13506	934	33504	316909
143055.3	131460	98681	44276	16757	25048	13504	1013	31937	324633
142971	131975	100707	45335	18682	23799	13422	1004	30526.26	324613
143874	134304	103675	46698	19713	23893	13528	966	29528.25	328042

144179	136909	106866	49473	21414	22117	13706	978	28529.24	342239
144280	138208	109404	49914	22995	22104	13817	956	28216.24	349150
145087	138788	110224.3	51539	21693	22331	14169	965	27820	346377
144423	137169	108297.3	50150	22487	22844	12673	1056	27889	348047
143508	135322	106742.2	49071	22414	22620	12825	1124	27380	344134
142654	136745	108164.3	49641	22870	23244	12857	1231	27131	337771
142491	134217	106240	49661	21998	22003	12812	1256	26603	344949
142861	132576	105212	49887	21590	20962	12844	1258	26093	358212
142828	130404	103106	48818	21221	19766	13190	1207	26115	356636
142608	127535	100854	48422	20727	18197	13258	1191	25601	362663
142769.2	130153.2	103568.2	47371	22062	20371	13604	1203.249	25471.75	360974
144119.3	135401.2	109045.2	49579	23242	22649	13539	1205.25	25171.75	367787
143859.3	139646.3	113443.3	50605	24366	24701	13856	1211.251	24964.75	377662
144436.3	142559.3	116191.3	50546	25486	26139	14245	1204.25	25123.75	376932
146137.2	143825	117693	51787	25904	26460	13672	1141.747	24982	371946
146944.3	145445	119330	53402	26513	25599	13789	1141.747	24982	373315
146786.3	146222	120161	53549	27107	25655	13906	1132.749	24938	383964
147024.3	146972	121176	54582	27160	25398	14037	1099.756	24730	387702
147891	146891	120962	56285	25835	24592	14132	990	24965	394061
149371	146340	120607	56989	24722	24184	14370	909	24858	383320
148265	144520	118512	57863	24299	21318	14260	833	25174	383631
148933	142913	116495	58828	23568	20614	14223	736	25643	377336
150576	149997.3	123282	62422	24040	22446	14574	791	25923	385104
150597	147905.2	120632	57716	24376	23860	14862	864	26422	389722
151660	149377.2	120835	55660	25074	24660	15432	935	27675	382705
152551	152848.3	123351	55986	25294	25507	15944	1014	28556	387938
154054.2	155983.3	126264	56066	26523	26531	16805	935	28859	390324
156403.2	155776.3	126828	56036	27642	26197	17198	908	28074	398269
158437.3	156684.3	127924	57037	28916	25129	17600	870	27913	399906
160449.3	154788.2	127296	55161	29848	25287	18256	843	26618	401445
159569.7	154928	126416.2	53926	28484	27253	17441	859.7266	27575	403499
159156.8	152401	124795.2	54258	28380	25597	17262	806.7434	26759	409349
158673.8	156065	128565.3	58094	28895	24922	17004	758.7587	26748	410361
158211.8	155274	128563.3	58610	28789	24825	16448	718.7714	26046	402831
157945	157256	129626	58207	30701	24502	16621	751	26934	394309
152389	136771	109220	48308	27498	17839	16306	804	26595	325404
160589	162287	133470	65864	27872	21642	17496	898	27973	392826
163369	170410	140631	67717	28397	25733	18405	955	28926	394768
165899	179514	149323	76716	28109	23982	18833	895	29270	392180
167679	176952	147440	73152	28363	26179	18956	846	28609	372067
168208	169889	139598	65695	28308	26123	18682	871	29363	381445.3
169311.4	171793.6	140560.7	71887.09	23958.05	25094.77	18830.78	886.4131	30289.5	383599.9
169368.9	173531.1	141694.2	71841.03	24570.53	25488.23	19004.41	894.2701	30885.61	385999.8
170160.8	174732	142249.8	71430.46	24892.98	25938.14	19198.25	901.6366	31523.54	394668.7
170311.3	175827.3	142899.6	71234.25	25131.58	26179.39	19564.41	907.4893	31963.18	403217.3
170132	176094.7	143068.5	70687.18	25322.99	26443.52	19824.8	912.7862	32056.41	409462.8
170187.6	176619	143587.5	70731	25482.28	26629.52	19954.67	918.4331	32056.09	414634.9
170406.6	177706	144570.6	71367.8	25657.92	26674.16	20080.68	923.0862	32155.33	419135.2
170595.4	178584.9	145330.9	71832.06	25735.12	26759.28	20214.41	927.1322	32269.94	422577.1
170654.6	179159.4	145988.9	72216.27	25907.39	26757.83	20317.4	931.1406	32182.39	425299.5
170577.2	179599.1	146446.8	72538.16	25995.91	26698.05	20424.69	935.7313	32159.55	428186.4

170610.8	180044.5	146929.3	72776.08	26214.44	26630.74	20518.09	940.7249	32117.4	431039.1
170647.2	180239.1	147164.6	72906.78	26444.33	26440.24	20583.28	945.9012	32071.56	433389.1
170637.3	180564.6	147534.2	73004.68	26662.13	26452.79	20624.57	951.4049	32021.99	435631.2
170786.6	181186.5	148168.8	73236.38	26896.31	26561.03	20685.11	955.435	32005.27	437984.7
171008	181983.4	148953.2	73476.16	27167.92	26759.64	20759.46	960.4766	32012.76	440430.2
171247.5	182598.4	149552.2	73667.32	27456.56	26816.13	20822.18	965.8167	32023.42	442705.4
171483.7	183193.1	150127.6	73866.93	27716.34	26862.62	20891.71	971.2769	32037.23	445108.3
171687.2	183802.8	150717.2	74371.5	27684.62	26894.98	20976.13	976.2456	32052.38	447039
171892.6	184681.8	151572.9	74868.01	27933.37	26921.36	21060.1	981.2153	32070.76	449318
172098.3	185503	152368.3	75364.68	28139.28	26932.08	21142.31	986.1858	32091.46	451535.2
172303.5	186365.4	153202.9	75852.16	28261.37	27075.99	21223.35	991.1571	32114.38	453735.2

Exports Tc	Exports of	Exports of	Exports Tc	Exports of	Exports of	Imports of	Imports Tc	Imports of	Imports of
RXIKO	RXIGKO	RXISKO	RXPKO	RXPGKO	RXPSKO	RMKO	RMIKO	RMIGKO	RMISKO

51356	42778.65	8232.047	75858	51593.59	35807.59	97649	53062	40926.72	14533.23
52774	44712.4	8391.605	79777	45787.04	30932.44	97143	53056	43533.81	15245.72
51637	44057.99	8051.946	80087	44628.1	29344.47	96440	53820	41785.26	14428.83
53008	44774.95	7996.402	78562	43403.27	27911.5	98384	55609	40002.21	13616.22
51658	43642.53	7737.653	75793	40561.31	30338.03	91061	51436	36886.21	13912.56
54275	44752.43	7910.642	72607	39332.4	29424.03	85966	47351	35698.57	13261.36
54801	46425.53	8117.659	69953	38394.21	28532.88	85141	44692	36035.53	13176.94
48514	42843.51	7394.046	65375	42144.08	31077.07	82360	43065	34031.69	12241.15
52295	44290.88	7478.719	66717	42234.3	32038.26	86696	45901	37039.8	11930.61
55761	47946.15	8004.959	72124	41563.67	31354.53	89395	50180	38916.95	12353.52
57680	49638.19	8204.133	74733	41579.61	31216.1	96976	54913	42599.08	13363.7
63712	53980.78	8824.189	81427	40642.43	30327.11	103057	59851	46460.17	14444.18
70444	59260.78	8482.844	77918	41690.2	30573.09	105096	62554	50124.98	13357.42
71030	61471.62	8982.249	75028	40766.78	30654.18	106733	64487	51473.6	13583.96
74183	65277.88	9504.866	71435	39983.16	30088.68	107917	65500	53906.03	14044.26
74287	64577.73	9310.041	69911	43747.86	32732.05	109557	65739	51779.4	13278.37
75583	64123.37	10055.8	73688	44190.88	33218.53	110869	68075	53709.86	13624.44
76145	64824.26	10258.29	77112	43106.82	32815.86	114987	69534	56679.91	14153.44
75678	65428.88	10225.63	79401	44119.82	33276.41	121005	71358	58441.41	14402.36
77087	66963.49	10392.28	82454	44350.48	33309.21	120947	73477	59356.82	14471.76

81680	67401.47	12234.51	81264	42591.27	35124.37	118957	75255	60880.1	16026.13
79797	66579.26	12110.88	79906	44016.17	36427.3	121816	76342	59734.52	15605
79365	68755.53	12417.83	80091	43132.68	35458.55	123424	76826	62241.53	16147.18
79186	67963.75	12312.78	79882	44027.88	36289.79	130351	76905	62275.85	16053.69
81709	68554.87	13192.57	80855	43843.64	37527.62	127308	76862	60357.2	16221.85
80893	67623.46	13086.23	81655	44580.34	38294.34	128345	78187	61614.78	16451.42
79244	68768.96	13335.25	82854	44485.84	38188.8	131600	80504	64156.74	17005.77
86138	70444.71	13677.96	86413	43494.19	37261.24	134867	84152	69811.28	18356.96
90850	73029.95	14468.55	87921	42397.2	40555.82	137747	87993	73756.18	18041.52
91210	75014.46	14457.3	87902	45374.17	42162.08	148632	91767	73843.46	17887.7
84446	73713.29	14217.24	88738	46469.68	43257.49	150515	94619	76000.15	18214.18
88409	76326.3	14412.91	90219	47282.96	43240.61	152415	96393	77304.21	18312.6
94239	78413.18	14671.35	91237	44924.17	43497.16	144074	97869	78487.62	20319.05
90447	75673.01	14035.66	92483	46479.79	44813.31	152177	98277	79673.85	20384.04
89295	76734.89	13774.53	95365	48946.94	45833.05	158343	98155	78012.47	19738.25
91956	78726.93	13850.45	92911	48593.1	44708.48	163702	98334	79998.07	20030.66
97171	79253.55	14530.57	90166	43430.13	46457.17	153011	98083	77958.04	22579.34
98768	80697.6	14775.51	88840	42393.73	45353.85	153800	97412	77055.13	22108.9
94100	80718.62	14825.25	87658	41525.24	44619.46	152766	97069	76029.21	21615.41
89660	80310.23	14580.68	86088	41286.91	43901.51	146711	96745	76817.62	21644.35
88880	78199.66	14247.31	80863	37848.75	44815.82	142176	95189	75757.9	22247.2
95392	80777.82	14545.38	79947	36943.14	43337.58	150150	98480	76377.45	22295.6
102435	83638.45	15013.72	79668	35091.56	41197.82	153491	102561	79958.31	23272.04
98873	84008.08	14989.59	80038	35820.55	42028.78	155871	100699	80630.34	23469.15
100948	84373.56	15108.71	79177	35077.51	43358.32	155226	103393	83146.58	22432.15
104216	87280.26	15798.83	78326	34097.08	42807.96	155839	106079	84853.48	22894.21
103478	89202.11	16255.13	77183	33988.09	43052.84	161735	107285	86420.56	23253.94
108559	91952.08	17189.34	75797	32593.32	42336.89	163008	110887	87175.39	23331.71
111796	98080.47	17072	75415	30666.55	42862.92	164412	111525	88785.43	23138.4
117361	101231.1	17592.6	75508	30959.95	43146.11	168416	114694	91095.85	23594.9
118973	100587.4	17716.55	76395	32005.83	45209.64	169888	115035	92923.2	23953.63
126850	103753.1	18346.85	78053	32207.67	45745.33	171219	117110	95703.52	24585.07
122378	104994.2	17291.26	79665	39822.87	45766.89	171685	117449	98160.84	20884.6
133627	111982.4	18643.39	81193	36844.73	42884.14	177983	127592	105053.8	22316.2
134226	117194	19569.49	82241	36875.59	43080.12	179037	127118	105839.9	22462.11
144053	122517.4	20599.87	82661	35080.8	41252.85	191715	135826	111489.4	23653.09
149410	127478.4	20760.78	82818	33170.13	39746.87	195102	139040	114877.3	23510.24
141469	125060	20201.87	82726	37232.23	44208.57	189698	134473	113965.7	23248.13
144716	125538	20168.57	82573	39746.45	46906.28	190280	134496	112239.1	22744.94
157318	130587.6	20836.77	82547	39427.19	46198.28	192044	137347	113165.9	22704.69
156990	130815.4	22434.25	82666	35579.97	46661.35	195408	140327	115419.1	24903.23
161660	135240.8	23030.32	83276	35881.14	46791.26	196028	138685	114931	24505.31
164695	139075.2	23622.02	84544	34901.33	45519.69	203678	145365	120214.4	25372.34
151594	136408.6	22929.41	86305	38565.56	49979.7	210978	145507	121191.4	25363.12
166520	144259	25159.47	84902	36846.86	50708.37	216924	152389	129520	26025.05
171121	143819.7	25301.76	86483	37229.21	51848.14	226748	160644	133963.7	26719.23
178784	148355	25908.11	90665	37149.65	51415.91	231088	165054	138220	27349.05
177232	153290.2	26606.67	93553	37074.28	50951.58	232076	171424	141076.3	27678.67
183832	159689.3	27246.71	91455	33875.22	52173.59	235485	169072	139988.7	27898.57
186989	161627.6	27673.4	87927	34635.13	53507.73	237006	170631	140993.5	27853.21
191686	164303.8	28490.63	84775	34467.4	54037.59	231747	166121	142155.5	27834.62

207605	170043.3	29721.26	83499	32442.25	51497.09	246510	178484	149502.3	29009.6
212035	181046.9	28633.18	88068	33346.48	55820.08	249196	179298	151921.8	29405.35
213255	183467.8	28501.39	91769	36760.31	60781.13	255736	184621	152411	29256.85
222534	191123.1	29758.99	95460	35368.6	58865.02	260260	188602	157557.6	30028.56
223904	195294.3	30214.44	100667	35592.61	59033.77	265611	192987	164389.6	31141.23
233459	198361.7	31249.95	100689	38374.57	65943.08	275711	201866	166325.6	30996.05
233785	200830.6	31986.94	101157	37235.55	64766.06	274760	199155	169753.3	31463.62
236863	204688.8	32289.44	101816	37500.06	64648.49	279534	202652	170437.3	31405.9
238772	206754.9	33085.67	100566	34865.82	60990.37	276990	200167	172143.8	31522.43
230937	202716.6	34449.29	102065	34276.38	56140.33	268813	193039	162493.3	31430.57
228009	194091.2	33210.04	102447	36035.14	59506.48	268428	191953	160927.9	30910.91
220149	185446.9	31223.98	102852	41387.08	67444.09	259211	183255	155038.3	29560.24
217486	182885.3	30372.69	103912	44269.4	71465.1	259316	181594	151380.5	28638.28
223313	187331.6	33407.08	104731	44680.54	68584.32	262818	184154	152831.4	28952.34
226815	192483	33694.03	106178	43344.71	65540.43	272525	193708	159272.2	29942.11
233019	196371.3	34430.4	106559	40400.85	61276.58	273520	194313	164783.8	30752.95
224705	194354.1	34460.49	107187	39081.89	59906.68	270761	192701	167672.7	31072.6
223006	196880.2	35658.58	106689	36323.22	56266.74	269848	193106	169330.3	33758.11
221812	186469.6	32498.28	109568	45595.33	67806.44	277116	196475	162657.9	32233.61
222334	188022	32709.89	110681	46260.15	68537.98	276838	195223	162255.5	31997.47
231840	192432.2	32885.25	111663	47105.3	68448.84	291593	206692	167092.3	32830.81
231907	195962.8	33740.04	112398	47015.8	73080.72	291575	209181	172307.9	32230.56
241796	205585.5	36416.61	111799	39988.32	63888.53	294108	213087	184776	34496.94
239674	205505.3	35868.54	113511	42011.34	66091.73	301579	220000	188316.6	35107.58
236790	201170.3	34294.81	116093	47368.54	72755.02	306102	224096	185195.5	34492.92
236573	202196.6	34250.61	115527	43541.05	75324.97	303022	221645	189527.9	34316.07
238973	202678.3	34498.13	115431	42918.51	74559.57	303588	222997	192279.2	34778.28
247435	209736.2	35334.63	114913	42393.93	72816.19	309722	230328	193037.4	34859
251891	217545	36724.63	114569	39998.5	68735.27	315061	234986	196303.5	35370.65
248944	208035.1	35543.09	117964	43638.31	76614.7	318332	236284	194238.9	35444.91
241589	205196.1	35187.67	120832	43872.92	76840.08	318970	235735	199017.9	36161.88
237645	204678.7	35447.68	120538	43405.94	76003.49	320425	233297	201571.2	36414.31
239271	205838.1	35749.55	119778	43478.83	75281.73	322054	236544	203124	36426.9
238029	210891.5	37008.72	117275	41625.59	69092.75	327750	240790	213164.7	37584.63
243444	211380.4	36657.75	121104	43342.8	70296.37	322423	237885	210912	36980.79
247475	203435.8	34285.34	121630	48295.12	75734.16	333262	250356	208867.9	36548.58
239175	200104.4	32504.18	122027	52764.5	79828.72	345104	252977	202987.3	35574
231871	193606.9	34210.06	121140	51088.15	83845.04	339202	252607	201195	35336.84
227620	198432	36003.32	121232	43345.57	73293.31	333159	251307	208973.3	36791.34
223536	191156.9	35981.61	115884	38657.12	67836.29	324104	242451	210223.5	37014.85
204756	164940.2	32197.01	112232	39765.15	72177.36	300555	222754	204292.1	35892.96
181934	142591.4	36533.49	107227	38895.81	73111.77	270101	192202	166966	37817.84
174355	138951.2	34516.58	109816	41863.77	75924.18	271782	189308	156340.2	35293.47
183806	148799.9	35597.3	113610	40545	70527.07	297307	203892	160965.8	36248.24
192485	158165.5	37364.64	116155	38975.42	66728.98	311210	211553	165980.1	37316.44
196501	160100.1	39590.84	118020	39177.34	75562.18	318349	224524	178870	41421.74
202914	161140.2	40099.91	116979	39483.6	76365.77	322902	231397	185590.8	43022.48
201340	160304.6	40088.97	115581	40148.08	77684.92	321320	233847	192905	44849.82
208341	166067	41680.28	116280	40382.98	77995.12	322909	235475	193274.3	45153.96
208178	168333.5	42362.95	116445	41059.67	80501.27	328501	241610	199149.6	43096.5
206751	168832.7	42439.55	121291	41804.74	81526.27	337017	246803	202897.5	44138.73

223188	174328.6	44504.78	119036	39846.06	78762.13	340543	251148	205169.6	44807.65
228815	180057.1	46076.72	120353	38089.52	75482.34	346655	255287	209691.2	45913.12
225967	181328.9	46218.54	120406	36505.67	77346.49	347059	261091	205853.5	46318.48
228343	177038.8	45424.15	119747	37187.86	79489.42	343018	252553	205960	46266.27
224883	178465.2	44507.07	119272	39900.5	83074.25	340021	245056	203332.5	45470.52
218507	179951.2	44766.24	119203	40609.97	84513.84	335534	240252	201105.9	44644.73
221569	178130.4	48415.96	123326	41155.59	83987.37	340055	244681	202919.4	45559.69
231931	179302	48697.25	126324	41587.2	85109.04	347775	251000	204255.9	45611.77
226294	178311.4	48789.43	130296	41928.43	86902.31	348185	251660	206549.8	46074.53
228622	177792.1	48825.37	134002	43068.79	90217.28	355086	256647	206746.9	46266.01
227129	180597.2	46564.07	133903	39115.21	96169.61	354745	251428	212523.9	47185.53
233880	189627.5	49004.02	133932	37379.48	92662.82	365415	265344	219224.6	49012.32
245545	194028.1	49925.95	131913	38085.33	94280.42	370284	271605	219020.1	49286.15
245518	192135.3	50021.96	131332	38123.98	95471.14	377239	281235	222883.4	50459.99
241511	191989.4	50049.04	130416	36077.66	96925.17	377295	280124	224490	50979.5
244426	200024.3	51856.55	128669	35601.36	94750.96	377056	279599	224915.8	51253.98
256411	201680.9	54215.77	126715	32571.99	89479.26	375765	277998	229198	52309.03
261561	200493.4	53614.65	124952	33868.99	92072.61	376145	276707	229028.3	52249.49
268224	201304.9	56669.12	124799	31291.74	89856.78	380938	281187	227978.3	55490.74
258126	197371.8	54358.76	124197	34955.22	97773.48	380989	282258	222954.7	53977.86
258874	205296.1	57035.31	123883	32227.69	90667.83	379437	282796	229255	55040.23
252900	208271.2	58580.81	123637	31357.34	89185.91	374195	280316	227840	54083.17
258710	203422	58829.28	125590	29571.14	91242.75	387996	291490	238802.9	51855.06
261901	201007.3	58428.6	127026	29304.75	90948.26	389922	291902	245778.9	52813.07
251609	194508.2	54256.81	130456	35326.8	105361.2	392340	291593	235033.5	50163.12
255273	201878.5	56173.31	132037	33793.31	100751.8	392654	292107	241788.8	51444.75
257745	198402.3	63472.59	131892	34517.44	100383.3	398864	297909	241959.8	53499.65
265626	204341.9	66234.18	131905	32103.16	94810.61	400536	299591	248382.4	54808.6
266689	205764.6	67156.81	132419	31951	95187.97	399214	298267	247732.6	54426.69
269416	193331.1	63524.42	131184	34844.4	104650.1	402606	301996	244069.2	53265.07
270246	200037	67001.57	132411	34448.14	104925.5	406754	306000	248137.8	56807.66
275330	206782.3	70215.73	133129	32205.31	99465.6	402106	300909	247283.7	56114.56
276053	205645	69348	133408	32616.95	99991.99	402370	300219	244830.9	55073.02
268424	205399.8	68934.7	133585	32177.6	98056.86	399630	297368	242255.6	54020.76
260125	196506.2	68182.46	133533	35250.39	102466.6	386272	287027	246295.2	54313.84
205673	155190.3	54178.58	119418	28992.39	84675.29	304786	219651	187201.1	41017.51
259663	189035.8	65727.32	132688	34513.5	100298.1	383478	285108	226408.5	49397.05
258659	191031.8	67791.64	135794	34343.72	101816	392636	294879	232083.2	50527.61
255909	188166.7	68391.18	136037	34405.17	100666.1	392631	293680	230515.6	51646.48
237145	170945	68797.36	135189	34190.7	99784.66	386665	290698	227424.5	52714.97
241166.5	171993.1	71770.76	140545.7	34535.67	104796.4	394140.5	296400.4	229939.6	55902.28
240696.1	177133.6	66159.83	143170.8	35718.48	106238.7	394418.8	295393.7	229645.6	55189.6
242481.9	179084.4	65994.82	143785	35730.33	106841	400268.8	300035.2	233951	55525.71
248902.8	183538.6	67961.53	146032.9	36171.41	108647.9	409440.9	307015.4	238428.7	58028.25
256354.9	188591.5	70360.75	147129.4	36338.99	109576.7	420287.8	315324.4	242930.3	61835.61
261422.9	191862.3	72157.89	148306.9	36477.78	110615.5	427391.7	320275.1	245613.8	64102.81
265255.3	194794.1	73058.5	149646.6	36743.76	111689.2	431921.5	323547	247457.9	65530.67
268694.9	197610	73682.27	150707.4	36892.78	112600.9	435371.9	325889.2	249039	66291.75
271370.4	199716.3	74251.46	151473.7	37031.14	113229	437688.5	327408.2	250101.9	66747.76
273477.6	201387.4	74687.61	152088.9	37120.47	113754.8	439923.5	328887	251170.2	67158.38
276025.7	203562.7	75060.38	152427.7	37093.6	114120.4	442688.7	330862.6	252706.5	67597.57

278179.1	205339.6	75436.81	153127	37171.87	114741.5	444954.6	332319.1	253773.5	67987.14
279955	206719.7	75832.65	153701.1	37223.85	115263.6	446923.8	333643.7	254723.5	68361.65
281536	207868.1	76265.29	154362.2	37288.58	115860	448953.1	335062.6	255783.4	68720.75
283061.8	209022.9	76636.26	155189.9	37398.39	116577.8	451157.3	336565.5	256919.7	69087.33
284665.4	210248.2	77014.55	156031.8	37516.17	117302	453373.9	338087	258080.3	69448.17
286100.6	211298.5	77399.46	156871.8	37638.15	118020.1	455423.5	339462.9	259099.6	69804.82
287673.8	212492.9	77778.24	157701.5	37754.11	118733.7	457490.9	340858.8	260133.4	70166.99
288791.6	213226	78162.98	158514.4	37875.9	119424.8	459654.5	342420.8	261337.6	70524.69
290321	214392.9	78525.5	159264	37988.82	120061.5	461994.4	344073.9	262608.7	70906.76
291812.7	215522	78888.01	159989.5	38113.01	120662.9	464258.7	345633.6	263782	71293.11
293258.1	216600.5	79254.94	160744.2	38236.16	121294.4	466566.5	347257.7	265024.3	71674.98

Imports To	Imports of	Imports of	Statistical	Final dom	Average W	Gross dom	Gross dom	Gross dom	Gross dom
RMPKO	RMPGKO	RMPSKO	RSKO	RYFDDKC	RLAWWIC	RYCMPO	RWWTOC	RWSLYO	RYGOSO

56344	42467.28	20033.36	3128	263192
52078	34368.92	16140.08	-225	277563
49504	32565.91	15244.22	-2254	290367
48254	31121.89	14538.34	-3660	304462
47266	30718.87	16371.58	-3672	288358
46926	30152.63	16069.54	882	277167
47002	29153.31	15551.03	-671	271574
47286	33287.19	17787.85	1067	263753
48141	34251.78	16804.88	-3554	274844
48820	33376.79	16427.35	-511	278383
49162	32558.06	16083.25	-3127	290652
49234	30917.36	15336.53	-2862	294361
48877	31783.29	16199.9	-3865	296482
48878	32242.11	16454.54	-2174	297612
49516	31536.51	16063.24	-1065	300970
50717	35990.08	18238.31	2165	302309
52289	35268.47	19348.54	1654	311922
53580	34471.02	18628.7	1802	315518
54235	35029.13	18516.54	-660	323736
54208	35539.39	18238.23	35	329453

73594	67035.05	6558.946	27191
74276	67656.27	6619.728	27535
74047	67447.68	6599.319	26565
73763	67188.99	6574.008	24821
77131	70168.07	6962.935	23658
79459	72285.91	7173.093	25159
80734	73445.81	7288.192	27228
83388	75860.22	7527.78	29011
83532	75672.73	7859.272	31275
85513	77467.34	8045.658	32099
86800	78633.25	8166.748	34364
87667	79418.68	8248.322	35645
90237	81454.44	8782.562	37369
93525	84422.42	9102.575	39711
96677	87267.65	9409.352	40142
99762	90052.39	9709.608	40861
101774	91760.53	10013.47	43109
103715	93510.56	10204.44	44707
105839	95425.58	10413.42	45363
107864	97251.34	10612.66	48191

53810	32427.81	19552.1	-1466	334814		110215	99509.08	10705.92	46889
53543	35197.11	20607.34	-1210	337829		112775	101820.4	10954.59	47401
53862	33821.67	19443.68	-1140	343735		115284	104085.7	11198.31	48761
54864	35441.41	20240.88	86	345338		118402	106900.8	11501.18	50562
56216	37269.32	21280.22	25	353526		121569	109782.1	11786.87	52453
57605	38197.41	21868.06	815	357145		124984	112866	12117.98	54757
58811	37739.05	21616.33	620	364178		127635	115260	12375.01	55978
59772	35134.21	20091.38	-629	367747		131236	118511.9	12724.15	56401
60580	37127.25	21051.53	-653	375685		135757	122821.4	12935.61	57831
61326	39726.38	22422.98	339	377040		139371	126091	13279.97	58088
62083	40778.33	22895.74	562	385037		142568	128983.4	13584.6	58250
62815	40896.05	22825.76	2045	386753		146213	132281.1	13931.91	59612
63353	38994.84	22157.06	961	395244		149293	135369.3	13923.74	61503
63617	40341.29	22837.56	159	395929		152623	138388.7	14234.32	61435
63509	42433.49	23997.01	875	395776		154758	140324.6	14433.44	61363
63012	40622.38	23008.37	-134	400447		157449	142764.6	14684.41	59562
62255	37461.72	23769.06	88	398314		158155	141968.9	16186.15	59359
61259	37084.59	23478.21	1638	391470		159054	142775.8	16278.15	57377
60062	37316.74	23431.79	2678	392720		158371	142162.7	16208.25	55142
58757	37060.95	22940.94	252	391695		158324	142120.6	16203.44	55286
57529	35399.78	23788.75	-2712	385762		159406	140879.5	18526.52	49661
56498	34682.43	23016.45	-89	387663		160678	142003.6	18674.35	51081
55813	32090.47	21209.83	-2489	391551		162464	143582.1	18881.93	52968
55559	33035.33	21932.97	-1176	392916		163800	144762.8	19037.2	52209
55647	33161.53	23372.14	1054	392347		163785	142739.6	21045.39	52956
56081	32587.28	23220.58	644	392527		164652	143495.2	21156.79	53186
56799	32828.86	23591.97	2381	395627		165035	143829	21206.01	53546
57629	32810.34	23719.32	2749	392092		165517	144249.1	21267.94	49966
58315	33596.04	23495.7	2759	390564		166091	143954.1	22136.93	51882
58547	33477.84	23541.96	2856	390019		166043	143912.5	22130.54	56099
58082	34552.44	24480.33	2012	389569		166333	144163.8	22169.19	59104
56996	33805.67	24178.01	60	391381		165989	143865.7	22123.34	63129
55754	36727.49	25884.05	616	396398		166753	144501.6	22251.4	64030
54742	31335.07	22325.07	54	401566		169378	146776.3	22601.68	63946
54325	31433.85	22632.2	2031	399455		170875	148073.6	22801.44	67850
54596	27935.59	20318.68	2322	403566		172434	149424.5	23009.47	69791
55273	27203.76	19586.56	485	404023		173892	150362.6	23529.42	70810
56174	31942.26	23204.02	236	406132		174982	151305.1	23676.91	71964
57109	35669.1	26123.23	-1438	407067		176667	152762.1	23904.9	72492
58012	35636.88	26294.19	-1713	407331		177139	153170.2	23968.77	77939
58950	34992.88	22771.58	-820	411002		177535	153246.7	24288.28	73716
60014	36713.02	23961.79	-965	411911		178701	154253.2	24447.79	75068
61284	35038.83	22852.9	-1054	416281		180962	156204.9	24757.12	78537
62703	39879.28	25897.73	1186	423679		184367	159144.1	25222.95	79751
63252	37894.17	26415.25	1455	426929	583.8221	186522	162083.3	24438.73	82724
65267	38816.96	26779.21	1675	433538	586.676	189603	164760.6	24842.41	82660
66043	38625.81	26304.71	70	443513	592.4308	194093	168662.3	25430.71	82051
66210	38887.06	26072.83	1075	447188	598.324	195716	170072.6	25643.36	82451
67083	36621.51	28183.09	-1626	447190	597.8081	199720	174398.4	25321.55	85928
66820	38589.46	29379	584	451507	599.2671	202458	176789.3	25668.69	84320
66398	39826.56	30241.33	481	450335	599.7235	203874	178025.8	25848.22	83926

67980	36238.47	27668.59	-100	454825	603.1201	208110	181724.7	26385.28	87284
70377	39141.07	28783.21	418	462117	611.1003	210855	185036.2	25818.78	92107
71301	42998.22	32217.41	1811	472118	618.651	215092	188754.4	26337.59	94341
71495	40485.54	31063.36	419	479643	626.6318	219454	192582.3	26871.71	97279
72194	38607.17	30472.02	1989	487878	632.0312	225089	197527.3	27561.71	97850
72688	43981.09	34654.59	2426	492103	633.2606	231179	203833.8	27345.18	99099
75445	42135.84	33939	2398	493689	643.6133	238459	210252.7	28206.3	102366
76728	41610.07	33978.06	1051	501572	655.811	242178	213531.8	28646.2	105835
77003	38388.99	31532.36	-573	501072	656.0513	243843	214999.9	28843.15	104219
76365	37220.51	29424.52	-267	506944	662.2733	244670	215052.1	29617.92	107621
77298	39457.43	31096.76	1906	510466	669.1159	245357	215655.9	29701.08	111327
77585	46334.45	36354.99	-511	510930	671.389	245566	215839.6	29726.38	107282
80063	50331.61	39263.73	1190	515092	674.7419	245671	215931.9	29739.09	107257
81051	50495.24	38576.6	1523	522338	678.1045	248242	217231.8	31010.17	111280
80058	46719.18	35611.36	2657	525443	672.6559	251482	220067.1	31414.91	119741
80583	42493.74	32473.75	367	527855	673.4716	255280	223390.6	31889.35	125788
79343	41067.83	31614.29	-663	532937	678.5797	258770	226444.7	32325.32	128914
77542	39415.72	28181.64	-1704	535100	677.5756	260700	227901	32799	127154
82205	49755.27	35997.32	1476	541083	682.0584	261760	228827.6	32932.36	124451
83610	50746.9	37149.91	2365	546136	687.7718	263623	230456.3	33166.75	125292
86603	49666.11	36787.14	97	553605	694.2857	267175	233561.4	33613.63	122517
83422	52112.42	38156.85	1314	556358	704.3214	271763	237383.4	34379.61	124293
81578	42846.1	31825.27	1966	558663	706.586	275923	241017.1	34905.87	129209
81879	43491.29	32852.21	-282	566187	695.966	279255	243927.6	35327.39	130122
82320	48530.2	37365.68	-1964	570848	700.2125	280736	245221.3	35514.75	129911
81712	45341.48	38091.31	-1186	577080	715.7052	283480	247829.7	35650.34	129476
81001	44245.11	37706.19	1102	580920	716.807	287884	251679.8	36204.19	131980
79112	43294.77	37206.38	2346	585944	727.1208	291764	255071.9	36692.14	138422
79947	40642.63	35020.11	2280	592416	730.2895	295302	258164.9	37137.08	140666
80978	44616.8	40746.16	1105	599493	735.873	297029	259991.9	37037.05	140020
82168	44527.08	40303.62	-790	602561	743.4622	300381	262926	37455.02	138714
84572	44571.72	39755.04	-63	606828	747.3237	304982	266953.3	38028.73	136987
90814	45152.41	39463.18	-241	615549	746.2588	309111	270567.4	38543.58	136508
88961	43714.44	35060.62	-1033	615203	738.6582	313786	273262.9	40523.13	138712
86424	45873.66	36354.26	-1492	616014	749.8494	318216	277120.8	41095.23	141081
82775	49857.61	39550.77	459	623189	773.712	320992	279538.3	41453.73	140175
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85117	50933.82	44974.47	-59	639218	772.7074	326092	284129.1	41962.85	137927
81924	42620.83	37788.7	-534	640996	785.1168	329243	286874.7	42368.34	139799
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79389	43131.79	36577.97	1516	624790	790.8849	327872	285680.1	42191.91	130456
79068	46517.59	41202.31	-603	619088	796.5839	323947	279877.4	44069.64	126814
83079	51702.35	43860.07	-1360	622537	795.1633	321409	277684.6	43724.37	126335
93588	48374.43	39891.17	31	632791	791.9316	321929	278133.9	43795.11	129275
99129	45789.64	37302.44	207	642113	800.6781	325692	281385	44307.03	137186
93371	49665.67	39772.96	-142	651301	802.6035	327584	283845.5	43738.54	144850
91313	49643.37	39993.98	885	655225	797.4156	330811	286641.6	44169.41	144381
87536	49609	40287.38	-612	659433	805.3093	335549	290747	44802.02	145148
87836	49945.97	40965.68	-1877	664156	814.9157	340675	295188.6	45486.43	151831
87184	49046.63	43072.12	779	664541	819.4808	346542	300226	46315.96	154741
90274	49148.36	43418.27	-372	667942	833.5176	347357	300932.1	46424.89	154815

89326	47252.88	41772.08	-1178	669798	822.2135	349813	303059.9	46753.14	159532
91140	44804.13	39429.52	-303	670058	823.7859	352130	305067.2	47062.81	160819
86565	45988.75	40346.85	-377	676928	837.3118	355618	307008.4	48609.63	161952
90545	47637.53	41530.85	-730	674571	843.0547	359212	310111.1	49100.9	163158
94584	50466.04	43881.28	-867	674201	851.5032	362499	312948.8	49550.2	163301
94986	51767.69	45061.03	1034	676968	842.7837	364646	314802.3	49843.68	159263
95204	52356.67	41943.63	-35	676184	842.3107	368811	316938.8	51872.24	162156
96732	52695.81	42520.31	-1408	678019	859.8276	370234	318161.6	52072.38	161533
96612	53317.51	43439.95	-161	678404	856.0208	372613	320206	52406.98	162661
98644	55274	45584.11	718	676548	864.9855	376175	323267	52907.97	163724
103756	53395.25	48752.05	-412	681044	866.1049	378213	325413.6	52799.43	168188
99946	50379.03	46265.95	638	691946	866.1676	382523	329121.9	53401.12	171336
98587	51838.78	47461.72	-806	699589	868.6055	387819	333678.5	54140.45	177602
95640	52674.94	47660.29	-1351	705905	881.4648	389582	335195.4	54386.57	177322
96831	50946.61	49848.9	-42	711587	886.253	395764	341209.4	54554.58	176693
97151	50783.53	48887.41	1088	716724	892.5856	399844	344727	55116.99	178235
97509	48071.83	45705.67	-1175	720607	912.5538	403696	348048	55647.98	185318
99289	50034.03	47162.02	-1604	727018	917.8745	407827	351609.6	56217.42	188416
99535	47284.28	46393.85	-2791	728871	925.3714	405117	348476.4	56640.56	195695
98442	52516.37	51500.71	1549	732368	923.4751	408748	351599.8	57148.22	192073
96214	48018.16	47273.03	423	731025	923.042	409388	352150.3	57237.7	200501
93348	47765.19	47412.41	2221	733503	921.3079	412593	354907.2	57685.8	203597
95984	46836.84	45855.32	-450	748106	918.6518	418609	362052.8	56556.22	207731
97529	45417.58	44913.88	-923	752348	918.5742	422553	365463.9	57089.07	203469
100292	54675.75	54496.92	378	759821	929.2414	430259	372128.8	58130.19	196579
100152	51137.83	51265.88	-249	767816	950.4255	439095	379771	59323.98	197477
100533	51651.39	51571.15	992	774737	954.169	447039	387171.9	59867.12	191252
100472	47608.24	47689.8	-59	779813	962.6164	450448	390124.3	60323.65	204430
100397	47902.65	48119.51	868	786156	959.0952	455031	394093.6	60937.41	216336
100035	53605.72	53975.53	-2498	788094	966.5509	461647	399823.6	61823.42	218858
100167	52801.43	53878.57	533	788904	974.1689	463893	402696	61196.98	212866
100678	49806.68	50725.1	217	786270	988.4583	470420	408362	62058.03	216111
101676	49973.61	50603.86	-1655	793017	1011.563	477983	414927.3	63055.74	209491
101835	48586.29	48728.47	-389	792765	1029.692	482300	418674.8	63625.24	204405
98895	49861.09	47173.62	-1800	783669	1040.319	477254	414524.4	62729.59	211373
85276	43185.89	40431.7	1386	687315	1121.95	440119	382270.4	57848.62	207553
98018	51256.36	47650.3	-901	772602	1087.135	478085	415246.2	62838.81	237719
97272	52148.66	48308.39	1491	781933	1088.042	492847	428067.9	64779.11	245394
98560	54544.93	47675.13	44	796478	1110.854	504752.7	436266.7	68485.96	259826.6
95534	52706.32	47287.26	44	793494	1113.314	508172.8	438455	69717.75	256642.5
97307.09	53576.79	48189.87	44	809275	1118.003	523481.3	452456	71025.25	259454.3
98592.15	54193.13	48858.6	44	819258.8	1125.742	536712.3	465687	71025.25	289926.4
99800.64	54465.52	49794.69	44	823716.8	1128.201	536043.5	464796.1	71247.43	299857.6
101992.5	55486.2	50965.86	44	833070.7	1127.437	537335.9	464829.4	72506.46	305608
104530.4	56705.76	52284.22	44	842742	1129.612	541298	467650	73648.06	310235.5
106683.6	57799.76	53343.44	44	848455.2	1132.789	545416.6	470704.1	74712.45	315506.6
107941.5	58390.51	54010.56	44	853658.8	1137.244	550087.7	474491.6	75596.07	322764.4
109049.7	58938.87	54570.38	44	858051.4	1142.007	554591.4	478152.8	76438.57	327388.2
109847.3	59315.82	54991.03	44	861539.5	1147.015	559562.5	482335.6	77226.9	328578.7
110603.5	59661.97	55401.09	44	864617.6	1152.841	563894	485988.2	77905.85	329961.1
111393.1	60021.99	55830.69	44	868361.2	1158.985	568208.2	489943.2	78264.98	332093.8

112202.5	60400.35	56261.76		44	871578.2	1165.235	572920.4	494006.4	78913.99	335649.7
112847.2	60689.63	56617.13		44	874639.2	1171.54	577844.7	498252.7	79591.95	337491.3
113457.5	60957.61	56959.43		44	877698.9	1178.005	582700.7	502416.4	80284.32	339265.6
114158.7	61307.5	57310.81		44	881092.2	1184.852	587767.8	506696.7	81071.07	343138.6
114853.9	61656.85	57656.63		44	884436.6	1191.316	592548.5	510772.1	81776.41	346356.1
115527.5	61995.62	57991.48		44	887629.4	1197.949	597465.3	514975.7	82489.54	349278.9
116199.1	62330.78	58327.9		44	890783.9	1204.557	602406.7	519204.6	83202.07	352550.6
116800.7	62631.29	58628.98		44	894410.1	1211.776	607533	523606.6	83926.35	356418.4
117487.5	62977.48	58969.56		44	898067.6	1219.436	612806.7	528147.2	84659.48	360095.4
118192.1	63341.68	59310.03		44	901686	1227.157	618153.6	532760.4	85393.21	363856.4
118875.8	63690.6	59644.75		44	905336.6	1234.915	623516.9	537390.5	86126.36	367632.3

Gross don RYNOSBC	Gross don RYCFCBC	Gross don RYGMIO	Gross don RYNMIUO	Gross don RYCFCUC	Gross don RYTSPO	Gross don RYTSIO	Current ac RYHCMP(	Current ac RYHNMIN	Current ac RYHNMIF

13580	13611	15651	11707	3944	5112.579	9256.421	73892	5680	1130
12912	14623	15643	11726	3917	5568.367	10081.63	74873	5504	1087
10915	15650	15564	11645	3919	6050.128	10953.87	74942	5307	1091
8072	16749	15677	11757	3920	6236.926	11292.07	74957	5277	1071
6663	16995	15939	11828	4111	6716.613	11162.39	78238	5426	1051
8186	16973	16502	12211	4291	6741.408	11203.59	80462	5602	1056
10300	16928	17127	12668	4459	6063.322	10076.68	81618	5874	967
12251	16760	17373	12745	4628	5690.657	9457.343	84174	6074	813
14271	17004	17884	13291	4593	6462.718	9948.282	84726	6013	1107
14679	17420	18368	13735	4633	6732.868	10364.13	87134	6264	1113
16438	17926	18892	14233	4659	7186.924	11063.08	88841	6313	1203
17215	18430	19337	14629	4708	7481.49	11516.51	90123	6382	1273
18754	18615	19974	15122	4852	7742.635	12262.37	92126	6787	1143
20826	18885	20739	15752	4987	7674.13	12153.87	94867	7047	1262
21059	19083	21423	16322	5101	7683.418	12168.58	97468	7296	1237
21649	19212	21699	16475	5224	7611.43	12054.57	100000	7511	1065
23074	20035	21710	16414	5296	7909.894	12639.11	102022	7552	993
24174	20533	22095	16712	5383	8361.031	13359.97	103974	7634	1081
24503	20860	22415	17003	5412	8538.868	13644.13	106110	7853	1128
26974	21217	22720	17207	5513	8862.207	14160.79	108145	8016	1163

24823	22066	23226	17663	5563	8913.578	15473.42	110452	8304	1023
25081	22320	23910	18240	5670	9474.263	16446.74	112968	8565	1047
26083	22678	24500	18707	5793	9685.89	16814.11	115432	8746	1095
27618	22944	24908	19029	5879	9902.269	17189.73	118508	8913	962
29043	23410	25832	19724	6108	10057.73	17574.27	121445	9238	1278
30676	24081	26218	19900	6318	10118.15	17679.85	124631	9538	1197
31043	24935	26513	19910	6603	10572.77	18474.23	127052	9809	966
30779	25622	27189	20442	6747	10603.35	18527.65	130423	9983	962
31701	26130	27947	21123	6824	10707.68	19974.32	134905	10358	1001
31657	26431	28962	21874	7088	11273.39	21029.61	138486	10618	1273
31201	27049	29587	22308	7279	11485.23	21424.77	141652	10751	1219
31898	27714	30373	22923	7450	11889.7	22179.3	145264	11018	1166
32958	28545	31224	23563	7661	12521.23	22599.77	148111	11458	1130
32093	29342	31751	23945	7806	13315.55	24033.45	151206	11655	1045
31366	29997	32471	24474	7997	13325.54	24051.46	153113	11845	997
29151	30411	33042	24758	8284	13574.03	24499.97	155574	12102	1032
27732	31627	33645	25301	8344	17787.26	23756.74	156381	12234	1054
25482	31895	33519	25109	8410	17354.39	23178.61	157379	11837	1075
23122	32020	33661	25166	8495	16960.49	22652.51	156814	11637	997
23255	32031	33624	25037	8587	15989.86	21356.14	156878	11400	836
17681	31980	34120	25520	8600	16996.5	19716.5	157936	11426	868
19287	31794	34993	26290	8703	17948.34	20820.66	159182	11767	1009
21081	31887	35541	26705	8836	18672.4	21660.6	160938	12202	891
19977	32232	35850	27009	8841	19242.76	22322.24	162248	12297	764
19909	33047	36346	27463	8883	18438.54	21942.46	162199	12387	741
19861	33325	36513	27567	8946	18458.17	21965.83	163023	12352	786
19829	33717	36754	27858	8896	18694.7	22247.3	163368	12340	919
16635	33331	37060	28077	8983	19132.59	22768.41	163811	12481	783
19730	32152	37363	28309	9054	19156.51	22152.49	164377	12651	758
23003	33096	38388	29213	9175	19102.72	22090.28	164327	12782	820
24461	34643	38881	29592	9289	19432.9	22472.1	164611	12731	905
27520	35609	39322	29875	9447	20059.87	23197.13	164269	12707	867
29185	34845	40097	30489	9608	19481.33	23515.67	165062	12921	780
28542	35404	40496	30944	9552	19891.37	24010.63	167698	13076	785
31783	36067	40953	31382	9571	20345.82	24559.18	169218	13252	743
33204	36587	41577	31937	9640	20537.47	24790.53	170798	13450	765
34357	36453	41932	32216	9716	20480.53	25089.47	172151	13332	806
34915	37049	42645	32813	9832	20409.07	25001.93	173139	13601	703
35048	37444	43502	33573	9929	20387.05	24974.95	174717	13919	816
38841	39098	43886	33818	10068	20415.81	25010.19	175094	13893	878
35254	38462	43859	33724	10135	21071.96	25218.04	175578	13773	807
35853	39215	44331	34174	10157	21155.27	25317.73	176825	14099	794
38836	39701	44849	34498	10351	20938.58	25058.42	179155	14298	810
39335	40416	44904	34592	10312	21222.18	25397.82	182614	14586	664
41708	41016	45628	35273	10355	21084.67	27423.33	184904	15030	813
40802	41858	46315	35803	10512	21457.61	27908.39	188112	15497	812
39407	42644	47017	36484	10533	21757.96	28299.04	192714	15955	678
38637	43814	47669	37016	10653	22171.76	28837.24	194478	16231	684
41331	44597	48709	37600	11109	22084.62	30420.38	198023	16691	727
38947	45373	48985	37983	11002	21929.41	30206.59	200310	17043	781
38039	45887	49491	38359	11132	21544.12	29675.88	201284	17418	802

41189	46095	50104	38991	11113	21097.85	29061.15	205059	17760	779
45323	46784	50026	38888	11138	22267.25	31037.75	208041	17909	712
46925	47416	50848	39539	11309	23005.38	32066.62	212492	18445	886
49009	48270	51224	39792	11432	23778.61	33144.39	217067	18446	878
48903	48947	51451	39866	11585	24328.76	33911.24	222896	18484	869
49277	49822	52688	41007	11681	22904.54	34796.46	228232	18828	989
51404	50962	53449	41604	11845	23060.54	35033.46	234745	19168	984
53874	51961	54679	42586	12093	23066.89	35043.11	237733	19855	906
51264	52955	56097	43784	12313	22972.02	34898.98	238686	20618	910
53874	53747	56767	44026	12741	23104.73	35907.27	240466	20732	994
57106	54221	56588	43872	12716	23234.72	36109.28	242110	20477	1019
52488	54794	56798	43958	12840	23516.62	36547.38	243285	20511	1070
52083	55174	57008	43969	13039	23843.93	37056.07	244358	20495	1014
55809	55471	58253	44989	13264	23233.13	36690.87	246120	20918	1123
63941	55800	59209	45715	13494	23979.08	37868.92	248548	21324	1047
69874	55914	60047	46311	13736	24169.84	38170.16	251530	21570	1092
73023	55891	61287	47397	13890	24569.56	38801.44	254206	22204	1123
71076	56078	60953	47412	13541	24304.96	35749.04	256501	22562	936
68302	56149	61016	47285	13731	24106.65	35457.35	257939	22564	839
68772	56520	61334	47499	13835	25244.31	37130.69	260168	22849	836
65614	56903	61512	47555	13957	25704.07	37806.93	264056	23018	1027
66988	57305	62102	48199	13903	25875.49	39094.51	268252	23536	927
71495	57714	63174	49041	14133	26096.93	39429.07	272024	24091	1003
72092	58030	63931	49527	14404	26216.41	39609.59	274979	24374	1009
71339	58572	64461	49873	14588	26315.18	39758.82	276105	24579	913
70388	59088	64335	49984	14351	26979.13	39785.87	278871	24752	1027
72620	59360	64959	50193	14766	27584.05	40677.95	283270	24878	931
77989	60433	65593	50546	15047	27816	41020	287154	25106	852
78816	61850	65756	50541	15215	28252.82	41664.18	290702	25279	812
77647	62373	65677	50872	14805	28921.81	42496.19	292386	25593	641
75491	63223	66990	52041	14949	29033.17	42659.83	295669	25957	685
72833	64154	67839	52550	15289	28260.9	41525.1	300183	26158	796
71133	65375	68710	53253	15457	28360.12	41670.88	304231	26441	885
74338	64374	68701	53392	15309	29711.23	40803.77	309223	26785	632
75339	65742	69532	53698	15834	30690.86	42149.14	313973	27292	669
72566	67609	70148	53799	16349	31199.85	42848.15	317096	27458	686
70777	69327	70936	54044	16892	31662.48	43483.52	319609	27361	658
68192	69735	71326	54439	16887	31412.86	41238.14	322360	27363	764
69270	70529	71579	54412	17167	31670.99	41577.01	325317	27108	846
69318	71975	71354	54106	17248	31530.04	41391.96	325380	26854	884
57112	73344	70173	52831	17342	30906.11	40572.89	323643	26135	502
53286	73528	70437	52892	17545	31814.63	40718.37	320558	25824	291
52658	73677	71276	53473	17803	31709.8	40584.2	318843	26175	528
55072	74203	72100	54030	18070	32280.01	41313.99	320147	26669	678
62837	74349	72819	54581	18238	32815.57	41999.43	324652	27296	896
72569	72281	73164	54894	18270	31704.55	43230.45	325583	27251	816
72600	71781	73974	55613	18361	32365.42	44131.58	327845	27483	754
73068	72080	75139	56568	18571	32616.74	44474.26	331612	27588	862
79223	72608	76183	57401	18782	32597.28	44447.72	335768	27902	916
81990	72751	76194	57510	18684	32241.74	43885.26	342099	27782	970
81508	73307	76552	57591	18961	32778.35	44615.65	343453	27514	1105

84775	74757	76962	57890	19072	32664.42	44460.58	346423	27582	1326
85226	75593	77408	57981	19427	32683.06	44485.94	349257	27458	1479
86378	75574	78094	58866	19228	33057.42	45599.58	352321	27530	1446
87122	76036	78284	58730	19554	33241.5	45853.5	355492	27529	1272
87161	76140	79422	59143	20279	33290.25	45920.75	358358	27453	1306
82938	76325	79464	59465	19999	33766.42	46577.58	360093	27551	1201
85418	76738	79601	59808	19793	33991.99	46561.01	364452	27457	1326
83980	77553	80263	59867	20396	34100.44	46709.56	366103	27286	1197
84768	77893	81145	59895	21250	34092	46698	368697	27396	1105
85208	78516	81138	60986	20152	34476	47224	372460	27477	1064
89237	78951	81638	60845	20793	34347.04	49064.96	374412	27664	883
92066	79270	82679	61741	20938	34925.99	49892.01	378614	28123	1367
97953	79649	83545	62263	21282	35439.89	50626.11	383792	28561	1492
97454	79868	84353	62946	21407	35859.08	51224.92	385471	28912	1769
94848	81845	84348	62681	21667	36103.53	52128.47	391300	28734	1283
94736	83499	85051	63108	21943	36767.64	53087.36	395049	28622	1395
99115	86203	85558	63420	22138	37513.18	54163.82	398572	28356	1550
99963	88453	86279	63794	22485	38103.64	55016.36	402372	28244	1619
107586	88109	87784	64886	22898	37828.68	56416.32	399512	29308	1570
103219	88854	89828	65884	23944	38028.57	56714.43	402909	30161	1351
112542	87959	88780	66121	22659	38359.31	57207.69	403354	30491	1126
115462	88135	89588	66669	22919	38631.45	57613.55	406329	31360	809
119337	88394	92020	68315	23705	40078.88	57940.12	411359	32340	1131
113125	90344	92727	68682	24045	42151.13	60935.87	414347	32311	1244
106848	89731	93473	69229	24244	42293.01	61140.99	421040	32257	1391
106330	91147	95096	70086	25010	42916.98	62043.02	428846	32820	1370
99235	92017	96114	70828	25286	46043.42	64985.58	443976	33418	1136
110933	93497	97040	71144	25896	43591.73	61525.27	444323	33318	1191
121473	94863	96967	71179	25788	41496.26	58567.74	445844	32583	1146
122784	96074	98527	72761	25766	38164.17	53864.83	449397	33116	1092
115479	97387	100762	74598	26164	40572.56	57640.44	452700	34059	1064
117572	98539	102656	76558	26098	42238.62	60007.38	460171	34800	1068
110346	99145	104452	78088	26364	44058.77	62593.23	468650	35532	887
103917	100488	106700	80057	26643	45158.05	64154.95	473970	36221	982
109641	101732	105919	79266	26653	21005.63	73944.37	468764	35271	904
105304	102249	100809	73532	27277	7795.201	27440.8	432025	29152	911
135859	101860	102844	75390	27454	13172.6	46370.4	469089	32498	937
143895	101499	102844	74576	28268	16987.02	59797.98	483350	32475	985
157187.6	102639	104507.3	75542.32	28965	22444.63	56651.19	496846.7	33107.88	1144
151912.5	104730	106131	76289.97	29841	23584.98	56027.34	500226.8	33709.03	1084
151691.3	107763	108385.1	77117.14	31268	25081.76	56808.78	515282.3	34407.65	958
180829	109097.4	109910.4	77960.2	31950.2	26372.02	56837.83	524795.3	35118.48	801.8591
188993.6	110864	113546.3	79363.69	34182.64	27123.63	57447.56	524016	35810.76	1203.611
193641.1	111966.9	115314.4	80404.7	34909.69	27899.45	58400.56	525235.4	36507.17	1235.153
197174	113061.4	116990	81470.63	35519.38	28313.53	59523	529122.8	37213.85	1280.397
201368.2	114138.4	118625.3	82577.78	36047.53	28767.96	60255.49	533160.8	37916.41	1368.993
207573.8	115190.6	120112.2	83613.56	36498.68	29255.67	60721.5	537681.3	38608.34	1373.982
211173.4	116214.8	121544.9	84648.77	36896.09	29677.74	61075.91	542095.5	39282.51	1378.991
211361	117217.7	122939.7	85678.27	37261.38	30122.36	61313.61	546972.6	39936.81	1384.018
211764.7	118196.4	124301.4	86700.03	37601.39	30507.14	61542.73	551205.4	40573.32	1389.065
212936.8	119157	125651.1	87726.45	37924.65	30816.69	61825.94	555387.3	41197.38	1393.667

215543.6	120106.1	126994.4	88754.59	38239.81	31206.67	62057.79	559997.2	41807.61	1398.287
216444.1	121047.1	128338.4	89783.64	38554.74	31602.74	62259.13	564819.3	42404.87	1402.923
217284	121981.6	129679.6	90812.75	38866.84	31979.18	62466.44	569571.6	42989.43	1407.577
220223.6	122915.1	131005.1	91837.49	39167.58	32387.22	62691.45	574527	43562.01	1412.222
222508.3	123847.9	132321.2	92856.92	39464.24	32755.72	62917.54	579204.8	44121.78	1417.042
224500.1	124778.8	133626.8	93869.43	39757.38	33130.49	63126.44	584016.9	44669.4	1421.879
226842	125708.7	134924.2	94875.92	40048.33	33504.81	63337	588853.5	45205.68	1426.735
229780.9	126637.5	136216.5	95878.25	40338.23	33895.29	63557.17	593979.8	45733.93	1431.604
232528.8	127566.6	137504.4	96876.25	40628.1	34293.03	63795.09	599253.5	46253.95	1436.49
235360.1	128496.3	138788.8	97870.12	40918.65	34693.39	64025.14	604600.5	46766.06	1441.395
238205.2	129427.1	140070.8	98860.42	41210.37	35092.98	64259.41	609963.7	47270.66	1446.317

Current ac RYHNMIR	Current ac RYHPRYC	Current ac RYHTRO	Current ac RYHTROC	Current ac RYHTRGE	Current ac RYHTRGS	Net Export RXNETKC	Current ac RYHTRGC	Current ac RYHTPO	Current ac RYHTPNC

4897	9049	12186	3328.109	1322.71	1860.328	21678	5674.853	27294	1133.39
5135	10695	11842	3234.16	1285.371	1807.812	25410	5514.657	30027	1246.878
5247	12747	10737	2932.374	1165.431	1639.122	24136	5000.074	31115	1292.057
5409	14297	10930	2985.084	1186.38	1668.585	24397	5089.951	32936	1367.675
5351	15743	12207	2959.087	2056.552	1862.902	27780	5328.459	34343	1360.937
5553	15896	13292	3222.101	2239.346	2028.483	31522	5802.071	35139	1392.481
5827	15276	14729	3570.442	2481.442	2247.782	31261	6429.334	33650	1333.475
5858	13402	15495	3756.128	2610.492	2364.681	26705	6763.699	34852	1381.107
6171	14092	15676	3838.034	2733.995	2473.937	26863	6630.034	36386	1415.076
6358	14640	16524	4045.654	2881.892	2607.765	31825	6988.689	39781	1547.109
6717	15899	16188	3963.389	2823.291	2554.739	26798	6846.581	35693	1388.124
6974	16741	16473	4033.167	2872.997	2599.717	31990	6967.119	38716	1505.691
7192	15934	16273	3783.364	2396.806	2831.975	33526	7260.855	40514	1574.632
7443	16668	16426	3818.935	2419.341	2858.601	32167	7329.122	39948	1552.634
7789	17997	17165	3990.748	2528.186	2987.209	32570	7658.857	42653	1657.768
7899	18117	17596	4090.953	2591.667	3062.215	33974	7851.165	43712	1698.927
7869	18086	17990	4702.34	2388.07	3179.047	39640	7720.543	44701	1762.904
7997	18824	18067	4722.467	2398.291	3192.654	32330	7753.588	42853	1690.023
8022	18981	20091	5251.513	2666.966	3550.319	26234	8622.203	46589	1837.362
8028	19277	19908	5203.679	2642.673	3517.98	26532	8543.667	47105	1857.712

8336	19736	20742	5693.863	2457.963	3852.644	34890	8737.531	49689	1896.579
8628	19704	21136	5802.019	2504.652	3925.826	31688	8903.503	50448	1925.549
8866	18843	20693	5680.412	2452.156	3843.542	30772	8716.89	51046	1948.374
9154	18869	20297	5571.706	2405.229	3769.989	24994	8550.076	52857	2017.498
9208	18944	20855	5961.133	2123.597	4394.206	32284	8376.064	53194	2005.967
9165	19431	21989	6285.272	2239.069	4633.143	27678	8831.516	57660	2174.382
9135	19764	26037	7442.34	2651.264	5486.068	23755	10457.33	57934	2184.714
9497	20477	24179	6911.255	2462.07	5094.582	28499	9711.093	59583	2246.899
9764	19420	25111	7490.246	2313.916	5581.314	33601	9725.524	64023	2380.538
9983	20388	24821	7403.743	2287.193	5516.857	24384	9613.207	63857	2374.366
10338	22723	25855	7712.17	2382.474	5746.68	16142	10013.68	64874	2412.18
10739	23473	26398	7874.139	2432.51	5867.37	19524	10223.98	65862	2448.917
10975	22810	27306	8685.492	2398.668	6091.794	32503	10130.05	67176	2529.782
11245	22513	29448	9366.819	2586.83	6569.661	20962	10924.69	67501	2542.021
11632	21748	28147	8952.997	2472.545	6279.416	19430	10442.04	70188	2643.211
11624	22993	29348	9335.011	2578.045	6547.352	18149	10887.59	73102	2752.949
12013	24804	30347	8403.902	3302.08	6870.965	27452	11770.05	73007	2560.472
12197	26316	31026	8591.936	3375.962	7024.699	30174	12033.4	81118	2844.938
12532	27084	31837	8816.523	3464.208	7208.321	22233	12347.95	77771	2727.553
12801	27060	33725	9339.362	3669.642	7635.789	21758	13080.21	77072	2703.038
13226	25673	34138	8738.63	4811.907	7038.782	20575	13548.68	73962	2591.182
13514	24359	36748	9406.737	5179.798	7576.928	20781	14584.54	80067	2805.064
13612	23289	37757	9665.02	5322.021	7784.97	25321	14984.99	79815	2796.236
13948	21971	38524	9861.357	5430.133	7943.114	18143	15289.4	79451	2783.483
14335	23085	39203	9620.61	5420.564	8214.173	17688	15947.65	80548	2811.312
14429	23526	40383	9910.188	5583.722	8461.417	20426	16427.67	80817	2820.7
14599	23597	41496	10183.32	5737.615	8694.623	15275	16880.44	78009	2722.695
14813	23461	41702	10233.88	5766.099	8737.786	22547	16964.24	80834	2821.294
14900	24274	42983	10708.27	5118.433	8958.737	19874	18197.56	83007	2884.255
15611	23514	43476	10831.09	5177.139	9061.49	22464	18406.28	75973	2639.844
15956	22855	43969	10953.91	5235.846	9164.244	22660	18615	82106	2852.948
16301	22581	43909	10938.97	5228.701	9151.738	30695	18589.59	83430	2898.953
16788	22241	44394	11611.69	4250.298	9541.954	29568	18990.06	81778	2783.73
17083	22533	44401	11613.52	4250.968	9543.459	31143	18993.05	83250	2833.837
17387	24304	44416	11617.45	4252.404	9546.683	33413	18999.47	86525	2945.318
17722	25086	44645	11677.34	4274.329	9595.904	36260	19097.42	86519	2945.114
18078	25421	44732	12165.08	3527.194	10044.77	37002	18994.96	87523	2929.163
18509	26007	44694	12154.74	3524.197	10036.24	32069	18978.82	88433	2959.618
18838	25590	44864	12200.97	3537.602	10074.41	35159	19051.01	90579	3031.439
19047	25925	45034	12247.21	3551.007	10112.58	46985	19123.2	89633	2999.779
19144	26157	45672	13214.94	3301.482	10666.48	42949	18489.1	91039	2987.145
19281	26107	45561	13182.82	3293.458	10640.56	49653	18444.16	92461	3033.804
19390	26361	45653	13209.44	3300.108	10662.04	44503	18481.41	94161	3089.584
19342	27143	45555	13181.09	3293.024	10639.16	25599	18441.73	94767	3109.467
19430	27637	46028	14783.93	2970.462	10485.02	33732	17788.58	96830	3342.311
19494	27817	46357	14889.61	2991.695	10559.96	30512	17915.73	99516	3435.024
19851	27242	47265	15181.25	3050.293	10766.8	38307	18266.65	99074	3419.767
20101	27368	48834	15685.21	3151.55	11124.22	38485	18873.03	99860	3446.898
20182	27875	48892	15876.32	2745.966	10871.46	40212	19398.25	102298	3590.03
20159	28255	49174	15967.89	2761.804	10934.17	38853	19510.14	104077	3652.462
20139	28088	49768	16160.77	2795.166	11066.25	46205	19745.81	102466	3595.926

20452	29025	50515	16403.34	2837.12	11232.35	47026	20042.19	103539	3633.582
20267	30211	49283	15868.56	2484.966	11313.95	53195	19615.52	106611	3771.207
20208	31538	49371	15896.89	2489.404	11334.16	51332	19650.55	108270	3829.892
20468	31503	49047	15792.57	2473.067	11259.77	60054	19521.59	109814	3884.508
20513	31104	49275	15865.98	2484.563	11312.12	60749	19612.34	110885	3922.393
21190	30989	49107	14518.56	2397.12	11799.82	60847	20391.5	112921	3973.303
21452	30030	48385	14305.1	2361.876	11626.34	62452	20091.69	114412	4025.766
21825	30821	49312	14579.17	2407.127	11849.08	61437	20476.63	115769	4073.515
22256	30225	49861	14741.48	2433.926	11981	64845	20704.6	115481	4063.381
22300	29367	54510	16991.17	3132.793	12541.27	66015	21844.77	115092	4032.479
22376	30180	53652	16723.72	3083.483	12343.86	63660	21500.93	121023	4240.284
22377	29674	54238	16906.38	3117.161	12478.69	64890	21735.77	116857	4094.319
22460	30383	53636	16718.73	3082.563	12340.18	62902	21494.52	116132	4068.918
22948	29406	53808	16533.69	3690.926	12853.62	66299	20729.76	114387	4205.737
23344	27630	54061	16611.43	3708.28	12914.05	61556	20827.23	115397	4242.873
23649	27277	54738	16819.45	3754.719	13075.78	67506	21088.05	115616	4250.925
24070	26951	55546	17067.73	3810.143	13268.79	61867	21399.34	119249	4384.502
23914	26227	56616	17585.86	3905.204	13385	60635	21739.93	116942	4181.175
23882	26617	56418	17524.36	3891.546	13338.19	54640	21663.9	118171	4225.117
23814	26763	56731	17621.58	3913.136	13412.19	56459	21784.09	121207	4333.667
23510	26774	57730	17931.89	3982.044	13648.37	52672	22167.69	122504	4380.04
23736	27617	59060	19145.95	3880.177	13780.44	53333	22253.44	126464	4737.524
23947	27299	59671	19344.02	3920.319	13923	60782	22483.66	125913	4716.882
24144	28131	60084	19477.91	3947.453	14019.37	52534	22639.27	129091	4835.935
24381	28329	61188	19835.8	4019.985	14276.96	47187	23055.25	132020	4945.659
24205	29354	60493	19203.68	3785.58	14254.36	49558	23249.39	134017	4776.395
24384	30485	61920	19656.68	3874.88	14590.61	51432	23797.83	138075	4921.023
24588	30654	62078	19706.84	3884.767	14627.84	53787	23858.55	140740	5016.004
24450	30955	62941	19980.8	3938.773	14831.19	52846	24190.23	140701	5014.614
24638	33049	68166	22558.49	3911.122	15418.95	48158	26277.44	140551	5230.945
25399	30545	65609	21712.29	3764.411	14840.56	42357	25291.74	141757	5275.83
25596	32104	67676	22396.33	3883.008	15308.11	37903	26088.55	143884	5354.991
25927	33554	68138	22549.22	3909.516	15412.61	40740	26266.65	144617	5382.271
25975	33540	72036	24977.97	3927.264	15614.95	30352	27515.81	153172	5372.576
25737	36512	73649	25537.27	4015.201	15964.6	40810	28131.93	160766	5638.939
25655	35349	76738	26608.36	4183.608	16634.19	34357	29311.85	157307	5517.613
26025	36095	77660	26928.05	4233.873	16834.05	18370	29664.03	157799	5534.871
26312	36904	78665.98	26179.67	4527.258	17962.63	14174	29996.41	159453	5693.842
26458	37264	75963.01	25280.14	4371.702	17345.43	16011	28965.74	158285	5652.135
26368	37190	75999.01	25292.12	4373.773	17353.65	15610	28979.46	155889	5566.577
26194	37770	76721	25532.4	4415.324	17518.51	16597	29254.77	154009	5499.446
26777	37993	82221	26269.58	6544.195	18242.55	18956	31164.68	150088	5283.382
26770	38445	83194	26580.45	6621.639	18458.43	12201	31533.48	149285	5255.115
26683	38903	86404	27606.05	6877.132	19170.64	-78	32750.18	150089	5283.417
26389	39455	88412	28247.6	7036.954	19616.16	-2750	33511.29	151641	5338.051
26827	39060	89810	28734.94	5905.417	19043.65	-3925	36125.99	152456	5826.286
27376	38219	93588	29943.72	6153.837	19844.75	-3092	37645.69	145446	5558.391
28118	38015	90373	28915.07	5942.437	19163.03	-4411	36352.46	152784	5838.821
28583	39038	94021	30082.26	6182.309	19936.57	1724	37819.86	153769	5876.464
28758	40328	89853	29152.53	5124.262	20116.82	-3888	35459.39	155791	5634.453
28972	40539	93019	30179.73	5304.817	20825.65	-8975	36708.81	162189	5865.848

28982	43266	92700	30076.23	5286.625	20754.23	1696	36582.92	164967	5966.319
29044	42748	93081	30199.84	5308.353	20839.53	2495	36733.28	164941	5965.379
29890	44299	93924	32480.38	5141.063	19603.01	-682	36699.54	168748	5960.555
29929	44542	92982	32154.62	5089.501	19406.41	5029	36331.47	170387	6018.448
30384	43159	92867	32114.85	5083.206	19382.4	4113	36286.53	170908	6036.851
30713	45111	92704	32058.49	5074.284	19348.38	2237	36222.84	171341	6052.146
31025	45378	94890	32636.18	4932.255	19921.84	4894	37399.72	171318	5761.079
31384	45702	97568	33557.25	5071.454	20484.08	10437	38455.22	173087	5820.567
31394	45841	99155	34103.07	5153.944	20817.26	8451	39080.72	174903	5881.635
32445	46039	102086	35111.15	5306.294	21432.61	7577	40235.94	176659	5940.686
32298	47447	101208	35624.3	5253.654	21340.39	6229	38989.65	179533	5824.947
32251	47946	100318	35311.03	5207.455	21152.73	2372	38646.79	180304	5849.962
32210	47659	100717	35451.47	5228.166	21236.86	7378	38800.5	181458	5887.403
32265	48556	100381	35333.2	5210.725	21166.01	-307	38671.06	183501	5953.688
32664	47714	104505	37431.83	5183.755	21221.45	-5349	40667.96	189350	5895.759
33091	52360	107760	38597.72	5345.213	21882.43	-3741	41934.64	188077	5856.122
33514	53533	110983	39752.14	5505.083	22536.91	8199	43188.87	192693	5999.849
33931	56377	112453	40278.67	5577.999	22835.42	11557	43760.92	196431	6116.239
34008	51634	112526	41346.53	5299.13	22364.43	13123	43515.91	195497	6077.719
34372	51204	114032	41899.89	5370.052	22663.74	2331	44098.31	198779	6179.752
34504	51436	116575	42834.29	5489.808	23169.16	4194	45081.74	197649	6144.622
34500	52006	116642	42858.91	5492.963	23182.48	3141	45107.65	198591	6173.907
34844	50810	117269	41919.9	5264.969	23091.35	-2892	46992.78	201804	6687.466
35127	53238	120472	43064.87	5408.772	23722.05	-200	48276.31	203300	6737.041
35581	54487	121908	43578.19	5473.243	24004.82	-9635	48851.75	204594	6779.922
35896	55564	123863	44277.04	5561.016	24389.77	-4716	49635.17	208446	6907.571
36274	53882	124156	43741.32	5237.07	24541.7	-8540	50635.9	210270	7451.406
36635	51473	125097	44072.84	5276.762	24727.71	-2267	51019.68	212296	7523.202
37450	48485	125171	44098.92	5279.884	24742.34	692	51049.86	215995	7654.284
38553	46644	126840	44686.92	5350.284	25072.25	-1161	51730.55	220759	7823.108
39475	48893	128278	45482.01	5301.918	25171.94	-3255	52322.13	220268	7753.24
40690	51115	132772	47075.39	5487.662	26053.8	7243	54155.14	222047	7815.859
41669	51431	131884	46760.55	5450.96	25879.55	7991	53792.95	221810	7807.517
42854	54189	134122	47554.05	5543.46	26318.71	3201	54705.78	224079	7887.384
43091	54019	143680	48513.04	5804.315	26605.85	8037	62756.8	224209	7834.992
43469	52989	232861	48383.92	31335.4	27239.43	20618	125902.3	210547	7107.854
41955	49935	188670	50771.71	15781.51	28054.21	9348	94062.57	227611	7685.754
41116	49773	173829	52465.29	14521.64	28949.57	2132	77892.5	232253	7919.137
41290.44	51346.55	178615	52227.91	14933.42	29265.53	-451	82188.13	235740	8079.488
41496.94	52713.16	184045	52750.19	15978.76	29613.79	-14598	85702.26	241749	8160.283
41751.49	53944.19	182237	53277.69	15386.69	29966.2	-12695.2	83606.42	245079	8241.886
42039.87	55371.81	155506.5	53606.86	11281.63	28119.93	-10818.9	62498.04	242739	8849.218
42349.32	56744.84	153104.4	53885.33	8416.99	28540.5	-14269	62261.54	248602.6	8839.733
42662.38	58031.6	153210	54165.02	6563.058	28904.87	-14772.2	63577.08	249001.2	8854.585
42976.39	59227.82	154297.5	54450.31	6350.74	29270.49	-17070.5	64225.93	250426.9	8886.432
43292.38	60347.54	155537.9	54735.32	6316.196	29670.39	-17928.9	64815.97	251983.3	8926.096
43631.23	61416.89	157157.8	55315.54	6443.543	29991.69	-17286.6	65407.06	257185.4	9006.417
43987.27	62414.27	159589.8	55922.51	6499.301	30357.29	-16236.6	66810.73	259035.1	9070.883
44357.44	63312.56	161224.3	56530.98	6448.109	30734.87	-15111.3	67510.33	260985.5	9136.85
44737.64	64122.89	163009.6	57140.87	6501.662	31127.62	-14624	68239.47	262765.5	9206.686
45135.4	64861.23	164742.4	57751.01	6635.839	31499.15	-14502.3	68856.43	265606	9278.638

45548.69	65548.97	167107.3	58361.57	6660.289	31878.59	-13915.5	70206.83	267947.5	9354.425
45975.84	66173.79	168791.2	58971.32	6674.042	32272.84	-13534.7	70873.03	269984.2	9427.33
46415.74	66741.29	170592.4	59581.89	6707.785	32706.35	-13321.9	71596.38	272029	9503.334
46863.26	67278.52	172859	60193.41	6903.114	33094.75	-13172.6	72667.71	275856	9578.21
47318.1	67781.79	174623.5	60806.83	6945.849	33482.66	-12943.6	73388.14	278218.6	9654.601
47778.15	68251.55	176442.1	61421.27	6977.449	33891.88	-12718	74151.51	280349.8	9730.909
48243.5	68694.68	178304.5	62036.21	7004.848	34321.33	-12382.6	74942.16	282581.8	9808.207
48712.72	69119.8	180349.4	62652.39	7232.871	34741.08	-12615.5	75723.11	286207.3	9887.478
49185.8	69526.69	182246.6	63269.2	7298.666	35167.27	-12676.4	76511.43	288565.2	9968.688
49662.67	69917.92	184153.6	63887.22	7358.907	35600.33	-12723.6	77307.15	290959.3	10050.68
50143.44	70295.08	186074.4	64505.86	7420.525	36037.64	-12831.3	78110.34	293375.1	10133.45

Current ac Current ac Current ac Current ac Current ac Current ac Current ac Current ac Housing S Housing S
RYHTPBC RYHTPRC RYHTPGC RYHTPGX RYHTPGC RYHTPOC RYHNSO RYHPSRC RIHSSO RIHMSO

								28.66528	45.63567
								32.6758	54.80543
								27.63452	52.73675
								22.6204	51.74615
								30.9656	52.5837
								22.75689	39.05769
								27.66756	46.63347
								30.40595	36.76913
								25.3726	27.79127
								27.77304	27.35033
								30.3434	27.51021
								29.55496	31.85219
								18.41592	28.9218
								15.74777	20.14761
								18.31237	17.17123
								22.29595	19.49536
8517.513	106.1428	17536.95	12637.29	4899.661	9757.045	18524.5	23.28954	27.04675	12.73958
9370.387	116.7711	19292.96	13902.69	5390.274	10734.04	17056.49	21.56075	33.32915	29.42012
9709.914	121.0022	19992.03	14406.44	5585.585	11122.97	16383.51	20.75017	24.09866	30.67862
10278.19	128.0838	21162.06	15249.58	5912.48	11773.94	14724.5	18.63743	13.28544	30.04568
10938.27	113.4944	21930.3	15732.91	6197.39	12412.7	19471	23.27035	11.54433	37.67727
11191.8	116.1249	22438.6	16097.57	6341.033	12700.4	21264	24.51973	11.97136	14.69426
10717.55	111.2042	21487.77	15415.44	6072.334	12162.23	22868	25.2292	16.02346	12.7434
11100.39	115.1765	22255.33	15966.09	6289.242	12596.67	22673	24.92525	31.80484	17.57308
11124.39	107.2906	23739.25	16584.61	7154.637	12646.75	19593.76	21.43761	43.46902	20.39461
12162.35	117.3013	25954.24	18132.04	7822.202	13826.76	18230.75	19.76191	37.99957	22.35165
10912.52	105.2471	23287.11	16268.74	7018.372	12405.89	23618.75	23.74507	25.01073	21.53963
11836.75	114.161	25259.4	17646.61	7612.789	13456.6	21274.74	21.43551	28.73668	20.25412
12326.04	110.7391	26502.59	18451.66	8050.927	14011.41	18734	18.93452	31.22311	18.57658
12153.84	109.192	26132.33	18193.88	7938.452	13815.67	22511	21.69421	31.94652	13.94934
12976.81	116.5858	27901.83	19425.85	8475.989	14751.17	24096	22.66813	35.81869	14.88373
13299	119.4804	28594.59	19908.16	8686.433	15117.41	24128	22.24271	32.41568	13.87035
12657	146.9908	30134.11	20860.86	9273.248	14566.89	22026.24	20.05832	29.62904	13.11675
12133.74	140.914	28888.32	19998.45	8889.879	13964.68	24590.25	21.43426	41.91897	24.73372
13191.58	153.1992	31406.86	21741.94	9664.914	15182.14	21319.25	18.4429	46.3918	24.29141
13337.68	154.8959	31754.71	21982.75	9771.959	15350.29	21535.26	18.33849	56.09618	23.30613

12769.52	155.8565	34867.05	24655.52	10211.52	14821.95	19719.01	16.58397	53.86829	17.27566
12964.57	158.2372	35399.64	25032.14	10367.5	15048.36	20290	16.68586	55.05842	25.56226
13118.25	160.1129	35819.26	25328.86	10490.4	15226.74	18661	15.21744	58.16342	24.63594
13583.66	165.7934	37090.05	26227.48	10862.57	15766.95	19482	15.73082	58.70186	32.61414
13000.12	157.4586	38030.45	27078.23	10952.23	15163.55	19422.76	15.20087	70.68259	44.0264
14091.57	170.6784	41223.37	29351.63	11871.74	16436.63	18033.75	14.05691	66.89956	40.56936
14158.53	171.4894	41419.26	29491.11	11928.16	16514.74	19559.75	14.50708	64.3514	42.89731
14561.53	176.3706	42598.2	30330.53	12267.67	16984.8	19999.74	14.7124	57.78246	33.64293
15215.04	189.1359	46238.28	33096.8	13141.48	17784.72	16813.24	12.31415	47.58611	41.87595
15175.59	188.6455	46118.4	33010.99	13107.41	17738.6	19714.25	13.91149	55.51313	47.63228
15417.28	191.6499	46852.89	33536.73	13316.16	18021.11	22954.25	15.54492	61.91912	38.12965
15652.08	194.5687	47566.43	34047.48	13518.96	18295.57	24230.26	15.92043	63.37764	43.66211
16008.1	208.8012	48429.32	35203.31	13226.01	18746.68	23493.75	15.1951	65.71033	47.13333
16085.54	209.8114	48663.62	35373.62	13290	18837.38	23123.75	14.48757	53.1372	38.64809
16725.86	218.1634	50600.77	36781.74	13819.03	19587.23	21748.75	13.82681	49.71024	31.89693
17420.27	227.2209	52701.56	38308.81	14392.76	20400.44	22356.75	14.01053	45.48624	41.62565
18051.85	196.5958	52198.09	39436.37	12761.72	20808.91	25664.75	15.66586	46.1836	41.80539
20057.39	218.4374	57997.24	43817.71	14179.53	23120.76	21668.75	13.65288	34.50846	31.12968
19229.8	209.4245	55604.22	42009.75	13594.47	22166.78	24453.75	14.99035	26.63147	27.11067
19056.97	207.5422	55104.45	41632.17	13472.28	21967.55	25780.75	15.56545	22.37647	20.85026
18598.15	230.4112	52542.26	39304.94	13237.31	21419.74	29790.75	17.59591	16.10519	19.91497
20133.29	249.4299	56879.22	42549.27	14329.95	23187.78	24814.75	14.90268	27.79967	24.07828
20069.92	248.6449	56700.2	42415.35	14284.85	23114.8	24684.75	14.61726	32.82307	32.80984
19978.39	247.5109	56441.62	42221.91	14219.7	23009.38	25606.75	15.03617	28.43207	29.21292
20582.74	267.6481	56886.3	40963.24	15923.05	23661.7	28865.24	16.84067	25.94213	35.24346
20651.48	268.542	57076.27	41100.05	15976.23	23740.73	28605.25	16.4699	28.17056	32.5781
19933.94	259.2114	55093.15	39672.02	15421.13	22915.85	29530.25	16.56119	27.51893	24.32528
20655.83	268.5985	57088.28	41108.69	15979.59	23745.72	25073.26	14.22862	29.84038	19.46916
22038.61	318.1991	57765.93	41356.68	16409.25	25241.07	25277.26	14.2861	24.37907	18.35768
20171.07	291.235	52870.86	37852.12	15018.74	23102.14	32500.25	17.60987	26.73181	15.42878
21799.4	314.7452	57138.91	40907.77	16231.14	24967.09	25937.25	14.49648	26.83562	17.06221
22150.92	319.8207	58060.3	41567.43	16492.87	25369.7	23647.24	13.34464	27.01349	24.75133
21347.74	349.2967	57297.24	40950.93	16346.31	24480.76	23759.74	13.17	26.06295	15.96213
21732	355.584	58328.58	41688.04	16640.54	24921.42	24249.75	13.30021	32.93203	17.56916
22586.92	369.5725	60623.19	43328.02	17295.17	25901.81	23091.75	12.6326	32.76928	17.68769
22585.35	369.5468	60618.99	43325.02	17293.97	25900.01	22870.76	12.29961	28.37974	15.21702
22759.99	398.091	61435.76	43925.65	17510.1	26087.24	22872	12.23121	22.93472	16.81708
22996.63	402.23	62074.52	44382.36	17692.16	26358.48	23577	12.5263	18.60411	14.21684
23554.69	411.9909	63580.88	45459.38	18121.5	26998.12	21217	11.27574	18.34511	14.60908
23308.69	407.6881	62916.85	44984.61	17932.24	26716.15	23538	12.37292	20.61206	17.133
23087.55	451.7385	64512.56	47211.56	17301	26526.44	19858.49	10.44678	22.28909	12.39618
23448.17	458.7945	65520.23	47948.99	17571.23	26940.77	18529.49	9.741802	27.19846	15.54468
23879.3	467.23	66724.89	48830.59	17894.3	27436.11	17552.5	9.16551	28.64242	17.35496
24032.98	470.237	67154.32	49144.85	18009.47	27612.68	17500.52	8.968324	29.94603	18.87618
24394.65	547.7431	68545.29	50320.83	18224.46	28284.71	16447.75	8.348604	35.74345	17.09752
25071.35	562.9371	70446.69	51716.7	18729.99	29069.31	15727.75	7.920387	34.11896	18.14647
24959.99	560.4368	70133.8	51487	18646.81	28940.2	16404.75	8.016745	36.05036	19.38281
25158.01	564.883	70690.21	51895.47	18794.74	29169.79	14195.75	6.830267	35.69122	20.0572
25074.64	578.493	73054.83	53751.23	19303.61	29243.17	17811	8.477715	34.21134	24.14804
25510.7	588.5532	74325.28	54685.98	19639.3	29751.72	15084	7.127029	31.99778	18.91929
25115.82	579.443	73174.81	53839.5	19335.31	29291.19	16819	7.82159	28.76352	19.53149

25378.83	585.5108	73941.08	54403.29	19537.78	29597.92	20567	9.34647	35.97536	21.77319
25068.93	649.094	77121.77	56988.11	20133.66	29489.23	16326	7.427256	37.62935	25.12867
25459.04	659.1947	78321.88	57874.91	20446.97	29948.12	17129	7.624071	39.81374	31.02541
25822.1	668.5953	79438.8	58700.24	20738.55	30375.2	14454	6.350753	40.01064	24.56619
26073.94	675.116	80213.55	59272.74	20940.81	30671.45	17287	7.443082	40.23026	30.53573
25810.71	665.8287	82471.16	60402.28	22068.87	30449.84	19023.25	8.046584	42.30214	32.03699
26151.51	674.6202	83560.1	61199.83	22360.27	30851.9	19170.25	7.975906	40.49024	23.06367
26461.69	682.6217	84551.18	61925.7	22625.48	31217.82	16874.26	6.896375	40.89817	33.78957
26395.86	680.9235	84340.84	61771.65	22569.19	31140.16	18735.24	7.582816	40.65745	32.84576
24696.36	760.5674	85602.59	62099.59	23503	29489.41	19785.5	7.811801	41.18079	32.33524
25969.03	799.7615	90013.93	65299.75	24714.18	31009.07	10726.5	4.311451	37.49696	38.32754
25075.09	772.2311	86915.36	63051.92	23863.44	29941.64	14413.5	5.667956	37.29269	32.59332
24919.52	767.4401	86376.12	62660.74	23715.38	29755.88	14315.5	5.587323	42.55756	31.3439
24456.5	958.1322	84766.63	59429.8	25336.84	29620.37	14808.49	5.696974	51.84037	37.97603
24672.44	966.5922	85515.1	59954.54	25560.55	29881.9	9304.494	3.571001	50.14579	29.52319
24719.26	968.4266	85677.39	60068.33	25609.06	29938.61	8419.505	3.18631	51.9339	30.78089
25496.02	998.8574	88369.63	61955.85	26413.77	30879.37	5415.514	2.04474	50.53594	31.65189
26265.2	874.3345	85621.29	59212.47	26408.81	31320.71	6277.5	2.326603	45.86004	46.06988
26541.24	883.5233	86521.12	59834.77	26686.35	31649.88	10596.5	3.92335	47.63091	29.55624
27223.13	906.2225	88743.99	61372.02	27371.97	32463.01	4908.49	1.818269	48.46546	36.19954
27514.43	915.9197	89693.61	62028.74	27664.87	32810.39	8545.511	3.123234	48.48359	38.45434
29178.77	984.1518	91563.55	64283.14	27280.41	34900.45	7703	2.784244	50.33415	32.00356
29051.64	979.8639	91164.61	64003.06	27161.55	34748.39	10675	3.783824	49.17487	37.0054
29784.89	1004.595	93465.58	65618.48	27847.1	35625.42	7729	2.725029	48.89262	38.82769
30460.7	1027.389	95586.26	67107.32	28478.94	36433.74	5124	1.807567	47.31436	36.90335
31124.04	1129.213	96987.35	68948.79	28038.56	37029.65	2293.245	0.805538	37.61036	34.25037
32066.47	1163.405	99924.1	71036.54	28887.56	38150.9	2321.25	0.806569	47.26493	39.8225
32685.39	1185.86	101852.7	72407.62	29445.12	38887.25	4101.247	1.415727	41.24287	39.03131
32676.33	1185.531	101824.5	72387.56	29436.96	38876.48	1699.258	0.577119	40.60984	35.34782
33362.42	1091.299	100866.3	71426.88	29439.46	39684.66	8210	2.701351	42.76607	38.01578
33648.69	1100.663	101731.8	72039.76	29692.06	40025.18	2074	0.686512	37.28026	38.17386
34153.57	1117.178	103258.3	73120.68	30137.58	40625.74	7480	2.423622	37.18581	32.98978
34327.56	1122.869	103784.3	73493.19	30291.11	40832.7	10100	3.210844	36.00385	31.25258
37976.21	1486.322	108336.9	77351.08	30985.82	44835.11	3562.242	1.130802	35.73499	27.99401
39859	1560.011	113708	81186.01	32522.04	47057.95	2078.251	0.655463	37.45936	29.68354
39001.4	1526.446	111261.5	79439.23	31822.31	46045.46	12131.25	3.724956	39.60746	34.12906
39123.39	1531.221	111609.5	79687.69	31921.83	46189.48	11597.26	3.51849	38.83819	29.04539
39784.74	1645.249	112329.1	80396.68	31932.46	47123.83	13395.74	4.023761	35.42178	44.24281
39493.32	1633.198	111506.3	79807.78	31698.56	46778.65	10026.77	2.996007	33.19311	44.15688
38895.5	1608.476	109818.5	78599.72	31218.73	46070.56	4155.752	1.233944	29.22488	45.49436
38426.43	1589.078	108494.1	77651.82	30842.24	45514.96	8966.737	2.6611	26.59223	41.97795
37971.44	1767.786	105065.4	72905.68	32159.72	45022.6	16098.25	4.685499	18.40621	32.35677
37768.28	1758.328	104503.3	72515.62	31987.66	44781.73	19650.25	5.701178	19.19967	23.12945
37971.69	1767.797	105066.1	72906.16	32159.93	45022.9	20867.25	5.972395	22.73123	25.48533
38364.34	1786.077	106152.5	73660.05	32492.48	45488.47	23720.25	6.673133	30.19889	29.97245
40749.7	1720.142	104159.9	71878.72	32281.16	48296.13	19067	5.342528	35.80026	25.71231
38876.01	1641.049	99370.55	68573.7	30796.85	46075.45	28278	7.646443	28.07289	35.33154
40837.37	1723.842	104384	72033.36	32350.61	48400.03	14797	4.067524	25.06035	35.01759
41100.65	1734.956	105056.9	72497.76	32559.17	48712.07	15668	4.206638	23.42249	33.31457
42690.27	1677.447	105788.8	73443.15	32345.69	50002.17	18470	4.938516	25.42298	36.34983
44443.46	1746.337	110133.4	76459.3	33674.05	52055.65	17015	4.568852	27.28215	43.63204

45204.7	1776.248	112019.7	77768.91	34250.83	52947.27	17383	4.631613	27.58479	43.85689
45197.57	1775.968	112002.1	77756.65	34245.43	52938.92	16597	4.389278	27.24608	39.90924
46261.91	1769.246	114756.3	79411.99	35344.3	53991.71	13921.5	3.657182	26.26599	52.73837
46711.24	1786.43	115870.9	80183.29	35687.59	54516.12	15257.5	4.000823	26.94114	54.45277
46854.07	1791.892	116225.2	80428.47	35796.71	54682.81	15452.5	4.038613	25.49794	52.63984
46972.78	1796.432	116519.6	80632.24	35887.4	54821.35	16888.5	4.374897	23.56294	44.86903
46662.67	1898.369	116995.9	79893.98	37101.9	54322.12	17709	4.5037	23.59401	33.21886
47144.5	1917.972	118204	80718.95	37485.01	54883.04	15075	3.805348	23.66543	34.81285
47639.13	1938.095	119444.1	81565.84	37878.29	55458.86	13985	3.507782	23.51197	41.76893
48117.42	1957.553	120643.3	82384.75	38258.59	56015.66	17331	4.280189	22.30859	41.45935
48522.73	1877.577	123307.8	84950.69	38357.06	56225.25	13368.75	3.305996	19.96726	33.73553
48731.11	1885.64	123837.3	85315.51	38521.78	56466.71	8172.751	2.00158	24.83	39.44583
49043	1897.709	124629.9	85861.55	38768.34	56828.11	7126.749	1.725718	25.35347	33.35755
49595.17	1919.075	126033.1	86828.25	39204.82	57467.93	4727.746	1.142373	24.61326	35.23309
49655.98	2150.02	131648.2	91635.72	40012.51	57701.76	5889.245	1.412797	18.60962	37.48835
49322.15	2135.566	130763.2	91019.66	39743.51	57313.84	11485.25	2.669746	24.99236	43.50768
50532.67	2187.979	133972.5	93253.57	40718.94	58720.5	9235.252	2.128846	27.11875	53.27428
51512.94	2230.423	136571.4	95062.57	41508.83	59859.6	7132.254	1.626271	29.09127	46.5417
52391.64	2305.853	134721.8	93999.88	40721.91	60775.21	-1473.75	-0.34031	31.80034	45.0218
53271.19	2344.564	136983.5	95577.95	41405.54	61795.51	496.2457	0.114014	28.5294	45.74004
52968.36	2331.236	136204.8	95034.62	41170.17	61444.22	2220.248	0.504789	28.97046	44.93055
53220.81	2342.347	136853.9	95487.55	41366.38	61737.06	115.2566	0.026014	31.01579	43.79961
53124.8	2543.565	139448.2	98659.36	40788.81	62355.83	-4332.76	-0.97158	35.9495	51.77778
53518.62	2562.421	140481.9	99390.74	41091.18	62818.09	-5648.75	-1.24576	28.8292	40.77634
53859.27	2578.731	141376.1	100023.4	41352.72	63217.92	-1992.75	-0.43127	28.85375	56.10314
54873.31	2627.282	144037.8	101906.5	42131.29	64408.16	-854.743	-0.18189	25.21956	48.98275
53031.93	2683.798	147102.9	104415.6	42687.27	63167.13	6473.753	1.34151	29.32411	57.89009
53542.9	2709.657	148520.2	105421.7	43098.57	63775.76	-2350.25	-0.4899	24.04485	52.01032
54475.82	2756.87	151108	107258.5	43849.51	64886.98	-12307.3	-2.59273	21.37504	48.05644
55677.35	2817.675	154440.9	109624.2	44816.66	66318.13	-15500.3	-3.26402	20.39999	61.86715
55335.08	2867.786	154311.9	110138.5	44173.43	65956.11	-9485.5	-1.959	18.09856	44.51186
55782	2890.948	155558.2	111028	44530.2	66488.8	-999.501	-0.20047	18.78494	49.52351
55722.46	2887.862	155392.2	110909.5	44482.67	66417.84	2645.502	0.520519	21.12612	57.7369
56292.47	2917.404	156981.7	112044	44937.7	67097.26	9511.499	1.835279	19.13838	47.01973
56365.47	2903.422	158371.3	112297	44808.14	65837.68	25084	4.809787	21.53485	47.28455
49300.1	2858.372	148721.1	109293.5	41987.2	61825.91	160567	27.64298	19.84748	59.71019
55486.59	2864.586	160774.3	117279.8	44294.31	66836.66	80275	14.45165	23.55597	70.74541
53943.55	2850.605	164053.2	121868.8	45670.91	68199.75	74544	13.57134	25.78971	56.75185
55283.33	2901.869	169475.3	122994.6	46480.68	66264.69	88349.75	15.59268	35.75468	65.64327
55714.54	2756.776	175117.4	128869.1	46248.28	66631.6	92659.76	16.2127	32.83922	65.5627
56149.12	2618.937	178069.1	132052	46017.03	67009.94	74242.24	12.72357	32.29745	70.46004
58376.66	2678.611	172834.5	126062.3	46772.18	69904.48	51469.02	9.0155	24.52065	71.18599
60600.14	2685.749	176476.9	127445.5	49031.44	72125.63	41116.53	7.282077	30.86435	66.13565
60472.52	2693.77	176980.3	127883.1	49097.25	72020.88	33825.2	5.956392	30.32764	65.67236
60722.98	2715.769	178101.8	128811.9	49289.88	72325.18	28101.77	4.898409	29.49188	65.03451
61015.95	2737.921	179303.3	129799.7	49503.59	72679.96	25843.22	4.458489	29.04489	65.0079
62768.86	2778.192	182631.9	131004.8	51627.13	74553.47	22986.01	3.944849	28.51558	64.77653
63117	2815.2	184032	132139.5	51892.47	75003.09	24809.52	4.207047	28.0856	64.44582
63516.38	2852.535	185479.8	133324.1	52155.64	75505.76	26805.61	4.496061	27.81805	64.49489
63842.64	2890.194	186826	134436.3	52389.68	75939.52	28193.97	4.681265	27.5636	64.69754
64594.37	2920.931	188812.1	135659.8	53152.3	76793.94	27418.09	4.516155	27.33945	64.86988

64990.48	2949.073	190653.5	137242.4	53411.08	77293.98	28272.03	4.608614	27.08768	65.06988
65407.74	2977.19	192171.9	138495.8	53676.13	77812.26	28857.08	4.657495	26.83685	65.2689
65802.99	3005.578	193717.1	139778.1	53939.01	78311.9	29486.33	4.712617	26.58612	65.46783
66801.62	3034.012	196442.1	141487.5	54954.69	79413.84	29589.33	4.691908	26.32839	65.67376
67188.28	3063.029	198312.7	143091.2	55221.53	79905.91	30084.42	4.728408	26.08342	65.89652
67585.8	3092.413	199940.7	144449.7	55491	80409.12	31001.53	4.827169	25.84928	66.10845
67982.93	3122.163	201668.5	145906.5	55761.96	80913.3	31784.24	4.903864	25.61611	66.31941
68951.18	3151.972	204216.7	147472.4	56744.32	81990.63	31584.08	4.835877	25.38966	66.52365
69385.59	3182.146	206028.8	149007.5	57021.25	82536.42	32314	4.900978	25.15761	66.73349
69823.09	3212.686	207872.9	150572.5	57300.37	83086.45	33089.4	4.971493	24.92622	66.94267
70265.52	3243.603	209732.6	152151	57581.58	83642.57	33841.12	5.037241	24.69552	67.15116

Housing C	Housing C	Real Dom	Real Dom	Real Dom	Real Dom	Real Dom	Real Dom	Real Dom	Real Dom
RIHSCO	RIHMCO	RQMORE	RQMMINC	RQMIMFC	RQMSUP	RQTWHO	RQTRETC	RQIMPRC	RQIOTHO
		16561.1	633.9928	450.761	124.7426	2820.476	5468.989		
		15284.92	608.2015	379.5521	99.22262	2864.596	5501.05		
		13128.43	583.217	291.0578	83.57437	2920.529	5666.436		
		10066.71	580.0219	204.7734	66.02267	2988.802	5514.898		
		13875.93	637.6445	400.1641	119.1307	3172.608	5614.869		
		12031.15	651.4256	333.5611	107.2067	3257.521	5601.559		
		11127.94	665.6043	299.3546	100.688	3307.494	5607.86		
		10434.71	667.556	268.7554	94.77531	3238.869	5773.312		
		12093.35	593.2843	334.5643	103.7181	3258.348	5829.952		
		12031.02	620.1906	335.182	104.1191	3289.454	5943.482		
		11219.93	614.3186	307.1913	101.5587	3412.096	5984.022		
		11302.71	609.1757	333.9725	105.5537	3439.533	6126.16		
		13364.55	638.3408	263.2086	116.5388	3641.608	6215.355		
		12956.12	638.5519	297.4941	123.0862	3577.363	6230.072		
		12058.87	657.8252	302.9988	132.1881	3705.411	6362.255		
		11386.96	698.3284	314.7656	136.5599	3862.674	6337.295		
		13464.28	687.2387	332.0836	138.4362	3891.205	6489.018		
		12048.56	681.8801	315.3163	132.5872	3824.308	6761.846		
		10603.51	666.9541	264.7246	120.8104	3976.046	6833.134		
		9408.815	669.4969	217.1634	112.408	4106.583	7076.204		
		10385.84	752.0578	387.5398	130.7721	4243.211	7579.688		
		9506.646	681.5564	343.2103	114.6918	4549.01	7080.729		
		8485.049	644.9277	258.5313	94.83394	4679.264	7428.92		
		9529.432	647.3084	313.2763	102.7812	4874.393	7463.18		
		9110.426	605.9884	261.331	97.98341	4827.259	7407.576		
		10199.67	623.7543	282.5157	102.1095	4756.87	7605.427		
		11487.39	653.1173	331.8717	110.1282	4857.1	7643.16		
		12129.38	736.0108	345.4116	111.648	4837.835	7761.045		
26.49957	34.63894	10979.81	697.7229	266.3707	99.87258	4890.531	7948.31		
27.25414	32.79589	11199.89	705.1445	266.9408	98.12496	4742.689	8128.84		
28.35208	43.58449	11531.98	673.6998	284.776	110.0546	4905.107	8476.439		
29.58999	46.23527	11105.66	608.9282	268.9368	120.3185	4956.364	8482.782		
29.89457	41.38549	12443.29	722.8992	338.6655	159.5313	5204.198	8566.594		
32.44898	59.40381	11764.56	699.0393	317.84	160.7211	5388.527	8310.669		
32.25869	43.2419	8876.696	517.0243	161.9205	130.9344	5425.49	8370.053		
30.66349	50.42648	9461.38	571.4722	197.3896	140.4221	5441.967	8552.139		
24.67224	39.11418	10842.49	663.2222	290.8812	137.7963	5581.321	8721.844		
25.32682	47.38723	11016.47	668.1503	313.6216	137.2496	5525.07	8993.504		
24.46942	50.1664	11557.69	676.3248	344.488	137.8015	5773.531	9235.737		
20.61041	46.02444	11216.28	589.3181	297.8703	122.0363	5761.073	9155.49		
19.27607	47.40191	9521.763	623.2461	280.2916	116.4074	5743.313	9090.979		
22.12832	44.1483	9749.028	603.4231	290.7263	101.0237	5859.043	9461.516		
28.95477	51.36941	10360.38	612.1592	301.8942	95.14491	6204.976	9746.988		
29.96215	51.20571	10546.08	617.5888	281.0256	82.89544	6401.623	10103.79		
33.50771	77.84338	10844.3	735.0526	322.6807	123.9555	6353.736	10208.69		
32.41077	61.99009	10464.22	679.3796	244.5792	103.4073	6553.496	10619.31		
33.51861	57.23435	9635.258	554.8038	153.4929	50.12231	6700.838	10768.51		
37.3057	54.32895	10705.95	606.0439	204.4462	58.24526	6834.336	10912.89		
39.05183	48.34058	12126.89	642.7698	185.4271	96.38362	6910.843	10961.31		

42.2595	51.91676	12308.11	596.5759	177.5637	75.40289	6992.436	10912.22			
42.20978	59.64789	12266.99	540.8033	164.1076	70.02289	6918.779	11022.6			
42.16737	64.7271	13184.5	570.6266	199.147	88.87424	7140.366	11268.85			
41.82591	70.48912	11526.08	497.5629	134.2593	71.32595	7386.54	11671.15			
39.70676	65.5304	11637.52	466.6002	130.7743	80.20206	7095.925	11641.94			
34.87699	65.01463	11504.8	488.8964	139.4227	102.1584	7083.138	11829.52			
35.44329	67.37028	11638.68	557.5811	177.0192	118.7663	6980.256	11628.05			
30.09254	53.83367	10506.07	544.1078	212.7739	119.1338	6826.35	11849.25			
29.90201	57.93294	9465.466	500.5137	168.353	123.816	6957.869	12016.9			
28.45373	48.40649	9151.591	466.4818	157.5852	112.1015	6972.569	12332.14			
36.30816	42.59759	8995.849	463.7965	141.9226	104.462	7025.717	12974.19			
27.09456	48.03658	9915.512	532.715	92.0124	91.53535	7335.645	12511.24			
37.93756	52.74747	9883.546	504.1261	89.14674	82.69477	7309.449	13201.94			
33.21692	45.05238	10066.07	516.3067	88.59397	87.74352	7278.101	13263.11			
29.63542	47.76574	9203.75	461.4489	62.68896	81.48741	7209.661	13462.96			
29.84961	49.97668	9734.08	517.8685	134.667	92.46524	7346.873	13303.18			
27.84478	52.08989	8598.635	482.2016	106.153	88.39915	7202.797	12965.49			
31.75461	52.34978	8871.584	500.9688	111.5764	92.25189	7273.275	12966.1			
26.81914	51.95219	9060.107	504.1088	115.118	98.10669	7226.57	13073.02			
26.11803	54.83244	9441.116	533.613	157.5873	82.23339	6996.375	13219.92			
27.68809	55.0709	8368.268	517.8528	137.9581	78.11597	7358.94	13338.94			
24.86804	60.16579	6135.652	461.3611	109.0462	69.87267	7371.854	13513.61			
28.66305	44.64614	6092.411	443.094	109.8744	72.8184	7530.118	13391.25			
29.50972	46.34411	5744.941	484.5089	114.6805	111.9465	7615.771	13401.86			
29.09858	40.73947	4762.832	365.9211	86.65182	110.6146	7861.217	13560.55			
31.89879	46.19323	7042.422	533.4248	134.5095	167.6831	8071.513	13694.47			
32.89128	47.9547	7864.484	655.1702	156.0181	195.8349	7994.251	13495.4			
26.63966	40.38151	6313.436	345.3862	119.7393	147.1197	7970.533	13360.79			
23.30079	33.95224	7057.554	535.4226	141.7626	234.5599	8267.746	13029.95			
21.13621	29.84038	8481.983	617.8752	144.6958	264.489	8247.497	13383.97			
18.8768	25.16206	8579.81	572.0639	131.5189	235.719	8512.749	13671.19			
21.02438	20.06218	6903.655	539.1267	149.7642	238.552	8079.032	14212.36	17845.38	32755.64	
22.79217	24.79543	6603.554	510.975	123.3174	221.3204	8325.095	14096.87	17819.07	32678.36	
25.27585	21.11658	6429.611	492.3314	127.3852	215.1297	8173.924	13726.77	17896.22	32180.28	
23.08161	23.27119	6273.276	435.6738	131.3605	202.9502	7954.006	13883.53	18094.03	32162.09	
19.12701	24.30312	6168.008	423.8044	140.0745	191.1406	8275.817	13746.92	18175.16	32154.4	
16.0378	25.88634	6214.307	341.4181	149.2186	185.4631	7871.665	13908.21	18334.23	31705.9	
14.0962	23.34784	4097.858	348.0119	136.162	201.4475	7848.119	13886.53	18471.27	31975.48	
17.69282	22.76406	4637.184	378.9113	127.4504	218.8627	7676.592	13942.8	18634.78	32606.54	
27.59741	34.04486	4592.165	333.2564	131.7811	149.9197	8244.806	13890.09	18547.79	32855.82	
35.40164	16.87855	5528.193	400.1136	138.4938	176.8053	8590.36	14109.39	18780.42	33490.54	
35.76601	19.4101	6401.24	395.5784	157.7701	272.8064	9006.251	14459.2	19000.62	33614.22	
32.53681	21.18937	7155.487	464.5434	183.4908	327.1356	9296.009	14561.88	19203.16	32704.96	
29.57175	23.69082	8643.711	340.7616	260.4721	394.016	9158.061	15423.94	20308.52	33264.42	
31.50832	23.51502	8992.385	640.0559	281.2449	605.7329	9322.219	15680.02	19372.82	33089.95	
34.82595	13.93876	10143.79	832.1674	298.1348	588.29	9642.222	15804.41	19032.7	32697.37	
33.03944	28.07054	9538.925	871.0989	297.0192	542.8996	10152.45	15977.29	19236.04	34277.07	
29.26489	14.2404	9210.694	159.9916	331.267	478.004	10229.17	15792.15	19531.03	34507.64	
30.34464	12.62865	8945.257	493.0492	334.7775	499.6147	10888.43	16004.87	19701.14	35755.56	
37.4479	16.56602	8736.425	914.3346	324.2693	415.739	11362.1	16258.78	19920.17	37857.76	
42.1908	16.41923	8887.646	1434.362	316.5998	391.5986	11827.64	18287.22	20129.51	38007.98	

43.92192	16.49139	8236.769	612.7684	300.0407	201.9268	12075.98	16993.63	20341.51	38230.26
49.21071	21.12614	8643.695	904.9846	303.9868	216.3102	12351.7	17298.56	20597.06	39327.64
48.75919	22.5504	8750.927	1031.397	308.1186	317.013	12844.99	17863.2	20763.69	40166.16
54.34372	20.93825	8954.072	1164.586	322.2531	583.4333	13126.3	17997.04	20916.11	40724.99
60.09319	22.8725	8807.779	1319.975	310.1676	415.9183	13408.88	18313.44	21313.29	42237.73
59.71908	28.24297	8635.74	1008.312	298.4516	465.0097	13664.59	18618.82	21607.54	42469.16
65.97802	29.11774	9031.588	871.7458	290.1218	551.6383	13819.12	18455.72	21905.32	42852.76
59.39208	28.57044	8988.939	979.4577	344.2392	385.6663	14336.61	18653.12	22227.75	43472.42
61.01249	23.68094	9428.672	684.35	314.4308	905.7617	15097.32	18330.49	22757.45	42355.11
57.53228	33.17102	8955.981	835.7316	336.6779	694.2699	15559.33	18691.36	23147.07	43293.9
51.5279	34.0891	8749.754	1013.903	348.3004	496.6584	15519.85	18968.81	23508.47	42972.48
62.48913	30.45826	9281.358	1385.249	358.8523	448.8411	15815.19	19197.27	23889.52	42818.84
58.52843	55.0561	8696.326	1068.348	331.3441	272.718	16764.94	19725.77	24284.31	43530.84
59.19987	46.05423	9296.024	1148.866	357.822	452.5641	16685.36	19452.37	24709.03	43645.25
51.95642	40.16516	9278.194	1111.407	379.565	463.6621	17004.11	19043.76	25068.47	44106.17
51.13928	41.10685	9382.279	916.0392	368.1907	496.7119	16802.09	18740.3	25441.58	44646.18
52.33737	44.29486	10141.39	1436.475	352.9751	524.3904	17289.99	19115.33	25599.54	44625.21
49.70409	35.01003	9844.33	1138.666	335.7502	390.093	16791.52	18258.07	25971.17	44454.56
41.48328	32.81461	9386.933	820.8155	371.7965	332.0194	16224.49	17873.9	26324.86	44657.22
33.51688	38.24588	8692.908	-4.94024	374.7503	339.7457	16200.66	17385.35	26717.82	44818.84
29.62729	38.42897	10155.86	777.1683	354.8087	234.617	15452.38	16662.35	27274.4	45427.17
23.347	36.07638	9735.205	718.4452	348.5189	251.9932	16571.15	17055.59	27599.28	46126.14
24.7812	27.91496	9323.368	625.4416	310.7868	305.0034	16912.17	16882.85	27879.81	45443.68
31.18422	26.36077	8789.804	844.818	272.4713	309.4356	16989.31	16857.57	28083.54	45524.91
29.66345	33.1408	8575.272	646.3013	311.1233	169.9395	16927.65	16682.42	28267.14	45673.13
29.47837	28.80862	8745.3	734.9713	296.6059	159.8458	17143.35	16764.11	28516.68	45733.82
31.05259	34.81867	8927.542	825.0543	271.0907	168.7924	17637.24	16944.94	28729.93	46293.23
29.54597	33.65556	8900.255	831.846	262.9519	231.3518	17874.75	16977.37	28982.19	46065.47
29.7545	22.58894	9174.412	972.1921	273.3291	159.9928	16910.77	17664.05	29057.42	45344.73
27.04753	18.80773	9055.532	1018.562	305.2124	227.3251	16752.63	17712.83	29275.44	45469.9
27.48678	33.93515	8743.15	859.1025	315.0668	237.3214	17396.94	17696.56	29439.94	45874.16
26.09446	18.276	8978.437	694.4372	325.5354	279.5599	17873.88	17794.64	29561.6	46951.74
24.69192	18.62252	7728.785	705.678	302.8737	238.087	17321.18	18059.25	29542.75	48438.9
29.24919	15.70839	7808.402	623.4824	292.0562	253.7921	17948.22	18263.59	29693.08	49536.64
30.82611	23.14889	7263.66	1035.382	309.4164	116.6267	18386.65	18374.94	29856.18	50050.49
30.01333	23.0435	7171.582	1319.804	351.3057	188.3542	18787.16	19185.2	30075.7	50305.67
25.1708	14.01405	7764.643	310.6082	365.6557	164.2804	19641.93	19008.85	30317.36	50255.24
23.28959	15.8821	7158.366	1051.445	366.4641	270.4289	19742.65	18938.59	30523.03	50381.89
20.60432	16.4453	7136.477	1366.931	339.4856	289.6652	19471.91	19348.46	30648.77	51409.57
19.68763	11.45386	6772.803	1209.81	303.4476	232.0753	19539.62	18809.53	30772.49	51722.1
20.03416	15.98996	8227.717	701.4094	269.9986	496.0876	19981.67	19199.61	30766.84	52629.7
20.36465	15.92406	7954.147	995.4384	265.1787	213.5929	20504.75	18809.76	30879.27	52714.12
26.4676	13.8459	7333.403	1157.067	276.9769	563.9857	20742.92	18970.1	30993.05	53688.04
27.22245	21.01893	5348.379	1595.365	248.376	528.655	20822.65	19285.57	31100.05	55567.87
28.05286	15.10139	7130.317	807.5292	159.3518	417.4038	20678.89	17988.77	31622.46	54579.69
31.33688	23.59746	5833.089	665.1546	150.2309	418.7438	21471.27	18338.68	31796.35	55634.22
35.29452	16.96914	6923.638	1126.855	216.0166	572.6304	22889.64	18756.48	31981.41	56009.46
34.25931	19.85778	7052.956	1272.461	187.2007	258.822	23519	19669.67	32170.18	56966.22
35.63481	18.91149	6525.828	808.1714	200.8471	180.8085	23282.72	19710.51	32357.61	57178.97
33.45603	19.24254	6612.795	858.4761	200.9148	370.5287	23838.27	20567.65	32545.3	58155.86
28.77991	13.21359	6915.346	971.7505	195.4401	500.9588	23930.57	20526.32	32712.95	58300.43

32.08376	14.52274	6513.231	1009.202	199.998	566.904	25031.23	20622.32	32909.75	58854.73
37.14687	23.55365	7292.505	946.6411	168.4259	416.3139	25614.95	20979.23	33349.24	59959.26
39.01168	20.16699	7073.472	980.3277	148.7903	365.8876	25545.69	20994.74	33614.77	61253.6
37.69112	18.6792	6486.096	862.4536	130.7715	314.0625	26004.63	21353.77	33845.81	62667.31
38.18328	26.65812	6897.128	898.5775	128.4124	318.536	27128.33	21549.05	34086.98	64771.43
38.55777	26.15827	7540.819	1238.922	101.4116	616.4954	27687.59	22310.62	34671.5	66543.76
37.00649	25.69152	7598.124	996.9672	98.96622	555.6598	28355.08	22675.87	34907.89	66126.28
39.66447	33.46435	7545.159	972.867	102.0985	614.737	28612.49	23333.34	35150.06	67251.24
38.50638	21.76311	6851.498	752.0439	97.52364	559.9079	28643.64	23197.77	35327.75	67753.92
39.34039	21.63192	6938.867	660.2532	69.64367	450.0565	28656.22	23525.96	35355.69	70391.48
39.43373	26.58035	7051.9	1208.241	71.08469	155.9797	28574.72	23870.9	35588.17	71599.62
43.67335	33.72077	7420.568	1379.507	76.79456	638.8676	29443.66	23645.98	35927.16	72599.62
42.30393	26.43911	7212.665	1251.6	72.07709	1000.696	28346.61	24638.36	36322.58	73968.48
43.62786	32.98185	6275.868	131.7609	74.56985	210.0522	28976.1	25531.31	36633.48	73887.85
45.60264	30.68099	6679.768	1469.418	79.63305	809.8968	29655.4	25549.49	37022.07	73877.68
49.48361	33.09086	6647.39	1402.829	73.20662	665.36	30203.07	25422.32	37386.68	73941.07
49.13432	40.08292	6267.374	1311.193	62.19048	504.291	30335.43	26214.88	37710.97	74443.8
46.63466	25.5757	6440.276	1169.597	56.4819	806.0718	31076.99	26202.96	37663.68	74010.26
46.48912	33.00292	5454.933	934.0402	42.69089	651.0582	31185.15	26708.13	37889.4	74519.43
45.85645	27.63093	5920.026	1178.658	46.00663	696.6962	30417.33	26970.4	38112.8	74717.11
47.4572	31.67753	6423.565	1313.705	56.42058	565.7738	31742.13	26633.71	38412.92	74820.8
49.08986	25.77257	6610.471	1274.54	48.06411	635.8995	31761.45	27297.46	38736.7	76238.73
46.59883	40.8544	6749.373	1170.865	50.46727	671.0086	31974.35	27478.62	39039.18	77332.25
48.41229	31.98319	6336.731	1112.221	52.51498	678.2784	31726.05	27716.87	39376.06	77376.45
48.40354	33.51671	6641.825	962.7746	56.15364	439.2136	32349.35	27820.65	39781.25	78264.56
47.4049	39.64369	6801.407	1263.732	56.38573	672.1908	34045.29	28027.31	40413.84	78918.55
42.87608	28.72374	6464.867	1229.927	55.45079	764.3998	34097.09	27996.03	40773.24	79963.81
42.28463	33.31624	6784.352	1215.206	52.31451	582.4919	34355.64	28239.8	41119.5	80832.55
40.7437	33.85302	6340.973	1169.535	43.84897	622.9175	35345.98	28614.86	41458.22	82054.69
42.10281	40.48976	5943.276	1072.515	58.37944	526.1731	36126.47	29116.99	41831.38	81739.35
41.39766	32.88938	5959.981	1122.519	51.4584	695.0099	35986.65	29297.71	42136.87	82851.76
39.11466	39.32362	5519.546	1236.7	50.11753	633.5909	35816.61	29604.94	42470.82	84671.47
37.35333	25.99413	5896.398	1363.466	50.44462	788.8261	36023.06	29664.35	42807.33	85670.23
38.01198	29.56312	5806.244	1113.327	98.3278	745.3765	37433.65	29218.76	42405.19	86199.48
34.87324	23.12047	5369.412	1111.907	95.97704	1292.196	37914.51	29653.6	42569.31	86659.66
34.79875	28.12515	5553.557	1103.854	94.5521	859.3803	37293.98	29806.94	42849.19	87725.32
37.91	30.12802	5242.788	1089.312	94.34305	721.4474	37099.06	30526.3	43226.31	87673.54
33.13231	31.65548	5613.996	1404.121	66.00276	1072.321	36870.69	30775.33	43651.39	87200.54
34.9286	35.21186	5871.74	1348.104	64.27923	980.4288	36679.08	30966.81	44052.89	86436.17
35.89498	27.8157	6166.433	1321.817	65.82222	1146.091	36399.3	30827.53	44402.99	86104.13
34.22993	38.82079	5924.631	1261.958	66.6958	1287.96	34719.33	29899.92	44744.73	84234.37
28.22902	29.27542	4410.885	1003.043	45.30022	674.2544	32251.28	29539.59	45016.61	84919.66
25.77612	38.39721	3733.947	1037.378	45.00642	651.5724	33168.5	29576.31	45306.73	86001.9
22.19908	21.42703	2856.654	1283.776	61.23498	940.0003	34978.76	29971.87	45564.95	85852.06
22.89863	32.8224	3099.314	1208.203	58.85838	707.7729	36815.86	29789.83	45921.31	86548.38
25.59698	23.46443	3163.72	1358.85	47.65451	1026.336	37027.56	30389.34	46188.77	85794.4
29.64166	33.5398	3412.061	1302.304	51.21057	1019.605	37086.57	30351.71	46583.4	86363.7
28.70829	44.29543	3643.835	1234.426	50.13059	1081.594	37089.12	30431.56	46950.49	86730.12
26.11005	34.89529	4128.784	1320.421	50.20433	1046.065	38088.35	30692.99	47265.74	88780.99
24.77019	34.27902	4593.775	1453.739	49.05712	1246.364	39972.2	30688.46	47578.82	89493.73
24.21886	39.72215	4563.533	1426.174	47.77262	1268.624	39425.63	30522.63	47858.78	88930.5

25.38688	39.18798	4916.116	1503.737	48.38271	1373.313	40224.97	30356.22	48234.91	90587.25
24.86768	30.27235	4815.377	1521.95	46.78756	1446.099	40426	30604.29	48614.29	90619.73
26.36252	36.58439	4342.746	1262.557	44.13867	1786.031	41613.28	30390.77	48972.48	91647.32
26.7846	24.75989	4363.682	1447.684	40.94623	1701.599	41275.58	30252.51	49310.62	91341.18
26.81703	32.06902	4272.613	1292.03	35.98579	1582.877	41304.83	30287.17	49647.79	91891.49
25.6409	35.77168	4445.359	1326.929	32.1293	1639.493	41526.7	30585.55	50044.71	91768.41
25.27049	30.33636	5457.74	1198.893	27.14482	1482.496	41998.41	31208.5	50478.89	93115.72
22.65635	42.83127	5584.301	1264.152	24.9547	1452.953	42616.66	31790.81	50825.21	94560.09
24.04159	29.25222	5478.008	1263.049	26.98762	1398.46	43380.44	32364.37	51136.23	94889.81
23.92128	39.80916	5835.551	1349.906	31.71286	1347.292	44080.08	32344.32	51491.66	95021.97
22.1442	27.43342	5486.135	1311.692	39.32151	1021.966	43353.67	31912.54	51907.69	94351.11
23.65873	35.80772	5754.377	1370.718	37.13826	1081.845	43774.93	31683.87	52287.89	94885.5
23.47216	33.89572	5903.655	1325.235	22.96338	1030.998	44862.05	31973.94	52655.22	96773.29
24.95237	36.60658	5745.433	1398.755	0.176851	1107.19	44084.15	32167.65	53055.6	98044.49
23.60045	90.93712	5516.368	1324.131	0.542581	859.1701	43151.48	31049.9	53451.46	100077.8
19.6181	45.39798	5462.547	1314.452	1.74E-09	824.9454	44369.7	31718.98	53830.7	100310.1
20.79913	39.77308	5674.043	1334.96	16.85049	899.1728	43939.54	32273.98	54172.95	101672.7
23.09856	35.27182	5855.442	1233.657	76.20696	958.3117	44938.08	32771.13	54561.69	101130.2
26.09322	40.55779	5884.195	1210.719	282.7429	605.6851	44510.47	33811.97	55125.96	102699.5
26.19826	29.86854	5986.425	1228.911	347.1829	715.5395	44213.97	33368.49	55358.21	102766.1
24.22361	46.69678	5866.734	1209.832	439.7405	888.5793	44849.16	33850.85	55723.31	103878.4
27.30504	44.27448	5730.645	1418.937	439.1336	929.796	44725.99	34233.09	56071.73	104390.5
30.46627	43.82003	5303.464	1318.844	318.7686	819.8939	45722.85	34703.99	56690.11	107514.5
30.70262	36.03912	5300.4	1374.905	287.6521	746.0746	45772.43	35139.38	57081.66	109938.2
32.62488	41.99945	5394.238	1417.379	276.2278	1232.332	46235.02	34905.06	57480.42	109638.9
29.61163	41.75742	5424.297	1373.272	267.3515	1088.9	47453.7	35337.17	57847.82	110587.6
26.67216	45.01346	5135.178	1439.826	265.2129	991.2762	47420.7	35339.44	58451.54	109936.4
29.27649	50.64112	4791.741	1366.368	278.0036	1209.671	47679.18	35746.5	58794.86	109653.9
26.28548	46.42124	5213.732	1445.955	281.5415	1083.178	47701.92	36439.49	59115.25	110567.7
24.94925	47.73754	5403.349	1392.65	283.242	1063.874	48286.2	36670.17	59416.35	111978.1
24.40465	31.08346	4923.397	1382.261	271.3843	886.1493	47990.6	36415.85	59916.85	111189.1
23.59699	38.48774	5348.435	1339.546	265.72	947.2721	48170.81	36768.51	60231.46	112371.4
18.9435	53.13448	5083.602	1231.75	271.038	913.6189	49195.73	36863.5	60548.62	114147.2
20.9976	44.45801	5119.766	1064.443	283.0577	879.3597	49347.25	36819.74	60834.28	115669.9
22.20024	47.6544	4829.345	982.7861	279.9195	1155.22	50243.33	36505.59	61368.49	114681.8
23.71728	52.14197	3971.904	1062.922	248.0351	701.8228	40054.32	30163.44	61567.77	112702.3
23.58387	49.84026	4830.428	1079.936	242.2418	606.8841	50656.41	36619.09	62023.32	118200.7
23.21224	50.03908	5050.723	975.556	255.0036	774.873	51187.54	37437.08	62424.82	119220.4
24.17075	53.31774	6012.193	971.1497	254.7369	791.5295	50423.44	37379.41	62933.29	120305.3
25.2369	61.24972	6095.245	997.3197	254.151	780.9211	48179.65	34887.84	63432.64	117973.2
27.47457	43.59141	5676.729	1039.373	253.5918	869.926	48750.74	37570.73	63861.98	118592.8
28.31715	62.84158	5505.679	1056.409	253.0593	859.1016	48813.16	37110.01	64387.96	116973.6
29.11107	68.97747	5363.229	1098.017	251.0348	851.7632	48905.09	36999.79	64930.51	117615
30.49725	66.40022	5187.742	1109.485	249.0517	855.7743	49631.12	37260.67	65450.94	118645.9
29.70633	66.12065	5078.86	1120.208	247.109	861.982	50200.1	37311.79	65959.9	119062.6
28.98136	66.10539	5048.543	1107.814	245.2063	865.1032	50863.42	37615.49	66460.07	120264.8
28.43838	65.18722	4790.698	1112.162	243.3427	887.6171	51493.89	37913.94	66956.07	121478.8
28.12484	64.34366	4824.451	1101.708	241.5177	895.39	51953.51	38193.98	67436.91	122677.1
27.86291	64.02593	4914.557	1099.781	239.7304	902.9508	52113.48	38244.97	67914.15	122995.6
27.64332	64.10344	5017.41	1098.665	237.9804	912.215	52236.43	38295.89	68389.86	123119.3
27.39424	64.27724	5201.748	1102.435	236.2669	918.8974	52381.3	38393.29	68866.39	123117.5

27.14771	64.49563	5270.686	1111.19	234.5895	927.6029	52554.75	38495.3	69340.44	123494.4
26.90204	64.71885	5289.945	1121.275	232.9473	932.9164	52660.65	38564.67	69813.36	123660.1
26.65411	64.95062	5268.739	1142.365	231.34	938.2586	52774.92	38647.87	70285.22	123934.1
26.39358	65.15855	5287.552	1116.413	229.7669	944.9551	52985.55	38777.77	70755.65	124684.4
26.13315	65.34665	5296.658	1108.443	228.2274	950.1586	53166.14	38883.8	71225.45	125427.2
25.90034	65.57228	5290.059	1108.421	226.7211	955.032	53337.57	38990.46	71694.28	126160.9
25.68193	65.84738	5270.826	1115.443	225.2475	959.5353	53514.18	39098.58	72162.07	126924.8
25.48551	66.10363	5183.524	1150.984	223.7383	961.0736	53754.73	39280.18	72628.97	127429.8
25.33151	66.33337	5173.789	1156.664	222.1945	963.9269	53972.15	39438.56	73094.7	127994.7
25.1966	66.51765	5222.768	1160.863	220.6169	965.4464	54178.67	39587.26	73559.21	128541
25.09023	66.66975	5232.356	1164.52	219.0064	965.916	54385.35	39736.83	74022.48	129132.1

Real Dom RQBSVO	Real Dom RQPROF	Real Dom RQADWS	Real Dom RQACCO	Real Dom RQARTS	Real Dom RQLAUN	Real Dom RQEDUC	Real Dom RQHEALC	Implicit Pri RPYCO	Implicit Pri RPCHO
3411.319	2088.435	1322.884	4014.877	1101.87	2348.175	8444.126	7304.447		
3469.353	2132.745	1336.608	4007.613	1107.948	2369.4	8752.941	7420.926		
3534.076	2181.325	1352.751	4061.855	1109.771	2382.136	8983.736	7487.163		
3563.848	2192.536	1371.312	4149.03	1153.53	2385.168	9182.773	7587.325		
3579.85	2195.605	1384.245	4289.853	1108.932	2371.866	9263.653	7617.718		
3626.961	2219.453	1407.507	4337.011	1228.588	2367.068	9443.128	7672.636		
3686.015	2252.84	1433.175	4367.326	1151.235	2396.454	9636.464	7785.825		
3755.953	2294.707	1461.246	4298.034	1092.011	2406.649	9834.278	7983.861		
3801.832	2319.715	1482.117	4282.271	1119.487	2401.084	9965.737	8138.238		
3899.961	2383.052	1516.909	4256.425	1274.604	2411.46	10103.48	8292.426		
4008.307	2452.195	1556.112	4250.203	1169.389	2433.399	10264.29	8437.122		
4129.507	2529.783	1599.725	4238.237	1133.315	2463.638	10497.09	8596.953		
4226.401	2595.958	1630.443	4205.973	1159.722	2504.749	10601.93	8740.454		
4354.638	2666.929	1687.708	4119.369	1299.296	2512.104	10747.33	8889.908		
4510.658	2756.3	1754.358	4210.255	1217.828	2560.063	10897.89	8971.37		
4661.867	2831.477	1830.391	4324.457	1219.026	2592.134	11118.87	9090.708		
4829.068	2875.578	1953.49	4367.762	1195.54	2570.646	11237.23	9055.744		
4963.884	2933.35	2030.534	4500.29	1355.498	2612.229	11409.18	9080.683		
5140.038	3040.566	2099.472	4566.553	1269.595	2648.326	11555.35	9226.869		
5311.208	3150.905	2160.303	4640.336	1300.402	2701.46	11901.24	9391.502		
5403.103	3239.047	2164.056	4634.261	1321.022	2706.29	12238.53	9610.431		
5571.197	3351.521	2219.676	4706.136	1425.344	2742.492	12439.75	9807.278		
5706.042	3427.364	2278.678	4698.716	1349.739	2777.838	12832.29	9942.71		
5811.765	3470.703	2341.062	4687.124	1466.955	2771.852	12953.09	10129.11		
5849.728	3391.93	2457.797	4706.605	1576.973	2709.745	13337.98	10716.83		
5948.51	3447.752	2500.758	4748.107	1736.864	2762.365	13851.02	10921.79		
5942.139	3420.856	2521.283	4740.354	1622.574	2812.2	14509.86	11126.38		
5934.139	3414.767	2519.373	4674.68	1583.9	2765.427	14955.57	11297.47		
5878.07	3471.7	2406.371	4662.473	1532.476	2773.2	15433.69	11862.24		
5925.867	3526.611	2399.257	4547.106	1537.13	2765.879	15686.84	12032.04		
6003.834	3594.351	2409.483	4508.957	1413.206	2758.841	16227.43	12243.59		
6160.724	3723.674	2437.05	4611.454	1465.568	2807.266	16621.72	12333.59		
6357.967	3842.831	2515.136	4594.602	1533.133	2853.036	17081.03	12719.56		
6445.511	3883.266	2562.246	4593.689	1425.199	2833.329	17476.21	12886.24		
6562.465	3950.827	2611.637	4607.389	1577.235	2860.074	17701.72	13022.6		
6613.115	3949.804	2663.311	4725.211	1547.64	2907.372	17744.34	13187.44		
6599.186	3853.568	2745.618	4798.924	1502.399	2931.998	18477.76	13532.92		
6566.5	3768.683	2797.817	4852.484	1516.963	2906.134	18800.88	13698.89		
6574.665	3726.752	2847.914	4854.315	1616.579	2861.512	19159.39	13859.59		
6854.304	3958.395	2895.908	4851.111	1653.28	2883.965	19279.83	14122.52		
7212.726	4287.394	2925.332	4740.222	1657.319	2949.321	19256.63	14706.35		
7346.008	4366.484	2979.524	4805.678	1714.549	2937.651	19633.63	14752.53		
7461.084	4419.211	3041.873	4944.946	1745.229	2960.699	19683.2	14899.12		
7531.588	4419.211	3112.377	5069.823	1710.419	2990.458	19776.73	15159.54		
7487.158	4347.747	3139.41	4907.29	1743.678	2887.939	20029.77	15668.51		
7591.052	4371.3	3219.752	5096.067	1736.231	2939.003	19857.94	15687.6		
7806.435	4503.096	3303.339	5108.652	1775.756	2961.73	20299.08	16061.59		
8018.549	4628.377	3390.173	5270.011	1769.455	2926.939	20569.31	16299.61		
8550.105	4973.509	3576.595	5812.527	1906.426	3281.574	20726.92	16624.17		

8815.071	5134.79	3680.281	5995.316	1934.558	3313.821	20699.64	16776.39		
9072.351	5277.743	3794.608	6158.791	2009.379	3335.42	20619.47	16973.16		
9405.726	5486.151	3919.576	6146.542	2057.862	3379.227	20859.88	17218.72		
9784.04	5660.13	4123.91	6165.32	2153.287	3369.279	20908.35	17315.97		
10013.82	5777.118	4236.698	6138.299	2287.979	3387.662	21142.74	17603.75		
10262.3	5935.181	4327.124	6150.412	2292.726	3416.895	21629.51	17889.7		
10510.27	6115.082	4395.186	6132.709	2358.588	3460.895	21701.09	18176.46		
10265.39	5964.906	4300.486	5929.71	2262.8	3394.508	22004.21	18590.46		
10449.57	6092.624	4356.942	6024.166	2231.364	3410.38	22015.75	18986.78		
10598.08	6173.341	4424.738	6189.805	2358.272	3443.005	22116.5	19334.94		
10755.89	6252.015	4503.875	6363.658	2450.833	3475.63	22502	19520.74		
10829.36	6207.12	4622.238	6383.557	2506.352	3464.159	22308.34	19389.77		
10993.56	6297.625	4695.931	6617.821	2582.79	3492.875	22625.39	19400.32		
11121.14	6367.515	4753.63	6776.544	2581.065	3518.69	22726.02	19495.17		
11157.82	6362.487	4795.335	6663.234	2454.052	3553.787	22809.31	19750.98		
11068.39	6349.06	4719.333	6695.194	2347.667	3607.404	23015.4	19832.53		
11094.2	6325.478	4768.72	6659.203	2409.888	3655.343	22962.66	20051.94		
11221.46	6379.667	4841.795	6687.096	2386.843	3704.159	23143.43	20122.74		
11396.5	6457.938	4938.558	6832.859	2430.628	3769.344	23307	20220.5		
12059.07	6780.55	5278.518	7331.346	2641.896	4069.886	23537.31	20327.26		
12265.21	6869.215	5395.991	7404.229	2702.876	4111.573	23499.31	20590.85		
12449.93	6942.844	5507.087	7492.998	2790.162	4126.395	23644.4	20782.87		
12679.09	7067.286	5611.808	7476.179	2820.055	4107.25	23729.34	20818.22		
12621.11	6993.92	5627.195	7447.871	2864.375	3994.9	23846.98	20642.07		
12764.19	7035.228	5728.963	7254.045	2837.28	4009.96	23923.29	20631.2		
13160.53	7325.409	5835.122	7226.552	2844.348	4101.519	23895.56	20793.7		
13760.16	7814.484	5945.673	7414.421	2918.564	4255.424	23975.06	21101.76		
13817.4	7819.407	5997.992	7240.93	2842.344	4297.572	23211.35	21132.29		
14231.41	8118.777	6112.632	7277.196	2913.154	4392.713	24277.52	21602.49		
14593.54	8365.228	6228.314	7220.53	2912.569	4434.731	24346.2	22090.62		
15002.08	8657.038	6345.037	7623.535	2963.481	4445.836	24684.45	22633.1		
15405.55	8828.344	6577.201	8059.173	3188.997	4667.375	24887.57	23497.23	0.402409	0.414193
15715.9	9194.655	6521.242	8072.735	3178.266	4726.699	25030.69	23736.86	0.406286	0.427381
15832.43	9239.455	6592.975	7840.487	3163.244	4758.766	24562.71	23936.88	0.410117	0.439968
15994.16	9289.527	6704.635	7665.877	3131.054	4755.56	24789.23	24234.46	0.411399	0.450458
16841.47	10029.23	6812.242	7744.507	3215.852	4841.985	24881.44	24183.28	0.427902	0.455099
16915.31	10290.79	6624.524	7627.086	3246.752	4868.426	24755.55	24246.67	0.441333	0.47022
16699.56	10165.46	6534.107	7493.893	3339.454	4875.036	24675.74	24478.83	0.45638	0.48119
16114.32	9827.607	6286.712	7199.465	3138.601	4813.892	25301.2	24572.84	0.469373	0.489491
16541.17	9888.029	6653.137	7590.937	3148.329	5026.577	25407	25008.45	0.478501	0.499028
16468.16	9808.493	6659.669	7792.872	3299.669	5111.129	25511.42	25101.55	0.477463	0.503827
16509.22	9799.972	6709.246	7776.35	3352.408	5195.682	25648.83	25000.36	0.48317	0.514323
16647.37	9771.566	6875.806	7629.488	3395.976	5321.649	25767.31	24725.15	0.485502	0.518822
16597.05	9722.089	6874.962	7494.714	3057.764	5204.605	26742.53	26623.45	0.496801	0.528855
17964.03	10614.96	7349.063	7611.363	3264.763	5392.02	26173.81	25457.04	0.502792	0.532766
18433.87	11018.44	7415.435	7831.442	3287.784	5513.338	26048.12	25065.7	0.509975	0.539083
19256.55	11363.99	7892.56	8281.158	3563.831	5614.266	25963.62	24800.51	0.513379	0.543295
18682.9	10790.33	7892.564	8207.244	3321.411	5889.993	26646.32	25579.83	0.52382	0.552676
18686.11	10652.33	8033.785	8146.353	3230.893	5913.812	27053.21	26292.07	0.527543	0.557206
18895.13	10587.57	8307.564	8090.189	3401.368	5885.023	27445.3	27025.38	0.532931	0.562039
19802.75	11053.27	8749.473	8206.482	3512.469	5881.285	27570.22	27608.33	0.533898	0.568079

20457.57	11088.34	9369.231	8325.953	3107.086	5675.821	27172.03	27082.09	0.547465	0.57594
21046.39	11617.51	9428.888	8293.956	3805.702	5977.514	27389.06	27525.3	0.55144	0.58047
21583.16	12090.41	9492.75	8284.387	3915.857	6214.194	27495.3	27600.98	0.55614	0.588322
21648.07	12529.76	9118.317	8261.743	3612.068	6509.417	27274.5	26978.4	0.562124	0.595268
23426.11	13445.66	9980.456	8381.177	3764.325	6384.871	27375.79	28526.69	0.571737	0.59725
23148.8	13418.47	9730.333	8582.013	3505.708	6364.856	27717.04	28794.84	0.575444	0.60653
23660	13549.4	10110.6	8979.659	3794.694	6381.773	28015.24	29336.33	0.58344	0.614314
24484.99	13958.72	10526.27	9060.547	3686.208	6353.127	28440.13	30200.23	0.587751	0.617906
25650.03	14728.86	10921.17	9111.305	4436.879	6862.497	27275.09	29228.97	0.597705	0.622266
26866.77	15327.42	11539.35	9164.514	4264.021	6745.396	27410.89	29646.99	0.601761	0.633335
26924.33	15240.98	11683.35	9118.72	4225.493	6723.833	27484.66	29961.96	0.609692	0.642909
26617.31	15097.12	11520.19	9268.787	3957.178	7091.279	27624.26	30070.42	0.615966	0.64949
26631.81	15086.25	11545.56	9741.104	4239.998	7195.123	27466.02	30489.85	0.626257	0.651917
27989.52	15410.58	12578.94	10003.57	4015.503	6968.054	27533.16	30410.31	0.634264	0.664961
28831.58	16121.86	12709.72	9613.987	3891.896	6842.934	27722.95	30443.55	0.642001	0.674744
29405.31	16419.91	12985.39	9884.656	3802.339	6753.396	27671.06	30801.73	0.648554	0.680377
28655.74	15700.68	12955.06	10314.56	4097.976	6840.736	27493.67	31323.14	0.651535	0.685068
28425.32	15697.5	12727.82	9967.182	3890.472	6962.653	27690.48	31575.77	0.662212	0.690954
28402.98	15564.44	12838.54	9739.271	3998.04	6893.837	27895.85	31565.45	0.669345	0.697722
28160.56	15503.16	12657.4	9140.246	3734.958	6995.241	28121.36	31745.34	0.679974	0.706256
27846.31	15523.53	12322.78	8489.763	3963.659	6460.325	28187.55	32159.16	0.688212	0.719757
27745.56	15522.53	12223.04	8120.559	3722.084	6431.715	28427.11	32316.6	0.689751	0.725927
27274.29	15128.13	12146.16	8156.363	3588.782	6621.283	28789.71	33025.1	0.703037	0.730921
26630.57	14857.66	11772.91	8154.225	3545.113	6594.768	29041.06	33296.17	0.701465	0.727395
26423.76	14649.52	11774.25	8113.072	3710.027	6617.349	29037.02	33035.59	0.71133	0.733122
25855.41	14301.63	11553.78	8265.64	3743.735	6530.651	28640.65	32682.84	0.710511	0.736965
25810.31	14411.92	11398.39	8046.798	3731.765	6363.981	28590.03	32914.16	0.714017	0.739921
26472.74	14748.14	11724.61	8073.05	3698.197	6335.912	28672.17	32638.12	0.706581	0.741991
26648.23	14825.48	11822.75	8047.496	3587.953	6531.606	29019.41	32811.26	0.712034	0.751434
26975.97	14905.49	12070.48	8197.737	3556.929	6660.859	29151.96	33029.2	0.721229	0.752623
27402.04	15088.01	12314.04	8278.765	3499.352	6482.255	29229.31	32935.53	0.730468	0.756189
27381.03	15467.75	11913.28	8004.776	3692.756	6373.988	29198.27	32948.01	0.73905	0.759754
27611.69	15427.69	12183.99	8333.413	3811.926	6405.188	28779.56	32705.84	0.735538	0.762325
28484.08	16111.38	12372.7	8468.743	3845.282	6538.141	29348.31	33253.84	0.733591	0.759624
28902.7	16398.29	12504.42	8540.952	3940.877	6895.125	29574.49	33300.73	0.729669	0.763525
29688.63	16690.75	12997.88	8421.487	3834.435	6824.767	29547.07	33119.01	0.729411	0.766527
29881.89	16597.18	13284.71	8591.149	3910.659	6714.419	29874.56	33549.42	0.737455	0.771929
30678.72	17122.92	13555.8	8678.249	3959.561	6817.633	29751.27	33523.55	0.739522	0.777298
31193.49	17403.87	13789.62	8740.433	4042.078	6793.522	29440.9	33018.02	0.743097	0.779386
31483.9	17169.31	14314.59	8969.683	3918.228	6847.767	29494.97	32847.54	0.746344	0.779386
31644.43	17248.15	14396.28	8573.55	3971.03	6852.546	29120.55	32243.46	0.744868	0.783577
31389.19	17230.68	14158.52	8717.603	3957.469	6779.769	28900.52	31809.86	0.751521	0.788656
31679.82	17310.6	14369.22	8931.307	4084.185	6874.26	29093.67	31768.76	0.755547	0.790149
32629.03	18204.92	14424.11	9127.433	4183.27	7043.22	29477	31661.53	0.756071	0.797618
34142.42	22186.12	11956.3	9175.489	4992.384	8996.863	27198.27	31623.54	0.757572	0.800243
34730	22607.9	12122.1	9126.455	5046.988	9124.728	26781.03	31715.25	0.760836	0.802627
36037.27	23440.9	12596.38	9019.205	5200.196	9264.578	27169.39	32125.4	0.765143	0.804714
36368.31	23814.68	12553.63	9201.251	5069.232	9261.032	26476.51	32646.61	0.765844	0.804416
38399.99	25371.29	13028.69	9853.736	4981.582	9391.301	27200.43	32368.18	0.770173	0.812129
38584.21	25464.43	13119.77	9780.883	5047.368	9592.5	27453.39	32733.67	0.775874	0.812728
39340.99	25822.88	13518.11	10279.98	5030.618	9670.385	27389.02	32657.48	0.77717	0.814524

40144.41	26309.79	13834.62	10203.81	5019.632	9713.814	27386.36	32412.27	0.778041	0.816619
42057.64	27889.89	14167.74	11265.2	5147.355	10157.56	27130.68	33218.61	0.78087	0.818533
43760.28	29052.23	14708.05	11337.6	5265.751	10249.13	27564.77	33500.51	0.786381	0.827804
45086.6	30158.17	14928.43	11127.52	5107.495	10501.94	27863.47	33704.97	0.793653	0.833187
46669.89	31319.3	15350.58	11194.49	5306.599	10744.97	28076.68	33925.1	0.792503	0.836477
48084.34	32992.29	15092.05	11461.87	5321.206	10678.42	27565.14	34152.16	0.797927	0.83745
49380.05	33934.85	15445.2	11633.31	5342.832	10681.85	27784.11	34454.47	0.80713	0.844285
50862.89	35005.31	15857.57	11594.89	5540.994	11022.08	28524.6	34873.66	0.818181	0.851418
51418.32	35201.15	16217.17	11500.33	5612.568	11053.25	27627.35	35450.1	0.818807	0.858847
51347.5	34714.1	16633.4	11587.54	5738.264	11227.92	28424.47	35132.42	0.818735	0.857828
51207.39	34440.75	16766.65	11437.15	5629.713	11176.92	27903.27	35482.98	0.827202	0.870196
50815.23	33966.19	16849.05	11378.87	5721.737	11450.75	27742.3	35252.02	0.831019	0.870785
50880.28	34063.76	16816.51	11742.84	5768.685	11553.21	27817.17	35529.78	0.833289	0.86519
52374.34	34011.32	18363.02	11528.81	5604.485	11540.26	28428.87	36003.09	0.839701	0.868079
52027.42	33703.87	18323.55	11864.31	5780.466	11741.22	28201.78	36099.56	0.840671	0.877476
52372.04	34469.82	17902.22	12262.97	5569.048	11728.27	28715.64	36109.21	0.847887	0.888929
53794.6	35440.99	18353.61	12283.91	5550.001	11921.45	29489.72	36688.54	0.850922	0.889516
53287.18	35406.38	17880.8	11256.85	5572.982	11730.43	28936.94	36914.65	0.855692	0.892403
53730.29	35795.95	17934.34	10837.08	5527.524	11662.39	28983.34	37027.09	0.854537	0.88921
54107.23	35744.33	18362.9	10769.42	5425.778	11669.1	29154.8	37753.38	0.868464	0.896177
53802.5	35118.54	18683.96	11093.05	5690.516	11625.28	29895.71	37612.08	0.867092	0.898209
54564.46	35560.26	19004.2	11005.05	5799.849	11818.51	29812.16	38173.16	0.871348	0.898059
55373.02	35680.51	19692.52	11125.89	5855.474	11980.57	30701.39	38175.33	0.874187	0.906433
55603.92	35650.28	19953.63	11450.97	5980.217	11782.02	30998.87	38639.68	0.874714	0.907877
55456.6	35580.55	19876.05	11244.49	5385.26	12138.51	30454.79	38785.03	0.879322	0.911631
56425.89	36328.53	20097.37	11272.66	5367.449	11834.11	31168.56	39332.15	0.883924	0.910388
55845.06	35745.86	20099.2	11368.82	5479.282	11998.52	32421.18	39182.62	0.891235	0.917848
57585	36659.77	20925.23	11091.48	5684.248	12345.81	32287.68	38831.19	0.896359	0.925595
58794.05	37335.05	21459	11241.04	5716.621	11927.17	33065.78	39168.04	0.903282	0.926169
59269.34	38184.76	21084.59	11402.92	5590.106	12055.74	33846.99	39836.36	0.902264	0.92601
59547.23	38718.96	20828.27	11338.44	5659.224	12434.05	33236.73	39668.51	0.906469	0.93456
58089.53	37634.15	20455.38	11092.03	5452.238	12391.55	33012.19	40128.05	0.907031	0.930855
58669.9	37882.93	20786.97	11445.81	5427.232	12143.46	33175.28	40849.08	0.912559	0.928575
59506.35	38485.92	21020.43	11312.85	5433.688	12543	32770.24	40286.39	0.933841	0.931018
60722.87	39470.1	21252.77	11242.72	5479.44	12124.66	33844.13	40963.63	0.928724	0.944314
62304.07	40070.98	22233.09	11246.96	5639.773	12059.21	35762.92	41029.16	0.915657	0.942051
61989.91	40122.2	21867.71	11169.07	5634.3	12664.73	36934.32	41352.42	0.911543	0.942617
60876.35	39574.75	21301.6	11249.17	5554.743	12546.89	36050.04	41901.4	0.920441	0.935682
61044.15	39826.8	21217.35	11410.02	5622.457	12630.89	36153.12	42070.72	0.93241	0.953331
61609.41	41110.82	20498.59	11530	5496.405	12634.82	36533.25	41776.08	0.949992	0.966497
61043.69	40838.42	20205.27	11455.6	5607.195	12930.2	36147.99	41919.81	0.955373	0.95249
59776.26	39475.87	20300.39	11685.47	5674.663	12648.12	37143.43	42406.93	0.951498	0.944708
58414.24	38920.57	19493.67	11484.3	5657.681	12366.56	36837.82	42447.05	0.947708	0.950836
58378.74	39292.78	19085.96	11438.92	5606.416	12602.98	36288.14	43389.6	0.943739	0.950279
58737.56	39246.78	19490.78	11202.51	5418.84	12600.74	36915.81	43481.62	0.944359	0.954178
58590.19	38345.28	20244.91	11478.09	5271.524	12236.51	37299.34	43738.89	0.949035	0.953559
59339.06	39042.8	20296.27	11436.98	5209.985	12289.28	37533.5	43611.71	0.954565	0.961853
59815.26	39067.63	20747.63	11372.02	5302.434	12219	37852.26	43398.27	0.966106	0.9707
60302.69	39684.29	20618.4	11296.91	5394.857	11983.21	37559.3	43758.33	0.974572	0.977888
59937.55	40058.01	19879.54	11628.83	5198.315	11913.11	37804.03	43565.05	0.983168	0.975339
60180.74	40052.01	20128.73	11591.65	5261.375	12422.94	38024.4	44331.68	0.984223	0.991265

59982.76	39817.19	20165.57	11869.1	5282.656	12399.4	37268.81	44622.99	0.99062	0.99456
61602.14	40695.18	20906.96	11982.42	5322.054	12281.35	37487.16	45205.48	0.993939	0.994835
61531.31	40659.14	20872.17	11644.81	5600.252	12394.08	38106.62	45016.77	0.997899	0.996578
62124.04	40779.22	21344.82	11837.4	5313.972	12442.23	37814.69	44716.19	0.999413	1.003149
62276.72	41053.37	21223.34	12311.33	5265.207	12503.62	38332.5	44922.28	1.001086	0.999863
61098.73	40593.87	20504.87	12485.26	4886.169	12560.47	39420.98	44603.16	1.001598	1.000411
60694.44	40410.43	20284.01	12532.86	5078.769	13182.72	39035.31	44119.05	1.013885	1.009055
61546.3	40679.31	20866.99	12685.1	5241.961	12850.75	38960.33	44209.56	1.013149	1.014
62554.97	41127.83	21427.14	12729.35	5295.108	12743.29	39155.23	44295.23	1.01871	1.017297
63698.7	41939.63	21759.06	12889.09	5457.362	12935.24	38781.93	44119.36	1.020376	1.015648
63127.28	41548.98	21578.3	13093.07	5524.279	13642.95	38820.07	44445.95	1.03047	1.023311
64494.38	42645.89	21848.49	13532.96	5567.031	13703.37	39475.02	44781.21	1.03555	1.040595
66044.23	43776.18	22268.05	13614.57	5541.953	13445.81	40320.94	45095.9	1.038947	1.041693
66369.31	43836.96	22532.35	13649.4	5681.937	13138.27	40289.17	44618.94	1.040052	1.038401
67546.29	44584.91	22961.38	13816.25	5813.817	13476.31	40080.14	45609.61	1.040995	1.039051
67055.43	44386.15	22669.27	14073.34	5885.867	13471.19	40032.81	45296.94	1.044375	1.050578
66941.47	44263.9	22677.56	14180.08	5815.626	13786.64	40352.61	45134.45	1.051413	1.05442
66878.41	44559.43	22318.98	14317.12	5687.889	13880.66	39380.84	45763.4	1.054946	1.05195
69431.25	46562.96	22868.29	14662.45	5834.868	13326.55	40696.87	45792.04	1.056652	1.049955
68632.93	46258.59	22374.35	14626.92	5963.685	13502.56	40488.85	46587.34	1.054358	1.063864
69350.77	46894.54	22456.23	14611.82	6050.659	13466.47	39920.39	46743.75	1.057185	1.064409
70187.05	47537.11	22649.93	14377.2	5936.789	13301.62	40001.09	47292.47	1.063034	1.065773
70290.99	47500.52	22790.47	14676.44	6077.044	13664.41	40404.33	47057.96	1.065905	1.065044
71586.14	48743.79	22842.35	14451.96	5982.374	13676.63	40810.29	46971.58	1.070689	1.072083
71273.08	49053.63	22219.45	14626.73	6251.532	13951.79	41071.05	47242.94	1.06976	1.072083
70776.98	49398.06	21378.92	15054.07	6394.249	14131.17	41349.93	46829.92	1.077103	1.07479
74359.28	51088.46	23270.82	15070.48	6264.797	13766.91	41282.51	47974.65	1.082766	1.080662
75443.87	52067.12	23376.75	15080.55	6235.575	14121.18	41991.86	48235.69	1.08485	1.089269
74778.55	51511.57	23266.98	15145.43	6101.047	14226.1	43171.76	48974.59	1.090335	1.094917
75801.1	51862.05	23939.05	15097.94	6126.98	14127.41	43118.67	49694.67	1.092399	1.091152
76753.99	53401.82	23352.17	15366.04	6272.353	13920.23	43157.68	49348.4	1.096073	1.097506
77446.9	54228.13	23218.77	15800.87	6395.302	13970.49	43127.06	49708.81	1.105604	1.111756
79978.25	55969.58	24008.66	15759.62	6259.376	13987.74	42490	50888.35	1.110215	1.115251
81059.66	56422.87	24636.79	15597.07	6484.569	14537.54	43037.66	51218.44	1.116669	1.111487
78377.02	54891.17	23485.84	13356.89	5241.87	13037.84	42509.29	49938.12	1.119334	1.112658
68697.91	50044.42	18653.49	6628.525	2270.107	9630.033	36718.78	42599.9	1.119602	1.109438
73803.76	53225.4	20578.36	9683.755	2814.764	11988.69	40363.83	48273.04	1.12102	1.11561
76432.11	55470.6	20961.5	9955.23	3120.459	12652.23	40518.9	49398.53	1.126439	1.118294
77333.07	56212.62	21120.45	9870.747	2908.634	12436.76	41597.04	50384.07	1.138426	1.123699
77252.22	56141.1	21111.13	9887.511	2818.793	12221.01	41244.01	51465.96	1.141387	1.132058
78936.13	57259.37	21676.75	12528.55	3514.529	13018.07	42417.6	51923.41	1.152131	1.145788
80081.86	57563.06	22518.8	13782.92	5131.28	13283.45	42269.73	52472.4	1.159316	1.154862
80810.85	57801.53	23009.32	14286.69	5538.053	13734.2	42736.61	52844.6	1.163039	1.159731
81971.55	58414.78	23556.77	14891.56	5765.761	14073.02	43154.94	53373.77	1.167143	1.163739
82508.23	58637.58	23870.65	15452.84	5906.445	14247.96	43509.07	53777.07	1.171763	1.167533
83256.77	58912.07	24344.7	15755.96	6022.434	14404.45	43675.95	54138.71	1.176243	1.171084
83820.51	59222.38	24598.13	16015.72	6067.171	14555.85	43739.56	54384.19	1.180718	1.174693
84650.84	59653.67	24997.17	16105.74	6097.063	14704.08	43775.12	54649.74	1.184991	1.178078
84917.56	59847	25070.56	16157.33	6108.136	14766.54	43832.18	54919.05	1.189328	1.181602
85116.85	59958.25	25158.6	16230.67	6122.44	14830.64	43893.23	55192.37	1.193862	1.18532
85251.3	60031.81	25219.49	16306.32	6142.652	14895.95	43953.77	55522.15	1.198653	1.189321

85558.58	60201.1	25357.48	16391.81	6165.84	14986.39	44010.71	55858.37	1.20382	1.193907
85669.5	60294.3	25375.2	16441.9	6181.97	15064.54	44064.28	56199.46	1.208836	1.198318
85835.32	60419.71	25415.61	16486.91	6199.645	15148.79	44117.83	56545.32	1.213922	1.202739
86214.83	60660.76	25554.08	16520.6	6218.428	15244.64	44169.29	56898.53	1.219096	1.207239
86588.17	60891.14	25697.03	16548.05	6240.507	15337.56	44223.21	57254.39	1.224333	1.211901
86940.98	61106.52	25834.46	16557.56	6258.464	15426.57	44279.68	57614.28	1.229423	1.216417
87309.12	61316.16	25992.96	16561.92	6277.737	15513.7	44338.19	57978.4	1.234663	1.221064
87669.93	61516.03	26153.9	16597.43	6301.473	15615.19	44432.02	58264.6	1.239806	1.225515
88046.37	61729.44	26316.93	16630.92	6327.291	15711	44514.24	58548.53	1.245131	1.230173
88409.51	61934.96	26474.55	16658.55	6352.775	15810.01	44599.08	58849.65	1.250367	1.234712
88802.63	62151.8	26650.84	16686.44	6378.841	15910.27	44671.36	59156.96	1.255612	1.239261

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RPCHGO(RPCHDU(RPCHSD(RPCHND(RPCHSE(RPCHDW RPCHOT{ RPCNO RPCGO RPIO

0.486133	0.716875	0.709559	0.353236	0.354426	0.372844	0.341795	0.530576	0.354395	0.551837
0.500102	0.732103	0.725741	0.366141	0.365897	0.386351	0.352857	0.55573	0.340676	0.572749
0.515313	0.753042	0.737473	0.378793	0.37678	0.399576	0.363352	0.587196	0.336415	0.607355
0.522453	0.773981	0.751227	0.381829	0.390898	0.416741	0.376967	0.626467	0.320848	0.636069
0.53165	0.774158	0.756131	0.392753	0.392227	0.412063	0.381336	0.64062	0.342852	0.624327
0.551214	0.7806	0.777573	0.412302	0.403982	0.422337	0.392765	0.649534	0.360366	0.624512
0.560531	0.788179	0.785259	0.420934	0.414878	0.43153	0.403357	0.655771	0.387761	0.63933
0.568605	0.801063	0.801037	0.426011	0.424913	0.443157	0.413114	0.655498	0.411912	0.64184
0.574403	0.803194	0.801961	0.432152	0.439764	0.455681	0.428277	0.666864	0.402984	0.638981
0.57845	0.804699	0.815293	0.434959	0.445058	0.461422	0.433433	0.679653	0.400361	0.636364
0.594017	0.809965	0.818525	0.452827	0.450942	0.466615	0.439163	0.695939	0.400015	0.644926
0.59713	0.826142	0.828221	0.452062	0.456236	0.474269	0.444319	0.722195	0.397071	0.645829
0.607268	0.822621	0.828601	0.467396	0.464744	0.492853	0.448173	0.738248	0.403768	0.655198
0.610363	0.829697	0.835482	0.469179	0.470694	0.495937	0.453911	0.746046	0.412046	0.648811
0.616863	0.830441	0.836292	0.476566	0.476645	0.499582	0.459649	0.743887	0.42205	0.655936
0.621506	0.841241	0.847626	0.478858	0.479918	0.508553	0.462806	0.730021	0.435192	0.662141
0.630444	0.841898	0.852182	0.489303	0.489851	0.52279	0.471586	0.717086	0.441662	0.661463
0.632606	0.845956	0.85948	0.491853	0.496467	0.526481	0.477955	0.712976	0.441521	0.650341
0.635386	0.850015	0.860696	0.493892	0.503383	0.529605	0.484613	0.715534	0.442202	0.664886
0.641564	0.858131	0.871642	0.496952	0.510299	0.536704	0.491272	0.723912	0.448195	0.678574

0.653435	0.866352	0.875407	0.50905	0.514005	0.55141	0.495223	0.738532	0.455708	0.67062
0.652195	0.890264	0.887188	0.50162	0.523584	0.554292	0.504452	0.759252	0.464806	0.682253
0.658395	0.895782	0.889625	0.508025	0.532865	0.558616	0.513393	0.783234	0.467433	0.698408
0.663975	0.911601	0.89978	0.509306	0.541546	0.570434	0.521758	0.816449	0.47534	0.696672
0.673542	0.906779	0.912418	0.521593	0.536585	0.569637	0.51686	0.836211	0.478618	0.723347
0.680984	0.904218	0.924247	0.529551	0.548058	0.582345	0.527912	0.845885	0.490504	0.721737
0.687807	0.910804	0.930365	0.535711	0.557472	0.588841	0.536979	0.848883	0.494476	0.736281
0.689667	0.930199	0.94097	0.533144	0.561885	0.597596	0.54123	0.841313	0.500271	0.752066
0.69642	0.931322	0.952784	0.539778	0.563153	0.603612	0.540199	0.847616	0.504416	0.759807
0.709139	0.941577	0.97639	0.549036	0.572807	0.611804	0.54946	0.861899	0.512363	0.749048
0.718755	0.951831	0.984529	0.557522	0.582461	0.620842	0.558721	0.882852	0.519388	0.769407
0.719686	0.97527	0.994297	0.553665	0.593578	0.634965	0.569384	0.912693	0.524988	0.783923
0.73169	0.984278	1.009325	0.562294	0.58833	0.643099	0.558545	0.935721	0.531747	0.799883
0.744756	0.993436	1.019049	0.57745	0.600635	0.654333	0.570227	0.950344	0.545362	0.794035
0.753155	0.998198	1.031205	0.585413	0.612653	0.661634	0.581637	0.952604	0.546737	0.795083
0.7544	1.008088	1.032421	0.582844	0.622382	0.675676	0.590873	0.945804	0.559958	0.786582
0.76646	1.012887	1.038294	0.596969	0.621217	0.678424	0.591105	0.900845	0.567413	0.802226
0.769574	1.000427	1.043546	0.605178	0.629692	0.684244	0.59917	0.86537	0.578968	0.775074
0.773934	0.998228	1.058494	0.609539	0.638167	0.683135	0.607234	0.836512	0.586322	0.797901
0.782032	1.004458	1.055666	0.620314	0.646924	0.693112	0.615567	0.809505	0.584165	0.800081
0.79448	0.997195	1.103504	0.630016	0.662281	0.70927	0.633388	0.799866	0.590593	0.791297
0.804105	0.988781	1.113896	0.645888	0.665388	0.708714	0.63636	0.791248	0.602554	0.779712
0.808762	0.99061	1.118292	0.651264	0.669906	0.714555	0.640681	0.783921	0.616562	0.781487
0.796653	1.003414	1.100307	0.632832	0.674425	0.720952	0.645003	0.777336	0.629396	0.756476
0.798122	0.996918	1.109192	0.634709	0.683706	0.738095	0.650749	0.795833	0.659241	0.818564
0.803381	1.006724	1.108	0.639825	0.685711	0.735264	0.652657	0.79945	0.644843	0.791082
0.807093	1.00055	1.109987	0.647756	0.687716	0.735264	0.654565	0.804931	0.621478	0.737606
0.807403	1.011808	1.104821	0.64571	0.690867	0.739794	0.657564	0.810286	0.596128	0.693078
0.81208	1.010665	1.11309	0.650839	0.704271	0.758666	0.672909	0.814096	0.603929	0.713207
0.813001	1.005278	1.111901	0.654398	0.704562	0.755206	0.673187	0.820648	0.630399	0.741316
0.81423	1.007074	1.113487	0.654653	0.711837	0.755494	0.680138	0.829157	0.656545	0.776587
0.816688	1.028982	1.109523	0.65211	0.71533	0.760973	0.683475	0.839681	0.671633	0.826953
0.810947	1.032458	1.121788	0.642668	0.724264	0.783638	0.68928	0.83124	0.660379	0.818215
0.801981	1.034238	1.122182	0.627317	0.726911	0.779174	0.6918	0.818533	0.649444	0.810211
0.805072	1.038153	1.125336	0.630959	0.732206	0.782448	0.69684	0.802827	0.637495	0.767325
0.806	1.059151	1.114693	0.627056	0.736619	0.786019	0.701039	0.783977	0.627573	0.759208
0.813092	1.06441	1.114004	0.637531	0.739126	0.803672	0.701538	0.795481	0.636712	0.774567
0.819521	1.059828	1.108965	0.647893	0.744099	0.803974	0.706257	0.80676	0.637333	0.792148
0.816153	1.059123	1.107802	0.643749	0.749949	0.803974	0.711809	0.813949	0.645913	0.788286
0.815235	1.068639	1.113229	0.638827	0.750826	0.803672	0.712642	0.821728	0.659598	0.805848
0.820497	1.072098	1.108716	0.644462	0.755355	0.81435	0.722426	0.804524	0.647101	0.787368
0.827528	1.07245	1.119476	0.653266	0.759472	0.812821	0.726363	0.779745	0.651927	0.776441
0.823554	1.073857	1.111022	0.649123	0.765352	0.811597	0.731987	0.748798	0.653902	0.784108
0.83242	1.081595	1.116786	0.657149	0.771821	0.814655	0.738174	0.714776	0.653357	0.782589
0.836536	1.085176	1.116586	0.662142	0.772594	0.820874	0.745465	0.693281	0.658169	0.804699
0.835617	1.087991	1.127729	0.658247	0.776977	0.821182	0.749694	0.692506	0.66287	0.804478
0.835617	1.079194	1.129266	0.660844	0.781653	0.819949	0.754206	0.705474	0.661978	0.790288
0.83623	1.087639	1.130419	0.658767	0.780776	0.820874	0.75336	0.733265	0.657464	0.789612
0.843695	1.098247	1.142338	0.664915	0.786275	0.82662	0.76358	0.755208	0.663339	0.793718
0.839076	1.09224	1.122256	0.663608	0.791538	0.82662	0.768691	0.769448	0.673048	0.801869
0.836921	1.079873	1.134614	0.66204	0.796509	0.830335	0.773518	0.775857	0.680924	0.811458

0.840308	1.081639	1.140793	0.665438	0.797678	0.837146	0.774654	0.771946	0.684384	0.837486
0.846454	1.095146	1.153882	0.669296	0.795635	0.835862	0.775628	0.755403	0.683607	0.824509
0.855999	1.099427	1.157733	0.681042	0.804686	0.837096	0.784452	0.740892	0.686749	0.81893
0.859694	1.095503	1.166591	0.686002	0.811402	0.84018	0.790998	0.732095	0.690186	0.795893
0.865853	1.101924	1.145794	0.69566	0.812277	0.845424	0.791852	0.726016	0.686801	0.790047
0.868848	1.100282	1.151162	0.702979	0.812984	0.839408	0.797063	0.727074	0.692006	0.802624
0.872509	1.093142	1.143123	0.71125	0.822888	0.843336	0.806773	0.728216	0.727057	0.811653
0.878	1.077791	1.16303	0.719778	0.831044	0.851495	0.814769	0.729644	0.733736	0.814868
0.892644	1.092785	1.170686	0.733993	0.833083	0.871135	0.816768	0.728097	0.722314	0.826123
0.895305	1.095694	1.180024	0.739842	0.829744	0.85358	0.815549	0.75049	0.725986	0.8297
0.912569	1.098217	1.157398	0.766164	0.838114	0.864628	0.823775	0.756506	0.724352	0.830184
0.90318	1.09209	1.16085	0.754408	0.847638	0.868408	0.833136	0.760888	0.733738	0.820114
0.888945	1.081998	1.149728	0.739586	0.848504	0.868408	0.833987	0.757512	0.739056	0.843983
0.897106	1.092978	1.137504	0.753387	0.845758	0.875727	0.834632	0.758832	0.745552	0.920622
0.905904	1.103582	1.156385	0.759778	0.856065	0.869587	0.844803	0.754754	0.747842	0.873142
0.921377	1.097731	1.172569	0.779463	0.864368	0.882452	0.852997	0.770901	0.759192	0.824591
0.915613	1.093709	1.157541	0.775372	0.869808	0.880698	0.858366	0.784155	0.766515	0.791377
0.934745	1.103944	1.143153	0.806258	0.859923	0.877548	0.849862	0.814008	0.76192	0.816267
0.91984	1.102838	1.131563	0.785827	0.86495	0.87841	0.85483	0.823091	0.765646	0.83558
0.926836	1.085133	1.133108	0.803193	0.872212	0.890762	0.862006	0.839211	0.797025	0.867157
0.922578	1.088084	1.148175	0.792722	0.878915	0.895932	0.868631	0.86771	0.787883	0.895003
0.92973	1.090114	1.143891	0.804752	0.873934	0.880842	0.866578	0.869138	0.787966	0.867704
0.942495	1.094943	1.132711	0.825373	0.878922	0.889583	0.871523	0.888037	0.784271	0.870369
0.940368	1.080457	1.123458	0.829447	0.883078	0.89776	0.875644	0.883306	0.792582	0.878275
0.943407	1.090486	1.13194	0.828428	0.888066	0.904527	0.88059	0.884686	0.803068	0.862336
0.944746	1.092637	1.110384	0.837258	0.883683	0.88955	0.879781	0.883501	0.814616	0.868896
0.953205	1.081833	1.108465	0.854965	0.890282	0.895325	0.886351	0.891518	0.825232	0.8743
0.964686	1.074383	1.108465	0.876212	0.895231	0.902199	0.891278	0.894687	0.825459	0.879745
0.961363	1.091147	1.112687	0.863565	0.898805	0.909898	0.894837	0.892501	0.830104	0.881865
0.964978	1.087666	1.088924	0.876115	0.895694	0.909506	0.891237	0.894716	0.829864	0.8897
0.973385	1.071693	1.081258	0.895935	0.904703	0.914109	0.900201	0.903532	0.840423	0.883512
0.960475	1.053491	1.070909	0.885398	0.908252	0.915192	0.903732	0.91522	0.84665	0.887805
0.945162	1.063149	1.070909	0.858552	0.91535	0.916005	0.910794	0.919436	0.86959	0.896566
0.957332	1.076187	1.05501	0.876938	0.9103	0.919037	0.905836	0.927396	0.852752	0.932972
0.972903	1.071687	1.064095	0.902186	0.922178	0.929065	0.917656	0.951867	0.871442	0.932377
0.959428	1.055188	1.066366	0.885938	0.929467	0.932588	0.924909	0.967618	0.878991	0.909435
0.954337	1.040939	1.07053	0.882938	0.934056	0.941261	0.929476	0.97588	0.890503	0.881535
0.94819	1.032371	1.038469	0.887485	0.926147	0.925314	0.923713	0.979071	0.897437	0.88572
0.970207	1.015659	1.032468	0.931031	0.940268	0.93702	0.937797	0.978088	0.904601	0.92794
0.988058	0.998946	1.05422	0.962205	0.949594	0.956974	0.947098	0.974733	0.910277	0.9664
0.953546	1.005024	1.038844	0.907279	0.951992	0.961231	0.94949	0.970802	0.906052	1.006594
0.949342	0.994716	1.03465	0.904947	0.94061	0.963541	0.941533	0.975773	0.934419	0.9964
0.950833	0.993181	1.032421	0.90916	0.950079	0.947251	0.951012	0.960266	0.93698	0.966409
0.944272	0.977063	1.027591	0.905938	0.954288	0.943245	0.955224	0.970765	0.935676	0.943982
0.947553	0.987041	1.041337	0.903955	0.959023	0.946449	0.959963	0.96702	0.941844	0.941494
0.956253	1.006946	1.015737	0.917543	0.950645	0.945308	0.950544	0.96161	0.942512	0.946316
0.963396	1.008109	1.019419	0.928654	0.959999	0.963364	0.959896	0.94935	0.940436	0.953656
0.968158	0.990654	1.005793	0.946185	0.97169	0.976906	0.971586	0.966951	0.953702	0.957628
0.976193	1.002291	1.019051	0.951617	0.977666	0.979827	0.977561	0.966402	0.959047	0.972691
0.977259	1.009323	1.001184	0.957917	0.973732	0.976971	0.973634	0.970013	0.986034	0.967924
1.001794	1.000315	1.027667	0.995023	0.983288	0.983379	0.98319	0.976525	0.980339	0.969977

0.998247	0.990131	1.018839	0.995755	0.991553	0.989788	0.991454	1.011028	0.986796	0.974646
0.9947	1.004231	1.02031	0.983305	0.995427	0.992725	0.995328	1.026064	0.986369	0.98819
1.004443	1.007908	1.020292	0.99884	0.990317	0.994534	0.990317	1.042185	0.988814	0.993854
1.005036	1.004745	1.012579	1.003481	1.001603	0.9996	1.001603	0.997894	0.994945	0.99871
0.995557	0.986951	0.978055	1.003481	1.003399	1.002533	1.003399	0.994014	1.007135	1.000798
0.994964	1.000395	0.989074	0.994198	1.004681	1.003333	1.004681	0.965652	1.009316	1.006742
1.004556	1.013943	0.98416	1.006733	1.01328	1.010902	1.015195	0.96984	1.034636	1.010306
1.006332	1.007178	0.998817	1.007708	1.020773	1.013576	1.022701	0.979976	1.020672	1.010102
1.007517	0.996434	0.984527	1.019168	1.025682	1.020527	1.027619	0.997162	1.022728	1.017064
1.001595	0.994444	0.980496	1.01039	1.028265	1.026142	1.030208	1.018088	1.018381	1.022317
1.010563	1.015528	0.972758	1.019045	1.033944	1.013029	1.041005	1.008543	1.037182	1.03562
1.038553	1.012714	1.005953	1.059923	1.041703	1.038695	1.048816	1.009167	1.033497	1.046056
1.030893	1.001457	1.001263	1.052666	1.050754	1.03791	1.05793	1.00582	1.040675	1.056557
1.019991	1.010302	1.020025	1.024366	1.053599	1.041838	1.060794	1.007431	1.043151	1.066527
1.017381	1.023161	1.002138	1.019125	1.054586	1.038696	1.066306	1.004419	1.045509	1.077273
1.034195	1.035241	1.014805	1.039677	1.06155	1.042066	1.073347	1.021337	1.043972	1.082916
1.0339	1.025577	1.012633	1.043545	1.068771	1.049843	1.080648	1.033484	1.049354	1.099682
1.026525	1.03202	1.018424	1.025653	1.071092	1.051917	1.082995	1.061493	1.049812	1.10708
1.026086	1.039431	0.988287	1.029833	1.066848	1.04594	1.078883	1.029253	1.050713	1.115058
1.046355	1.059359	1.018323	1.047419	1.075802	1.055151	1.087938	1.03187	1.048838	1.111193
1.036073	1.048598	1.011448	1.036578	1.085524	1.064618	1.09777	1.018036	1.052764	1.1166
1.035486	1.044612	1.021942	1.034169	1.087826	1.073317	1.100098	0.996876	1.058778	1.139337
1.046585	1.068841	0.992461	1.050484	1.079787	1.070605	1.092741	1.039768	1.060679	1.15999
1.04688	1.056791	0.996451	1.055567	1.091874	1.072385	1.104974	1.036613	1.074575	1.158101
1.038314	1.047954	0.992461	1.046127	1.097918	1.068061	1.11109	1.048173	1.071777	1.145538
1.044222	1.062414	0.998627	1.047822	1.098421	1.07442	1.111599	1.055597	1.079074	1.154742
1.058263	1.075278	0.979703	1.07405	1.098629	1.082891	1.111682	1.082151	1.080217	1.15413
1.067437	1.063972	0.998779	1.090095	1.106586	1.085182	1.119734	1.088325	1.077088	1.164266
1.063885	1.05953	0.99554	1.086934	1.11902	1.091035	1.132315	1.114069	1.081766	1.179895
1.054415	1.069221	1.005978	1.060922	1.119766	1.09867	1.13307	1.131717	1.083483	1.190116
1.062522	1.07842	0.993581	1.074085	1.125809	1.117218	1.129769	1.120452	1.091076	1.185699
1.081479	1.07842	1.000757	1.10746	1.135757	1.126437	1.139751	1.121091	1.096873	1.202039
1.076444	1.071967	1.001116	1.101613	1.146201	1.131814	1.150233	1.116635	1.099304	1.206638
1.075555	1.075193	1.016546	1.092843	1.140233	1.141545	1.144243	1.109162	1.113241	1.215084
1.07783	1.085757	1.019374	1.091115	1.139203	1.140785	1.137232	1.110176	1.124379	1.227165
1.062076	1.091403	0.985696	1.068857	1.146865	1.136962	1.144881	1.117862	1.159802	1.214212
1.074263	1.090193	0.995473	1.088913	1.147607	1.147411	1.145622	1.123918	1.141124	1.246397
1.07783	1.096647	0.999457	1.091115	1.150325	1.164487	1.148336	1.143171	1.149551	1.263893
1.096064	1.121815	1.001321	1.112176	1.143098	1.157837	1.131207	1.15637	1.175547	1.30889
1.106703	1.132271	1.00193	1.125835	1.149374	1.169322	1.133413	1.16543	1.163932	1.339791
1.12701	1.150624	1.003152	1.159303	1.156907	1.176467	1.142652	1.173476	1.167917	1.361999
1.129018	1.149171	1.005735	1.162875	1.171415	1.185858	1.161375	1.171135	1.170846	1.35596
1.132185	1.152181	1.00746	1.165544	1.177299	1.193791	1.166014	1.171171	1.171771	1.357898
1.134582	1.155044	1.010029	1.16748	1.182006	1.199068	1.170824	1.179083	1.17593	1.351093
1.136497	1.157344	1.011899	1.169126	1.186616	1.20411	1.175678	1.182573	1.183123	1.345141
1.138355	1.158501	1.013533	1.171507	1.19113	1.208543	1.180491	1.187224	1.190389	1.341084
1.140169	1.158143	1.015504	1.174535	1.196012	1.213427	1.185415	1.194518	1.197259	1.341133
1.141905	1.157736	1.01753	1.177432	1.200648	1.218318	1.189865	1.201883	1.203927	1.343373
1.144255	1.158559	1.020279	1.180569	1.205058	1.223567	1.193718	1.20932	1.210442	1.346687
1.147285	1.160786	1.023341	1.184075	1.209281	1.228581	1.197423	1.216825	1.217207	1.351498
1.150243	1.163289	1.024395	1.187958	1.214043	1.234467	1.20148	1.224401	1.224261	1.357553

1.154039	1.16673	1.026154	1.192686	1.219156	1.240455	1.206027	1.23205	1.231074	1.363595
1.157743	1.170054	1.027802	1.197341	1.224039	1.246381	1.210242	1.239769	1.237813	1.370391
1.161348	1.173243	1.029352	1.201921	1.22901	1.252334	1.214575	1.247557	1.244821	1.377221
1.16529	1.17724	1.031065	1.206692	1.233844	1.258163	1.218781	1.251792	1.252225	1.384112
1.169194	1.181169	1.032679	1.211468	1.238983	1.264144	1.223373	1.256056	1.259381	1.390808
1.173014	1.185079	1.034259	1.216114	1.243933	1.27012	1.227668	1.260346	1.266375	1.397279
1.176898	1.189047	1.035881	1.220839	1.249059	1.27616	1.232207	1.264666	1.273601	1.404153
1.180628	1.192998	1.037414	1.22532	1.253977	1.282098	1.236494	1.269011	1.28108	1.411462
1.184511	1.197078	1.039046	1.229996	1.259131	1.288147	1.241085	1.274731	1.288557	1.418637
1.18833	1.201093	1.040603	1.234618	1.264121	1.294153	1.245437	1.280489	1.296042	1.425914
1.192161	1.205135	1.042186	1.239242	1.269118	1.300181	1.249785	1.286283	1.303543	1.43302

Implicit Pri RPIBO	Implicit Pri RPIBRO	Implicit Pri RPIBNSO	Implicit Pri RPIBNMO	Implicit Pri RPIBIO	Implicit Pri RPINO	Implicit Pri RPIGO	Implicit Pri RPXO	Implicit Pri RPXIO	Implicit Pri RPXIGO

0.572909	0.323072	0.424652	1.446921	0.674382	0.603448	0.608104	0.63383	0.684983	0.743144
0.579947	0.310455	0.404626	1.537865	0.605023	0.539359	0.603166	0.627908	0.716338	0.76408
0.604411	0.30092	0.390923	1.569747	0.555195	0.493703	0.588186	0.641288	0.762651	0.807776
0.620434	0.280548	0.382626	1.633462	0.51462	0.451064	0.583043	0.631914	0.756358	0.809212
0.610107	0.294107	0.400457	1.745591	0.554239	0.491311	0.618977	0.651955	0.778098	0.831814
0.618135	0.310055	0.415495	1.753984	0.613086	0.508765	0.64137	0.66171	0.73988	0.810417
0.650758	0.32396	0.437354	1.577446	0.679296	0.569385	0.653868	0.67303	0.732049	0.780433
0.661545	0.331736	0.463578	1.596312	0.743578	0.64748	0.66008	0.727896	0.832152	0.851037
0.654613	0.328824	0.447456	1.649416	0.694993	0.610959	0.669953	0.715505	0.786366	0.838718
0.643162	0.328992	0.430068	1.682371	0.664957	0.580645	0.663713	0.696832	0.779254	0.818656
0.642164	0.336437	0.412929	1.646935	0.643114	0.535797	0.652642	0.711506	0.806779	0.846855
0.63302	0.3295	0.406354	1.674363	0.618162	0.482255	0.640903	0.682014	0.791201	0.843556
0.649769	0.33043	0.425414	1.649163	0.645601	0.487013	0.648071	0.6952	0.778647	0.8469
0.645695	0.331706	0.432069	1.656315	0.662441	0.519397	0.668204	0.720317	0.824257	0.871454
0.656442	0.347847	0.443674	1.656751	0.683673	0.56153	0.687667	0.734182	0.825513	0.858374
0.66771	0.356462	0.450791	1.655897	0.718057	0.603563	0.721733	0.734287	0.84327	0.887588
0.665284	0.357421	0.451033	1.652433	0.706767	0.580275	0.709817	0.714555	0.841208	0.900645
0.649098	0.358907	0.445652	1.618379	0.71123	0.565217	0.69755	0.742548	0.842918	0.899356
0.663244	0.353617	0.445197	1.604598	0.712107	0.541414	0.678257	0.75533	0.857938	0.90136
0.673975	0.360184	0.445572	1.562256	0.706399	0.531429	0.683376	0.767492	0.856902	0.896018

0.665705	0.37853	0.440932	1.549682	0.695903	0.551502	0.673672	0.747658	0.824106	0.89046
0.683179	0.389093	0.451381	1.58577	0.717314	0.575926	0.671815	0.76168	0.86116	0.920273
0.705003	0.410277	0.453271	1.607507	0.72323	0.595162	0.691378	0.769333	0.881119	0.906861
0.705237	0.429002	0.461673	1.612115	0.732281	0.619128	0.729205	0.766256	0.881002	0.915236
0.733018	0.442622	0.465736	1.586809	0.729399	0.637413	0.716314	0.752074	0.856552	0.901045
0.729648	0.463349	0.477125	1.57812	0.748521	0.641758	0.715605	0.77868	0.871237	0.919837
0.739986	0.470738	0.491527	1.577233	0.738174	0.655319	0.712319	0.797329	0.903324	0.91871
0.755604	0.482982	0.511348	1.568981	0.756581	0.650206	0.720794	0.774959	0.844877	0.911803
0.765592	0.496565	0.522579	1.54731	0.761324	0.667377	0.729099	0.76225	0.82699	0.904865
0.755417	0.509408	0.518573	1.538995	0.751131	0.668085	0.735038	0.767773	0.829756	0.887375
0.77725	0.511489	0.514717	1.559699	0.771059	0.696391	0.734325	0.813425	0.90954	0.916463
0.796791	0.51355	0.522329	1.588048	0.758046	0.701646	0.742794	0.80229	0.879571	0.896093
0.812662	0.542003	0.531638	1.575151	0.756587	0.719623	0.745782	0.792991	0.834782	0.881749
0.804783	0.539313	0.541036	1.55764	0.758565	0.737911	0.748871	0.81501	0.872599	0.916639
0.804966	0.544692	0.548802	1.581771	0.767415	0.7432	0.758922	0.799863	0.891203	0.911468
0.793919	0.542511	0.553407	1.566266	0.755138	0.742526	0.750561	0.786177	0.873961	0.897179
0.80703	0.546286	0.565089	1.587911	0.766313	0.748491	0.754809	0.79434	0.835465	0.894696
0.778802	0.530982	0.56059	1.574419	0.769231	0.747454	0.757635	0.781072	0.833691	0.89123
0.810639	0.521384	0.559958	1.563557	0.762659	0.742553	0.753707	0.814005	0.874219	0.890154
0.818845	0.51257	0.560245	1.548277	0.789496	0.748858	0.75069	0.835934	0.915325	0.892549
0.810001	0.534251	0.552797	1.484736	0.760024	0.713647	0.732128	0.837955	0.890077	0.880336
0.794515	0.543579	0.542325	1.504131	0.78576	0.713333	0.733982	0.807373	0.860995	0.884794
0.795675	0.541381	0.538397	1.516872	0.781377	0.723629	0.719707	0.78672	0.839147	0.894339
0.75936	0.534624	0.533769	1.501515	0.772498	0.698259	0.713275	0.771944	0.813731	0.833411
0.843405	0.529408	0.556048	1.451126	0.772117	0.705637	0.71452	0.795927	0.835044	0.873314
0.801964	0.527032	0.540065	1.423044	0.773002	0.713362	0.717624	0.807472	0.857114	0.894596
0.740048	0.525096	0.533183	1.391119	0.763246	0.717439	0.720751	0.8134	0.880786	0.893127
0.693856	0.526698	0.519899	1.376129	0.78219	0.727679	0.733505	0.812374	0.901749	0.930593
0.71874	0.532094	0.545951	1.386836	0.748892	0.718451	0.725732	0.835517	0.902662	0.906042
0.75309	0.530321	0.549309	1.417147	0.731766	0.71873	0.71576	0.836594	0.90404	0.922947
0.789384	0.528378	0.551392	1.46764	0.736931	0.718394	0.703883	0.842325	0.905029	0.942642
0.848423	0.534959	0.555955	1.515302	0.726815	0.71649	0.69603	0.846539	0.907631	0.977188
0.831235	0.539102	0.564534	1.507897	0.752898	0.723497	0.710923	0.844753	0.920942	0.953125
0.825872	0.545429	0.570988	1.505561	0.756829	0.72889	0.726156	0.878724	0.934834	0.990509
0.777672	0.549094	0.575689	1.497162	0.756901	0.736878	0.737283	0.884759	0.951276	0.967425
0.772391	0.55585	0.575784	1.481627	0.767295	0.734304	0.756802	0.881724	0.968338	1.010953
0.786858	0.557984	0.578242	1.492393	0.756171	0.741351	0.754465	0.900415	0.980543	1.027136
0.807781	0.552095	0.577612	1.511633	0.750108	0.747811	0.745708	0.916345	0.989489	1.000396
0.799396	0.545681	0.58307	1.488737	0.748463	0.737226	0.731362	0.920568	0.993415	1.023506
0.814355	0.544417	0.584685	1.486161	0.735485	0.726054	0.729387	0.921474	0.992207	1.068309
0.797765	0.542324	0.59098	1.462226	0.723999	0.721137	0.729297	0.92249	0.989146	1.050947
0.793946	0.550902	0.602119	1.440541	0.725866	0.718699	0.735642	0.913437	0.984826	1.042226
0.793229	0.550417	0.606712	1.454268	0.744233	0.742991	0.736353	0.91781	0.981372	1.028897
0.791822	0.554237	0.608502	1.436108	0.744439	0.75	0.734633	0.912874	0.980144	0.964356
0.812639	0.57172	0.606285	1.462716	0.767143	0.716923	0.746331	0.913938	0.979762	0.994722
0.810541	0.572117	0.618668	1.448436	0.772176	0.751701	0.756044	0.920419	0.988283	1.034246
0.798638	0.559722	0.61711	1.418193	0.764225	0.769373	0.760071	0.915648	0.983595	1.042558
0.806275	0.56291	0.625856	1.432416	0.784561	0.773707	0.761793	0.91477	0.983586	1.000225
0.81135	0.576949	0.630992	1.469546	0.793999	0.785398	0.778085	0.91589	0.983773	0.997162
0.815083	0.577929	0.629516	1.477995	0.778598	0.825249	0.767522	0.921641	0.986839	1.005245
0.820723	0.581568	0.624283	1.49375	0.775848	0.84307	0.749462	0.934982	1.000198	1.027434

0.843472	0.581049	0.630435	1.44776	0.753061	0.8781	0.742387	0.945622	1.009648	1.085359
0.828367	0.583571	0.638568	1.454712	0.795557	0.83945	0.750165	0.930722	0.995274	1.034654
0.830136	0.596326	0.644887	1.408777	0.780672	0.809623	0.756055	0.918354	0.980751	1.011892
0.808046	0.599134	0.645965	1.387954	0.784196	0.786611	0.768431	0.923097	0.987885	1.020999
0.802014	0.598346	0.646318	1.363988	0.798476	0.758547	0.780125	0.918924	0.985364	1.002779
0.810951	0.606987	0.660911	1.359122	0.829987	0.779835	0.78541	0.925315	0.988221	1.028798
0.821381	0.612901	0.677857	1.359211	0.826118	0.809804	0.776176	0.935907	1.000248	1.029955
0.82281	0.609711	0.686853	1.349105	0.811009	0.830571	0.775785	0.938883	1.001376	1.025
0.832951	0.61822	0.704705	1.352372	0.79107	0.859402	0.780499	0.953185	1.015965	1.037839
0.841591	0.622696	0.696311	1.360712	0.805671	0.850694	0.779908	0.957172	1.022937	1.024605
0.839426	0.633091	0.700226	1.376673	0.833786	0.845647	0.785028	0.961369	1.02803	1.06183
0.827599	0.632506	0.695203	1.375328	0.880256	0.835037	0.784791	0.952759	1.016225	1.060695
0.858171	0.638532	0.696773	1.368198	0.880102	0.84343	0.787941	0.946015	1.010148	1.056187
0.954426	0.660958	0.705204	1.380106	0.889316	0.798319	0.803586	0.957137	1.022627	1.061609
0.890297	0.660761	0.707392	1.378912	0.874275	0.856721	0.796792	0.957376	1.021141	1.047874
0.828999	0.658783	0.713917	1.346693	0.863519	0.875946	0.810223	0.961768	1.025054	1.059264
0.784368	0.664348	0.718178	1.333833	0.866408	0.897799	0.810774	0.97058	1.035237	1.042325
0.808569	0.682771	0.730066	1.315003	0.8664	0.881678	0.838535	0.959989	1.016663	0.996357
0.838869	0.684906	0.727996	1.267463	0.872711	0.870676	0.814365	0.919236	0.966589	0.994814
0.879994	0.708358	0.739602	1.256884	0.911618	0.866067	0.809551	0.917485	0.962804	0.98505
0.923707	0.705036	0.748323	1.242535	0.887589	0.872424	0.801394	0.901968	0.940243	0.980108
0.888843	0.728407	0.76462	1.225537	0.88731	0.871935	0.808547	0.915722	0.955409	0.976843
0.884749	0.742477	0.779533	1.23779	0.881996	0.87963	0.830779	0.937598	0.981563	0.997401
0.882719	0.739193	0.794554	1.204804	0.898966	0.884409	0.843716	0.932118	0.974198	0.981613
0.856771	0.744306	0.80957	1.163231	0.8957	0.887619	0.852277	0.910054	0.945758	0.961778
0.869437	0.74686	0.80797	1.162281	0.895616	0.88484	0.843217	0.914564	0.947496	0.956011
0.878681	0.764222	0.810357	1.166397	0.878976	0.887679	0.849318	0.921452	0.954836	0.970878
0.889322	0.780454	0.815875	1.14439	0.877786	0.872999	0.852137	0.91425	0.942049	0.95842
0.892427	0.788927	0.824316	1.131285	0.884092	0.877744	0.85329	0.922306	0.952634	0.951227
0.896611	0.793566	0.831619	1.129229	0.88415	0.893536	0.869541	0.91453	0.937954	0.964374
0.883913	0.800911	0.835236	1.102847	0.899843	0.907677	0.872366	0.910062	0.93159	0.942393
0.888702	0.804505	0.843613	1.098502	0.914793	0.915811	0.876392	0.920246	0.943849	0.941581
0.901551	0.8091	0.848892	1.101355	0.901076	0.925638	0.881923	0.940087	0.978518	0.977309
0.935888	0.828426	0.850431	1.093338	0.906135	0.923191	0.922653	0.974049	1.018254	0.990776
0.953924	0.843563	0.874425	1.089911	0.907657	0.933744	0.90242	0.951287	0.973312	0.966351
0.894313	0.86142	0.896096	1.064276	0.912664	0.94356	0.905525	0.907051	0.904564	0.948619
0.875554	0.881107	0.878585	1.02456	0.920763	0.952912	0.916748	0.903041	0.911864	0.939589
0.880919	0.880071	0.900125	0.999099	0.918442	1.009034	0.90781	0.934831	0.942028	0.956947
0.920485	0.879667	0.939951	1.045747	0.923819	1.002516	0.95534	0.96162	0.978517	0.952062
0.962933	0.889708	0.950006	1.087165	0.945246	0.986568	0.969219	0.992856	1.009122	1.00092
1.009878	0.886886	0.956677	1.151314	0.948631	0.977973	1.006123	0.997269	1.029723	1.084249
0.998986	0.889091	0.952936	1.167821	0.964818	0.992288	0.990547	0.990694	1.008586	1.040322
0.969153	0.888808	0.941269	1.12656	0.963381	0.974652	0.95848	0.967364	0.978458	0.992541
0.946913	0.893687	0.922981	1.118077	0.936667	0.960261	0.935608	0.951583	0.96153	0.960184
0.942245	0.903953	0.935926	1.108815	0.970579	0.957517	0.939293	0.95543	0.968107	0.952451
0.946475	0.912684	0.946292	1.063792	0.95991	0.95074	0.962645	0.96117	0.970962	0.955516
0.953095	0.914869	0.95719	1.042068	0.962541	0.958566	0.953183	0.964985	0.967824	0.977163
0.960981	0.922821	0.959777	1.023837	0.966237	0.964402	0.942701	0.979	0.985194	0.99213
0.966863	0.940984	0.960255	0.981875	0.967343	0.976039	0.985385	0.990287	1.003595	1.009515
0.962912	0.938127	0.96601	0.984201	0.966473	0.983068	0.975643	1.001688	1.000327	0.990702
0.969549	0.954452	0.974281	0.986816	0.973019	0.985507	0.975396	0.994446	1.001098	0.981759

0.975549	0.966345	0.983469	0.993715	0.978185	0.973415	0.989608	0.994326	0.994767	1.019907
0.983474	0.981889	0.988693	1.009274	0.980097	0.975941	0.993993	0.989492	0.987046	1.004497
0.990245	0.993636	0.998387	0.999821	0.984755	0.988601	1.000431	0.99448	0.993946	0.989004
0.999241	0.997049	0.990039	1.016853	1.003788	0.996212	0.99412	1.001514	1.002216	1.032138
1.001206	0.99894	1.003837	0.996286	0.999298	1.002669	1.001899	0.997934	0.996394	1.002516
1.009511	1.010616	1.007564	0.987266	1.013767	1.009748	1.003686	1.006202	1.007657	0.976968
1.011973	1.016854	1.008092	0.990819	1.017562	1.011349	1.008082	1.009404	1.0121	0.983541
1.008763	1.011666	1.01056	0.993512	1.013781	1.011332	1.015943	1.003071	1.000017	1.0106
1.013995	1.024745	1.020357	1.00425	0.987111	1.01926	1.028145	1.0095	1.00449	0.99595
1.017976	1.028933	1.028079	1.005221	0.998869	1.020356	1.035077	1.013169	1.007589	1.012248
1.033705	1.043782	1.037848	1.027196	1.013819	1.021607	1.040408	1.026786	1.031555	1.036712
1.04442	1.052321	1.045779	1.031083	1.03826	1.02904	1.053085	1.02251	1.034253	1.019348
1.056246	1.066535	1.053558	1.040241	1.045468	1.028896	1.060455	1.019886	1.043686	1.055457
1.068944	1.074783	1.058032	1.061517	1.064514	1.029895	1.058799	1.018964	1.056888	1.079218
1.078875	1.085813	1.062384	1.080423	1.070582	1.044014	1.071602	1.043783	1.082261	1.093781
1.082745	1.091233	1.062535	1.086175	1.084488	1.059779	1.084411	1.058417	1.087073	1.06724
1.099949	1.109825	1.058398	1.122432	1.097008	1.077026	1.098995	1.087875	1.117035	1.140977
1.105136	1.118775	1.058579	1.129341	1.098312	1.096606	1.115558	1.095682	1.115113	1.168773
1.115772	1.140855	1.058099	1.130612	1.104798	1.089607	1.111446	1.091014	1.11298	1.180128
1.112481	1.148134	1.05938	1.107096	1.097982	1.081119	1.104524	1.077165	1.095918	1.140573
1.120359	1.166791	1.079756	1.09682	1.096985	1.066941	1.10059	1.087198	1.111077	1.114937
1.148084	1.188448	1.071665	1.109974	1.103424	1.067649	1.103391	1.098968	1.12896	1.090929
1.170901	1.244513	1.073835	1.104206	1.102374	1.078382	1.110645	1.093255	1.115527	1.122213
1.166299	1.232968	1.079299	1.12171	1.107388	1.100694	1.121991	1.10847	1.134765	1.169529
1.152621	1.224201	1.09129	1.081914	1.107763	1.112299	1.112927	1.074368	1.089572	1.114869
1.161312	1.240935	1.101803	1.102599	1.115216	1.12426	1.124501	1.082317	1.095357	1.095596
1.160228	1.239129	1.105003	1.097622	1.106397	1.119786	1.125576	1.086631	1.101791	1.097415
1.1715	1.241613	1.107915	1.121121	1.105303	1.117841	1.131688	1.10684	1.127028	1.123249
1.188104	1.259884	1.113778	1.134267	1.103295	1.117241	1.143267	1.119796	1.140771	1.133603
1.199284	1.271768	1.119036	1.145529	1.103418	1.107948	1.150274	1.116833	1.136996	1.214811
1.194562	1.257445	1.128914	1.16068	1.113182	1.117797	1.150499	1.117373	1.136579	1.167344
1.211472	1.280401	1.137844	1.166934	1.132661	1.123034	1.162226	1.11936	1.138917	1.152875
1.21599	1.290667	1.133449	1.167442	1.147259	1.129476	1.163564	1.121196	1.142183	1.165628
1.223514	1.296212	1.148633	1.174582	1.161296	1.146401	1.172848	1.121001	1.142279	1.134863
1.237429	1.31601	1.152699	1.184842	1.166115	1.150466	1.177397	1.122374	1.144392	1.146227
1.229958	1.308541	1.142665	1.17288	1.151662	1.14801	1.158488	1.113142	1.132871	1.136013
1.264172	1.383776	1.148895	1.180159	1.144547	1.154788	1.162121	1.135928	1.160073	1.205706
1.283479	1.424532	1.152094	1.172386	1.148981	1.164398	1.167496	1.155248	1.182368	1.211335
1.333218	1.51421	1.18873	1.1557	1.156799	1.185475	1.189716	1.174685	1.207093	1.242149
1.365225	1.571218	1.238762	1.122656	1.151403	1.218676	1.214967	1.207863	1.244618	1.306423
1.391007	1.616375	1.282712	1.147724	1.161599	1.247991	1.23012	1.220697	1.266668	1.343875
1.38172	1.558137	1.297796	1.161442	1.166539	1.259238	1.241799	1.200014	1.276584	1.340946
1.38327	1.559254	1.300926	1.166625	1.172531	1.266275	1.246656	1.214587	1.291784	1.359458
1.375482	1.545895	1.299019	1.167925	1.177594	1.268597	1.245841	1.219441	1.295756	1.362453
1.368862	1.535265	1.294918	1.16682	1.183601	1.268962	1.243655	1.224471	1.298966	1.367872
1.363763	1.526282	1.295257	1.166227	1.18962	1.272435	1.244209	1.228252	1.302498	1.372637
1.363085	1.521991	1.300845	1.166605	1.19548	1.273158	1.247134	1.234147	1.3078	1.376631
1.364861	1.52143	1.305069	1.166982	1.201355	1.274297	1.251127	1.237465	1.310033	1.374806
1.367867	1.523826	1.309141	1.167339	1.207339	1.275581	1.255722	1.243419	1.315135	1.377968
1.372451	1.529244	1.313201	1.167976	1.213356	1.27797	1.260971	1.248511	1.319586	1.380395
1.378549	1.536568	1.320293	1.168446	1.219447	1.281771	1.266556	1.251994	1.322231	1.379829

1.384592	1.544125	1.327196	1.168847	1.225397	1.287074	1.272201	1.258065	1.328454	1.385558
1.391588	1.553392	1.333999	1.1693	1.231413	1.292746	1.277853	1.264069	1.334744	1.391473
1.398582	1.563252	1.340699	1.169852	1.23747	1.298762	1.283584	1.269943	1.340954	1.39736
1.405606	1.573264	1.347198	1.170499	1.243529	1.305004	1.289435	1.275967	1.347601	1.404219
1.412397	1.582987	1.353869	1.171302	1.249734	1.311055	1.295227	1.281813	1.354079	1.410812
1.418941	1.591857	1.360584	1.172166	1.255772	1.316696	1.301033	1.287539	1.360568	1.417497
1.425973	1.601648	1.367309	1.173006	1.261849	1.322773	1.306869	1.2934	1.367181	1.424292
1.433529	1.611432	1.374346	1.173739	1.267967	1.32887	1.312721	1.299479	1.373943	1.431338
1.440874	1.621005	1.381098	1.174501	1.274351	1.335086	1.318618	1.305856	1.381004	1.438547
1.448348	1.630685	1.387927	1.175415	1.280592	1.341305	1.324531	1.312132	1.388036	1.445849
1.45561	1.640365	1.39482	1.176296	1.286767	1.347519	1.330435	1.318513	1.395301	1.453289

Implicit Pri Implicit Pri Implicit Pri Implicit Pri Implicit Pri Implicit Pri Implicit Pri Implicit Pri Implicit Pri Implicit Pri
RPXISO RPXPO RPXPGO RPXPSO RPMO RPMIO RPMIGO RPMISO RPMPO RPMPGO

0.411476	0.533299	0.485112	0.430812	0.725251	0.801119	0.893416	0.409023	0.502467	0.463138
0.433785	0.490718	0.528972	0.482599	0.711261	0.802039	0.840781	0.390312	0.509639	0.53649
0.470942	0.473772	0.526004	0.493056	0.704013	0.789409	0.874586	0.41176	0.513272	0.542044
0.482787	0.477254	0.534447	0.512235	0.686077	0.76743	0.917655	0.438285	0.514424	0.554113
0.503066	0.491919	0.538715	0.508703	0.72659	0.796271	0.938754	0.45498	0.533301	0.546674
0.491599	0.517664	0.560046	0.528753	0.753693	0.821862	0.921648	0.453535	0.551421	0.571721
0.478585	0.546438	0.583485	0.554537	0.757755	0.845386	0.886424	0.44314	0.568784	0.610925
0.528749	0.596818	0.542582	0.519688	0.790153	0.868478	0.929153	0.472206	0.58529	0.553909
0.53157	0.601481	0.549379	0.528318	0.776195	0.848892	0.900781	0.469401	0.588438	0.567435
0.524752	0.568715	0.57061	0.551798	0.791085	0.834576	0.921448	0.487234	0.590741	0.592835
0.54834	0.555725	0.577525	0.561177	0.768963	0.827636	0.913541	0.488788	0.592388	0.613706
0.552251	0.512054	0.593175	0.579908	0.764004	0.827304	0.912576	0.492693	0.593513	0.648449
0.549707	0.532855	0.582251	0.564054	0.785748	0.849314	0.92749	0.496922	0.602553	0.632913
0.554125	0.553193	0.595239	0.562372	0.806133	0.870486	0.954309	0.516292	0.61185	0.633545
0.547734	0.586603	0.612739	0.578449	0.8243	0.888214	0.944411	0.517545	0.621577	0.666606
0.572026	0.611477	0.571302	0.542457	0.833101	0.902037	1.002144	0.557944	0.63042	0.606797
0.579627	0.596651	0.579449	0.552692	0.851356	0.901623	0.997358	0.573236	0.631318	0.623285
0.573574	0.586238	0.610775	0.575253	0.837173	0.901746	0.965483	0.563714	0.62639	0.648349
0.582067	0.582952	0.611022	0.580857	0.808314	0.904622	0.96401	0.570316	0.61322	0.63224
0.582692	0.571628	0.618953	0.590891	0.818797	0.910149	0.983299	0.588006	0.593197	0.602514

0.596236	0.587123	0.624145	0.601545	0.843221	0.922198	0.984251	0.591451	0.574373	0.580589
0.614895	0.603246	0.610155	0.585998	0.830055	0.931794	1.028206	0.622598	0.559905	0.518848
0.610273	0.608033	0.629047	0.60819	0.825188	0.93661	0.99818	0.608637	0.554974	0.538381
0.61401	0.616797	0.623508	0.601251	0.788149	0.936233	0.998253	0.612564	0.560203	0.528265
0.622851	0.618849	0.624673	0.60353	0.812235	0.928912	1.015117	0.624368	0.56934	0.531279
0.632299	0.624763	0.626358	0.603007	0.820383	0.920217	1.002072	0.620407	0.578821	0.540025
0.630229	0.631062	0.643327	0.619738	0.818913	0.912029	0.982071	0.61247	0.584023	0.563042
0.624679	0.622892	0.677375	0.653873	0.823456	0.905148	0.936305	0.588624	0.583668	0.614294
0.625479	0.630998	0.694509	0.6419	0.831205	0.901174	0.930559	0.590997	0.581033	0.586556
0.630548	0.650213	0.668559	0.636109	0.792945	0.897719	0.965608	0.619262	0.578482	0.552494
0.650726	0.662129	0.671084	0.637368	0.800957	0.894324	0.963705	0.624691	0.578838	0.545221
0.649873	0.667077	0.675559	0.653103	0.803851	0.891123	0.961758	0.630718	0.582998	0.554014
0.649448	0.672479	0.707195	0.680156	0.862321	0.887656	0.944172	0.628384	0.589775	0.585517
0.681063	0.672405	0.692784	0.669122	0.821977	0.885751	0.931989	0.627642	0.597906	0.576169
0.699742	0.656572	0.662392	0.658737	0.792375	0.885956	0.950874	0.647522	0.606308	0.554515
0.70278	0.673774	0.667077	0.675166	0.769484	0.887669	0.93076	0.640469	0.61382	0.581824
0.70714	0.689462	0.696728	0.686805	0.822496	0.889746	0.931948	0.647326	0.619741	0.607674
0.705346	0.690624	0.704449	0.694335	0.811632	0.889695	0.936364	0.656539	0.622962	0.607172
0.702313	0.6866	0.70548	0.692316	0.807647	0.885751	0.941465	0.666198	0.622723	0.591378
0.712392	0.682569	0.692752	0.686979	0.827211	0.878371	0.920954	0.657561	0.619211	0.579236
0.720702	0.70821	0.69126	0.694055	0.830654	0.870006	0.901196	0.653667	0.613325	0.5537
0.732899	0.698876	0.690954	0.700246	0.795085	0.863942	0.918345	0.670094	0.607119	0.549407
0.743113	0.686813	0.712362	0.721376	0.795441	0.862891	0.912458	0.667769	0.601903	0.581544
0.696667	0.673093	0.6871	0.696206	0.773794	0.867576	0.893249	0.653669	0.598427	0.559093
0.702336	0.673567	0.695549	0.667297	0.797759	0.876587	0.912972	0.656313	0.596618	0.551671
0.711726	0.67671	0.711162	0.671732	0.819243	0.88831	0.930121	0.668596	0.596263	0.565434
0.705818	0.684581	0.711208	0.665819	0.807673	0.901431	0.937281	0.67557	0.597176	0.56933
0.716898	0.697218	0.741769	0.677194	0.834407	0.915184	0.975013	0.706542	0.59923	0.579963
0.705776	0.703574	0.751327	0.700358	0.844245	0.929666	0.97951	0.722381	0.602298	0.58275
0.720081	0.709726	0.75164	0.702711	0.854105	0.944696	0.997668	0.740313	0.606248	0.590985
0.725658	0.713581	0.739615	0.6822	0.859254	0.960464	0.997329	0.743602	0.611033	0.57254
0.74927	0.714835	0.752251	0.690054	0.873367	0.9768	1.002589	0.750117	0.616605	0.579483
0.730451	0.719337	0.704683	0.638967	0.880887	0.992184	1.024031	0.766655	0.622449	0.534246
0.750906	0.724755	0.782096	0.700233	0.915425	1.007109	1.05511	0.79116	0.628969	0.621258
0.731217	0.73298	0.800511	0.714057	0.91814	1.021193	1.057975	0.794052	0.636337	0.621788
0.758869	0.744232	0.858748	0.761	0.915734	1.03358	1.086183	0.8155	0.644241	0.711876
0.749745	0.75451	0.934757	0.792037	0.928489	1.043448	1.096144	0.814919	0.652561	0.755822
0.736192	0.764367	0.842716	0.720603	0.939066	1.048902	1.074205	0.801203	0.66027	0.66192
0.757325	0.772274	0.7961	0.684916	0.941502	1.048812	1.090822	0.818998	0.666935	0.60871
0.795904	0.777339	0.807555	0.699752	0.949433	1.043496	1.099222	0.833595	0.672482	0.624041
0.793695	0.78141	0.852425	0.734371	0.947438	1.035004	1.077417	0.838626	0.676811	0.688875
0.792675	0.783023	0.853266	0.739259	0.934295	1.025951	1.059979	0.834904	0.680908	0.672496
0.784566	0.782504	0.889987	0.770969	0.9331	1.018505	1.054496	0.839079	0.685285	0.724165
0.74304	0.780731	0.82034	0.715173	0.904492	1.014315	1.04271	0.836748	0.689568	0.655069
0.781113	0.776589	0.809682	0.71191	0.923134	1.025645	1.039103	0.834288	0.694887	0.677854
0.805123	0.782477	0.822478	0.714602	0.933111	1.038433	1.072261	0.867314	0.685844	0.673935
0.817594	0.781117	0.862594	0.754142	0.932727	1.030772	1.059894	0.864178	0.687567	0.687044
0.78921	0.782209	0.893127	0.786354	0.944462	1.0098	1.056568	0.868799	0.696013	0.692558
0.793232	0.783544	0.888122	0.796833	0.940357	1.041822	1.079548	0.896768	0.675238	0.667638
0.796889	0.792874	0.845072	0.755888	0.942828	1.046469	1.086562	0.910554	0.671895	0.627981
0.804216	0.803963	0.830194	0.731738	0.9702	1.083644	1.086468	0.918592	0.675096	0.607512

0.842828	0.813974	0.879559	0.765696	0.978865	1.095454	1.122057	0.957301	0.673419	0.681874
0.828132	0.799484	0.856401	0.749749	0.96274	1.074044	1.086005	0.938135	0.67262	0.669273
0.824538	0.793808	0.80377	0.712395	0.949464	1.048277	1.087915	0.947597	0.691126	0.634217
0.830049	0.7945	0.869755	0.765837	0.96399	1.058435	1.085489	0.952292	0.717043	0.700739
0.82047	0.787478	0.903368	0.798184	0.964267	1.052118	1.058211	0.934008	0.735172	0.760777
0.852315	0.801607	0.838707	0.735907	0.964557	1.044658	1.088524	0.962435	0.757457	0.713553
0.843989	0.808209	0.875532	0.758964	0.979986	1.065105	1.072815	0.953707	0.757373	0.772966
0.848046	0.814636	0.881978	0.771383	0.987891	1.068033	1.090261	0.97491	0.778204	0.817938
0.846462	0.827795	0.952103	0.820656	1.014304	1.096744	1.094878	0.985186	0.797631	0.911958
0.828161	0.825494	1.024779	0.875098	1.015081	1.097167	1.109153	1.00431	0.799725	0.944206
0.852395	0.828321	0.981762	0.831524	1.015416	1.098654	1.115151	1.016826	0.797899	0.899501
0.865309	0.827101	0.856921	0.735476	1.003584	1.090284	1.096644	1.007372	0.777728	0.749403
0.873546	0.819251	0.801703	0.694592	0.996128	1.09622	1.119022	1.035988	0.73998	0.677368
0.88284	0.8273	0.83882	0.716856	1.008409	1.107025	1.133136	1.05982	0.754648	0.696138
0.887755	0.830973	0.880509	0.763889	1.005163	1.092211	1.128419	1.063528	0.77896	0.767127
0.895952	0.836447	0.954305	0.825377	1.015794	1.10339	1.105281	1.049352	0.787226	0.857947
0.871806	0.841697	0.998553	0.854557	1.026632	1.110072	1.08375	1.036179	0.807381	0.896454
0.856992	0.848616	1.084596	0.90892	1.017417	1.084089	1.036918	1.000127	0.840886	0.989119
0.889229	0.826528	0.864256	0.754426	0.962622	1.022863	1.036258	1.005515	0.800328	0.790626
0.882087	0.828787	0.862841	0.756017	0.955609	1.012002	1.021248	0.995793	0.801136	0.789221
0.893459	0.828654	0.85474	0.763595	0.932824	0.981901	1.018716	0.996971	0.797363	0.831328
0.893334	0.838752	0.849367	0.743566	0.946391	0.989292	1.015049	0.994086	0.827156	0.797387
0.886593	0.853371	1.010624	0.860762	0.974509	1.018908	0.993098	0.974443	0.851884	0.976752
0.885546	0.850887	0.973846	0.842351	0.96643	1.005173	0.992478	0.975232	0.858792	0.973644
0.888324	0.840412	0.872481	0.772976	0.940141	0.97091	0.992952	0.976626	0.852794	0.871123
0.900707	0.850927	0.899055	0.785386	0.958006	0.988274	0.981377	0.963037	0.871977	0.929425
0.910314	0.857257	0.918117	0.798687	0.976781	1.004955	0.989663	0.972171	0.894273	0.96831
0.907911	0.863627	0.932183	0.82019	0.961779	0.97207	0.984865	0.969024	0.935244	1.010766
0.899271	0.867276	0.989214	0.869945	0.961173	0.96813	0.98406	0.970371	0.942262	1.096253
0.924916	0.861856	0.92058	0.802659	0.94648	0.955642	0.985135	0.97197	0.932253	0.975922
0.900504	0.858779	0.93457	0.816835	0.945368	0.953808	0.957404	0.948661	0.933429	0.99351
0.890877	0.87482	0.959927	0.839204	0.953696	0.974496	0.955792	0.952564	0.925141	1.012482
0.922067	0.89271	0.97175	0.859125	0.981717	0.996956	0.983851	0.98774	0.884687	1.0263
0.903239	0.907568	1.020982	0.925365	0.982413	1.002998	0.959415	0.98441	0.904599	1.067799
0.891469	0.896684	1.000403	0.927953	0.965533	0.966572	0.923172	0.952517	0.941602	1.028956
0.900499	0.901028	0.906087	0.869257	0.932663	0.911834	0.925518	0.956865	0.997137	0.960243
0.925396	0.902563	0.833462	0.828772	0.890198	0.882167	0.930992	0.961052	0.94459	0.918424
0.969233	0.923873	0.839919	0.823043	0.921613	0.900925	0.960353	0.972408	0.999013	0.97093
0.939091	0.932419	0.999865	0.950964	0.979892	0.947678	0.967583	0.977376	1.077853	1.204912
0.951661	0.963998	1.107971	1.015401	1.034325	1.011809	0.990729	1.000664	1.090751	1.342844
0.994061	0.939518	1.016663	0.900784	1.080874	1.096887	1.01543	1.027827	1.014322	1.085789
0.962269	0.959376	0.974888	0.888392	1.052173	1.083516	1.012317	1.037379	0.960426	0.876235
0.946912	0.948095	0.916735	0.865838	1.004886	1.028282	1.010559	1.039029	0.944258	0.814413
0.951188	0.933923	0.964617	0.949885	0.958746	0.985134	1.012776	1.043878	0.899485	0.934052
0.955477	0.932943	1.024866	1.025363	0.944337	0.961608	0.994747	1.02697	0.912508	1.060335
0.955188	0.944077	0.97071	0.971255	0.955379	0.956504	0.968401	1.002856	0.957321	0.991294
0.970692	0.959377	0.970157	0.967995	0.963837	0.967134	0.972594	1.006159	0.957509	0.970071
0.980717	0.968109	0.951278	0.948743	0.985354	0.988099	0.966123	0.996527	0.977312	0.949837
0.994304	0.966546	0.949928	0.94915	0.97494	0.977675	0.960746	0.986191	0.963147	0.932941
0.979101	1.004036	0.9686	0.958303	0.989802	0.981271	0.97669	0.987956	1.010117	0.972073
0.971383	0.983107	0.970272	0.965088	0.993297	0.988541	0.986509	0.992662	1.005638	0.999989

0.993625	0.993624	1.009728	0.990873	1.004478	0.99562	0.999868	1.002183	1.030159	1.054274
0.976287	0.993993	1.068376	1.045755	1.008066	1.006804	1.005601	1.005339	1.014121	1.116813
0.979349	0.995515	1.057872	1.050438	1.007638	0.989981	1.025982	1.020606	1.053948	1.059665
1.015332	0.999816	1.037245	1.020917	1.01132	1.006723	1.008694	1.00506	1.023248	1.038855
1.014622	1.000662	0.963708	0.973811	0.989404	0.998025	0.982832	0.983718	0.971052	0.972119
0.991227	1.004052	0.949529	0.95991	0.991268	1.00584	0.981862	0.989964	0.957499	0.938421
1.013126	1.005003	0.972365	0.999254	1.005455	1.012923	0.990644	1.027711	0.988057	0.999869
1.041793	1.008336	0.988934	1.013406	1.007718	1.012554	1.00921	1.052665	0.995617	1.017101
1.01909	1.018558	1.021985	1.034078	1.020354	1.019471	1.007462	1.05197	1.021736	1.030334
1.03199	1.022985	1.027671	1.028866	1.021217	1.019669	1.026646	1.068583	1.023124	1.016145
1.010838	1.018252	1.027662	0.999794	1.040412	1.04723	1.009975	1.03123	1.019488	1.073767
0.991644	1.001814	1.058251	1.021101	1.036838	1.045424	1.031514	1.045936	1.015338	1.091802
1.0312	0.977159	0.997804	0.964127	1.034039	1.042087	1.053466	1.061269	1.012831	1.044045
1.042124	0.948703	0.963502	0.920304	1.039816	1.056607	1.086846	1.088289	0.994396	0.978616
1.026667	0.97268	0.983495	0.942694	1.058972	1.079136	1.099087	1.089809	1.004358	0.972569
1.0073	1.00579	1.016774	0.983794	1.066011	1.083173	1.099046	1.085988	1.019979	0.994143
1.038566	1.036065	1.127407	1.056816	1.094716	1.115591	1.10443	1.089655	1.038099	1.072817
1.06946	1.065433	1.099454	1.041467	1.099504	1.120152	1.104614	1.090271	1.04361	1.055132
1.075761	1.052877	1.133727	1.067496	1.094144	1.120763	1.114692	1.099613	1.021319	1.070495
1.062717	1.046837	1.004217	0.970727	1.072957	1.093755	1.116578	1.107394	1.016477	0.94874
1.029831	1.04497	1.084515	1.042294	1.079876	1.102038	1.096202	1.09633	1.019529	1.017177
0.995289	1.04472	1.112137	1.057256	1.092548	1.114781	1.105979	1.118734	1.031999	1.004238
1.025257	1.054375	1.160254	1.075252	1.087867	1.104775	1.099578	1.146439	1.042434	1.086022
1.063043	1.061192	1.191844	1.098122	1.112451	1.132661	1.096883	1.155686	1.057562	1.154502
1.055992	1.050316	1.004964	0.963522	1.076398	1.089433	1.102087	1.169062	1.043383	0.972958
1.040312	1.062255	1.075386	1.031407	1.092682	1.099915	1.08351	1.152934	1.075895	1.071188
1.04378	1.062665	1.087169	1.022389	1.098404	1.106835	1.106278	1.160027	1.078034	1.068711
1.054457	1.072378	1.179729	1.092483	1.125684	1.138198	1.114467	1.170984	1.093668	1.175573
1.056864	1.084301	1.203196	1.104538	1.14268	1.159941	1.133703	1.196415	1.097662	1.171739
1.124987	1.082617	1.091298	0.993753	1.137251	1.163161	1.168341	1.241228	1.065567	1.012798
1.099141	1.08528	1.099779	1.008502	1.140923	1.162585	1.149968	1.239277	1.081434	1.043406
1.070756	1.086397	1.183966	1.070732	1.146223	1.163352	1.13549	1.234525	1.100936	1.131835
1.090118	1.085332	1.170325	1.066281	1.140657	1.156306	1.137306	1.247387	1.099778	1.138039
1.066436	1.085144	1.187673	1.088578	1.138686	1.151523	1.133771	1.254398	1.105975	1.178971
1.062506	1.084953	1.111306	1.031585	1.159144	1.17867	1.101084	1.235751	1.106578	1.130782
1.046591	1.082081	1.205157	1.113425	1.144475	1.170666	1.101081	1.243723	1.075121	1.093772
1.115312	1.092744	1.13595	1.05474	1.130639	1.160052	1.170996	1.32835	1.049144	1.03366
1.09787	1.106271	1.18275	1.0765	1.129117	1.157682	1.1791	1.340389	1.048154	1.007289
1.099191	1.115741	1.192874	1.100082	1.129037	1.144256	1.16858	1.290872	1.08817	1.013042
1.04406	1.141003	1.219883	1.127852	1.143255	1.145274	1.17348	1.25298	1.142294	1.056573
1.035808	1.139494	1.253891	1.114991	1.151798	1.149128	1.187394	1.208772	1.165057	1.079795
1.054149	1.069048	1.147129	1.055009	1.131755	1.125937	1.163524	1.184945	1.154156	1.063459
1.057302	1.082145	1.150652	1.071527	1.13136	1.121056	1.161811	1.162515	1.167245	1.076972
1.066111	1.087138	1.13699	1.082684	1.145528	1.133817	1.179468	1.152547	1.185643	1.09382
1.066324	1.09245	1.126507	1.093256	1.153125	1.141357	1.191758	1.138236	1.1934	1.098971
1.069119	1.095166	1.119319	1.099216	1.154387	1.143461	1.193257	1.141006	1.191871	1.094764
1.077786	1.101392	1.116169	1.108498	1.157088	1.148	1.197503	1.146036	1.18897	1.091911
1.090137	1.105891	1.114773	1.114901	1.160566	1.152879	1.201851	1.152532	1.188145	1.09074
1.100128	1.112746	1.114689	1.124037	1.166006	1.158586	1.207248	1.159522	1.192718	1.094632
1.10973	1.118515	1.113987	1.131926	1.170739	1.163559	1.21152	1.167118	1.196671	1.098037
1.120271	1.122612	1.119109	1.135689	1.174325	1.168171	1.21532	1.174372	1.19717	1.098806

1.127277	1.128	1.121924	1.141899	1.178937	1.173056	1.219509	1.18184	1.200907	1.102502
1.134386	1.133144	1.124474	1.147875	1.183248	1.177531	1.22328	1.188937	1.204691	1.106193
1.141544	1.138233	1.127449	1.153627	1.188139	1.182636	1.227694	1.19663	1.208926	1.11033
1.147507	1.143113	1.128452	1.159717	1.193514	1.188298	1.232674	1.20488	1.213418	1.116426
1.15353	1.147777	1.129021	1.16565	1.198893	1.194093	1.237781	1.213288	1.217541	1.122165
1.159495	1.152158	1.129389	1.171267	1.203685	1.199112	1.242091	1.220961	1.221634	1.127893
1.165494	1.156621	1.130149	1.176861	1.208651	1.204446	1.246712	1.228991	1.22549	1.133465
1.171714	1.161626	1.131421	1.183011	1.214178	1.210291	1.251836	1.237536	1.230075	1.139779
1.178219	1.166681	1.132292	1.189355	1.219078	1.215577	1.256351	1.245576	1.233822	1.145275
1.184389	1.171498	1.132831	1.195494	1.223394	1.220218	1.260201	1.252997	1.237163	1.150347
1.191095	1.176234	1.133335	1.201526	1.227666	1.22482	1.263998	1.260384	1.240452	1.155415

Implicit Pri	Implicit Pri	Net Export	Gross Fixe	Gross Fixe	Permanen	Transitory	Multiple H	Single Hou	Gross Fixe
RPMPSO	RPYFDDC	RXNETO	RINNRGB	RINRGBO	RYHPERM	RYHTRAN	RKHMO	RKHSO	RIBRNO

0.431419	0.454343	4813	4744.327	928.1122	180088	11947.9	2787.468
0.502007	0.44509	7858	4480.556	1176.216	180967.3	4134.76	3372.87
0.508839	0.437197	9428	4325.139	1372.099	181858.5	-2400.07	3582.996
0.521239	0.427286	10089	4401.21	1516.008	182777.8	-7389.57	2970.315
0.513927	0.452557	11317	4161.9	1608.058	183738.8	117.8071	2826.958
0.537483	0.471898	12950	3858.16	1648.417	184747.8	-319.145	2517.002
0.57382	0.489813	13826	3984.006	1637.047	185811.2	2557.369	2420.102
0.519339	0.515389	14311	4218.375	1573.867	186935.1	-1101.3	2791.075
0.529153	0.508359	13959	4128.102	1209.172	188128.2	-4974.28	3504.041
0.551097	0.513629	13751	3980.534	1141.347	189398	-6295.34	4070.039
0.568412	0.509013	13494	3729.538	1121.458	190747	2648.9	3811.178
0.598093	0.512896	13368	3867.136	1149.58	192171.6	-872.745	3732.282
0.576235	0.524593	13791	4162.578	1369.055	193670.7	-6585.55	4042.468
0.576082	0.530668	14011	4463.154	1435.519	195242.4	-475.855	4210.336
0.607322	0.53528	14187	4696.157	1492.495	196878	306.6481	4345.993
0.555662	0.545496	14120	4829.594	1540.004	198568.7	1094.468	4184.554
0.570001	0.548025	13158	4952.634	1602.003	200305.6	-1616.07	3998.388
0.601908	0.55432	13125	5166.927	1621.091	202081.3	3810.125	4763.243
0.600069	0.557584	13403	5395.611	1621.165	203886.4	1786.351	5538.166
0.589039	0.561443	14157	5538.689	1602.221	205715.5	1002.282	6298.456

0.617824	0.568514	14719	6075.83	1480.959	207565.1	-1112.94			6501.069
0.568587	0.576237	15807	6566.895	1457.308	209432.6	52.92873			6809.611
0.600866	0.58396	16779	6815.526	1447.961	211314.1	-2875.53			7448.43
0.593479	0.590794	16298	6987.727	1452.918	213205.9	-5155.26			8352.511
0.573565	0.596619	16622	7423.971	1471.04	215101.6	-1164.29			9621.773
0.581462	0.605965	16199	7792.738	1505.053	216989.5	-5473.2			10870.93
0.605946	0.612817	16099	8118.469	1553.863	218856.5	622.4648			11450.37
0.662187	0.62154	15544	8550.154	1617.48	220684.5	-686.763			11230.75
0.637568	0.626298	16115	8774.447	1726.292	222455.6	-3038.22			10725.04
0.603283	0.633749	14980	9048.597	1807.321	224151.5	-396.351			10678.45
0.598487	0.639398	15008	9368.249	1890.989	225750.6	3930.569			11346.2
0.611765	0.648431	15426	9593.413	1977.286	227231.2	7100.271			12220.29
0.655857	0.655665	15786	9852.452	2149.823	228575.3	8592.91			13901.84
0.647775	0.666027	16024	10171.23	2207.798	229772.1	10258.4			14195.51
0.624078	0.67272	16728	10501.98	2234.936	230819.4	2297.001			13230.03
0.653802	0.676398	17003	10767.69	2231.262	231725.2	2807.956			12750.69
0.665465	0.687354	17498	10275.27	1994.033	232499.8	6638.426	1540.802	2183.629	13162.82
0.666375	0.688205	18867	9970.434	2009.898	233156.4	-3456.47	1551.007	2194.901	11202.73
0.654398	0.691749	19070	9508.015	2076.041	233714.7	89.02657	1561.232	2205.204	9043.915
0.650189	0.69248	19469	8951.037	2192.46	234191.1	324.4736	1571.479	2214.537	7823.204
0.659268	0.70407	18278	8505.237	2560.905	234601.9	623.2264	1580.793	2219.74	7372.185
0.662406	0.709305	18622	8261.274	2697.223	234964	-5585.41	1591.462	2228.401	6354.097
0.704012	0.715778	18583	8026.751	2803.184	235294.6	-4251.78	1602.532	2237.357	7932.793
0.673789	0.714956	13717	7719.654	2878.821	235605.5	-1481.18	1614.004	2246.61	8103.787
0.637757	0.720477	13794	7603.82	3027.132	235904.3	-2107.08	1630.12	2257.423	7877.7
0.646541	0.720366	14658	6740.764	3001.256	236197	-525.139	1640.698	2266.763	8113.151
0.645497	0.719989	13351	6086.334	2903.752	236487.5	4497.537	1649.981	2275.892	8215.266
0.653654	0.717668	14725	5458.619	2734.655	236779.2	712.9769	1657.968	2284.813	7632.777
0.661607	0.72138	15170	5717.972	2250.723	237080	-1615.7	1660.792	2292.854	7433.64
0.667281	0.729121	15844	5769.133	2036.803	237398.6	7819.83	1667.735	2301.623	6758.637
0.641631	0.737492	16212	5678.605	1850.479	237741.9	-1132.86	1674.929	2310.451	6510.639
0.64332	0.743723	21390	5725.105	1688.931	238124.7	-4886.05	1682.375	2319.338	6557.616
0.582694	0.741825	18776	5411.048	1542.963	238560.8	-1905.72	1691.678	2329.786	7131.521
0.67027	0.741226	20834	5397.215	1434.335	239058.9	962.616	1698.983	2338.188	7800.41
0.663824	0.743087	23587	5462.822	1354.146	239626	-216.711	1705.897	2346.048	8154.984
0.752328	0.744029	25451	5290.781	1302.464	240269.8	2314.105	1712.42	2353.366	7895.418
0.791757	0.748101	27840	5478.896	1318.373	240998.1	1248.164	1717.468	2359.281	7114.16
0.687242	0.749641	25076	5414.096	1308.166	241820.8	325.6625	1723.642	2365.857	6155.722
0.62687	0.751306	28383	5505.244	1310.886	242749	-1321.86	1729.857	2372.235	5527.419
0.637903	0.754603	37926	5650.339	1326.536	243794.4	292.546	1736.115	2378.415	5974.738
0.693509	0.752807	34745	6174.261	1433.479	244967.1	-2372.01	1743.338	2382.914	6053.017
0.675019	0.756695	41267	6833.902	1443.662	246277.7	-5100.16	1748.773	2389.387	6486.091
0.727396	0.759749	37731	7296.145	1435.42	247734.1	-5367.3	1754.059	2396.224	7247.255
0.660843	0.762997	25137	7849.012	1408.721	249339.6	-4689.82	1759.195	2403.423	7158.55
0.691505	0.768474	28834	8225.856	1270.919	251091.7	-4901.52	1764.3	2411.981	8044.358
0.694677	0.770507	25206	8450.654	1244.191	252983.4	-5579.72	1769.09	2419.507	8769.493
0.717414	0.767919	31130	8513.991	1236.041	255002.8	-712.389	1773.683	2426.998	8875.444
0.734537	0.770231	28314	8515.429	1246.49	257132.4	1236.527	1778.079	2434.454	9064.253
0.739703	0.776478	31067	8591.371	1342.747	259353.9	-661.009	1780.716	2440.88	8748.174
0.70331	0.780659	30786	8706.5	1363.526	261650.3	-1237.18	1785.343	2448.663	8709.998
0.682175	0.785957	35040	8622.02	1376.028	264004.1	-5.69301	1790.397	2456.807	8573.595

0.761475	0.786661	36274	8925.929	1380.25	266396.3	3069.55	1795.88	2465.314	9157.139
0.734489	0.788411	41531	9345.529	1408.975	268808	-264.103	1802.239	2474.937	9734.571
0.683103	0.791817	39185	9831.275	1383.52	271223.4	181.4723	1808.397	2483.867	10530.76
0.737049	0.79461	44792	10389.48	1336.666	273626.5	-464.477	1814.803	2492.857	11362.78
0.77788	0.793215	43780	11028.2	1268.43	276001.3	1658.645	1821.457	2501.908	11337.7
0.683176	0.798772	45483	10872.38	1016.614	278331.4	3970.792	1828.359	2511.019	11024.83
0.723959	0.809811	46338	10060.82	970.6223	280602.2	4078.881	1835.509	2520.191	11874.22
0.755651	0.815287	43983	9101.228	968.1605	282802.8	4580.26	1842.907	2529.424	12110.25
0.837579	0.820269	44880	8517.571	1009.214	284926.7	2755.466	1850.553	2538.717	12308.44
0.881142	0.821584	47621	9005.459	1226.283	286971.8	8281.988	1857.166	2546.481	12601.99
0.842018	0.827439	46693	9509.435	1301.332	288938.7	-3036.58	1864.233	2554.008	12767.55
0.704631	0.830731	48650	9658.114	1366.872	290836.4	1196.516	1874.118	2562.616	12402.14
0.64059	0.832634	46512	9612.505	1422.898	292670.8	3465.209	1882.155	2570.821	13271.48
0.67433	0.828987	49982	9718.312	1455.216	294449.1	4989.205	1892.223	2579.131	14397.5
0.744774	0.839656	45909	9755.296	1497.854	296181.8	757.41	1901.13	2587.905	15407.21
0.830813	0.852248	50148	9770.11	1536.656	297884.4	-627.837	1911.198	2597.651	15952.49
0.861781	0.860816	44870	9793.742	1571.635	299573.4	-1826.2	1922.026	2607.319	16121.04
0.930293	0.863365	42711	9900.452	1645.811	301264.4	1080.967	1929.079	2616.253	15374.09
0.734866	0.855093	38204	9659.32	1655.969	302971.3	768.0169	1938.671	2625.274	15449.37
0.724967	0.86424	41246	9644.216	1645.112	304709	-3480.68	1947.119	2633.702	16319.51
0.754752	0.855838	38511	9640.763	1613.23	306493.3	-1875.06	1956.416	2642.691	16703.23
0.71938	0.864243	39897	10126.73	1457.827	308336.5	-267.594	1963.07	2651.785	17088.5
0.868649	0.872926	46133	10470.11	1424.852	310248.8	995.3688	1974.391	2660.265	18016.79
0.851448	0.876273	38620	10760.53	1411.82	312240.4	169.8065	1983.204	2669.342	17863.9
0.747376	0.881154	33734	11004.36	1418.729	314322.3	-3368.65	1992.264	2678.347	18060
0.764203	0.882972	32160	11489.46	1262.904	316506	-3798.74	2003.578	2687.33	17607.68
0.784859	0.889981	30595	11212.5	1382.754	318799.2	-5247.28	2011.321	2694.896	18058.89
0.812444	0.892595	34454	10941.47	1595.649	321206	-8226.72	2022.028	2702.319	17746.74
0.87882	0.894175	36495	10983.29	1901.588	323725.3	-5815.61	2032.433	2709.173	16997.52
0.784111	0.897878	33871	10959.21	2702.226	326347.7	1858.299	2044.533	2716.356	18128.46
0.805384	0.903354	27287	11299.11	3034.446	329058.1	-5796.96	2053.582	2723.557	17893.88
0.832924	0.905096	24162	11685.79	3296.849	331843.1	-288.749	2063.714	2730.08	17426.35
0.861616	0.906743	24892	12096.98	3490.971	334683.5	4071.08	2070.584	2736.286	17028.24
0.963924	0.919566	26823	12030.61	3547.697	337560	799.7696	2078.221	2742.467	17858.81
0.940055	0.925694	34229	12513.38	3632.92	340457.1	-4693.9	2084.487	2747.679	17986.54
0.876407	0.918416	22628	13057.29	3677.533	343360.5	2347.972	2092.204	2753.117	18453.79
0.827146	0.917814	21021	13114.77	3681.536	346250.7	3423.705	2101.56	2758.997	18555.42
0.791111	0.919897	17733	13734.58	3557.203	349111	6689.517	2109.343	2763.706	18389.47
0.977743	0.933826	9309	13580.21	3515.035	351927.8	-873.317	2119.327	2768.961	18648.91
1.104244	0.950849	2059	12875.18	3467.409	354694.4	-6234.08	2126.928	2774.525	18541
0.921155	0.957509	-8576	11889.9	3414.553	357403.1	-3639.91	2137.167	2780.045	18161.01
0.853803	0.95555	2174	11923.53	3287.514	360040	3644.732	2146.117	2784.723	15304.82
0.828566	0.949943	1606	11784.97	3250.952	362587.6	-95.9316	2155.941	2788.349	14589.98
0.977579	0.945185	-2203	12342.75	3236.47	365032.1	2644.332	2162.1	2790.981	14571.53
1.123348	0.947788	825	13218.85	3241.962	367359.4	5169.789	2171.603	2793.549	16445.5
1.009548	0.950904	-1930	13152.09	3242.826	369558.2	4714.569	2177.887	2796.016	17806.55
0.982033	0.955199	-2613	12713.38	3306.833	371622.3	12863.75	2187.454	2799.818	17849.96
0.953886	0.963601	-6360	12618.18	3405.763	373550.3	1214.29	2199.424	2803.312	17432.18
0.927663	0.971704	6662	12561.98	3542.692	375353.6	5527.286	2208.671	2806.529	17094.53
0.937709	0.97862	10	14088.41	3962.511	377044.9	6410.456	2218.73	2809.37	17821.85
0.958933	0.980856	-8537	15138.17	4072.242	378642.2	-2947.63	2229.36	2811.767	18941.66

1.010304	0.987869	-1771	16947.38	4118.953	380170.2	-2805.47	2239.86	2814.302	20434.18
1.075062	0.994263	-3969	18640.98	4102.637	381650.4	-1561.27	2248.172	2816.559	20142.49
1.053424	0.997979	-5246	17930.28	3735.799	383101.8	-1132.54	2257.884	2819.048	21775.45
1.039265	0.999572	1673	18559.99	3708.38	384541.4	-4379.38	2265.516	2821.442	22545.39
0.975063	1.000727	7005	18769.09	3732.917	385985.6	-3314.17	2274.954	2824.372	22797.16
0.940261	1.001723	7263	19232.35	3809.417	387445.9	-1572.34	2285.434	2827.258	23346.85
0.994601	1.012613	6284	18232.01	3938.604	388930.8	750.6337	2293.778	2830.109	22099.09
1.004486	1.012353	8853	17693.66	4118.758	390447.2	236.2291	2308.065	2831.643	22243.71
1.007763	1.018564	4752	17298.79	4350.603	392002.7	-96.3512	2317.433	2834.116	20798.34
0.981891	1.021303	4820	16674.68	4634.146	393605.1	5068.359	2329.262	2829.775	21003.19
0.99368	1.031749	1561	17692	5215.989	395262.1	-95.0421	2337.005	2831.282	20183.53
1.00452	1.037699	-2810	18810.4	5504.319	396986.6	-4600.65	2347.155	2833.024	20480.39
0.963513	1.042333	2284	19929.02	5745.691	398791.3	-2347.14	2357.041	2834.84	21192.81
0.913874	1.045012	-8180	21023.15	5940.066	400684.3	-2135.8	2367.551	2837.018	21027.08
0.956969	1.048016	-11313	21273.82	6253.906	402671.4	-1488.14	2391.534	2838.608	21671.99
0.994242	1.051976	-6824	21901.09	6287.322	404756.2	4732.685	2405.268	2839.028	22512.89
1.086336	1.06106	6348	22506.29	6207.038	406940.8	4484.337	2417.262	2839.646	24367.28
1.0777	1.065395	11225	22760.34	6013.122	409232.1	7674.452	2430.871	2840.85	24451.62
1.100134	1.068357	13125	22027.36	5308.124	411641.6	815.1525	2442.509	2842.532	25478.04
0.975513	1.065695	4114	21140.67	5046.092	414188.1	-5066.09	2452.296	2843.7	26549.48
1.041821	1.06897	7338	21403.33	4829.873	416891.7	-3669.84	2466.665	2844.784	27664.39
1.020142	1.078029	5855	20594.36	4659.868	419767	-4054.42	2480.061	2846.592	28016.41
1.072747	1.084485	-1071	21490.95	4555.735	422825.1	-4110.97	2493.273	2848.909	30713.7
1.129012	1.088025	-1772	21974.63	4472.337	426073.2	-3121.81	2506.95	2851.361	28885.08
0.944012	1.084876	-11147	22889.62	4427.541	429514.2	1487.872	2521.289	2854.268	28987.39
1.033333	1.092641	-9174	23132.43	4420.497	433148	4065.744	2535.328	2856.308	29671.5
1.03115	1.096999	-13976	1E+15	4435.778	436975.7	9576.336	2549.307	2856.815	29713.94
1.130557	1.100645	-10058	1E+15	4448.374	441002.9	-578.135	2566.821	2859.251	28420.58
1.123714	1.108108	-8361	1E+15	4466.15	445244.4	-11710.2	2582.531	2861.197	26608.11
0.968999	1.111711	-9517	1E+15	4484.039	449714.7	-14502.1	2599.274	2863.92	26476.16
0.987975	1.113837	-13215	1E+15	4641.582	454416.4	-13233.4	2611.172	2866.592	24836.08
1.073769	1.124683	-2694	1E+15	4609.514	459337.7	-10885.9	2625.36	2868.774	26552.68
1.085868	1.129402	1129	1E+15	4516.432	464453.6	-8732.9	2640.83	2870.107	28144.31
1.135787	1.136268	-3480	1E+15	4363.365	469728	-3452.65	2654.131	2871.954	28336.65
1.124632	1.140786	-5183	1E+15	5356.953	475116.3	-6400.93	2668.232	2877.501	29105.17
1.099298	1.13841	13402	1E+15	4540.325	480570.4	42992.13	2683.454	2883.427	30196.61
1.046234	1.146119	12647	1E+15	4412.372	486035.7	11873.91	2698.1	2889.32	33637.53
1.02316	1.154156	12722	1E+15	4162.672	491500.6	-328.302	2712.797	2895.119	1.397213
1.090583	1.17341	17393	28821.91	4592.09	497119.3	7117.578	2728.313	2897.76	42897.78
1.13011	1.182623	7349.126	30397.6	4737.4	504347.4	508.2717	2745.812	2900.667	46172.09
1.152033	1.19321	11658.72	31608.09	4702.913	501486.4	7771.293	2758.896	2904.133	45154.09
1.149409	1.197591	13939.96	26109.27	4983.402	500772.6	-6432.21	2776.793	2907.81	46597.2
1.161447	1.201136	15982.27	27103.15	4861.293	499910.1	-13050.3	2796.224	2911.685	45304.52
1.181864	1.202794	12249.17	27456.04	4880.412	496658.6	-8679.1	2815.011	2915.907	44057.07
1.194024	1.205027	9083.693	27632.91	4910.422	493961.7	-2590.6	2833.728	2919.932	43174.01
1.197449	1.207555	9548.085	27840.63	4959.164	491102.4	3858.661	2852.441	2923.775	41614.02
1.195729	1.211014	11949.19	28139.61	5008.876	491440.5	4590.558	2870.924	2927.482	40832.7
1.196252	1.214903	13387.36	28455.63	5029.734	494183	6389.199	2889.197	2931.111	41153.35
1.201794	1.219058	15093.31	28625.65	5065.24	497501.3	7069.817	2907.39	2934.674	41302.01
1.206564	1.223638	15955.5	28917.05	5104.553	500849	7260.614	2925.602	2938.183	41421.27
1.207291	1.22863	16226.43	29170.28	5151.948	503950.5	6518.172	2943.858	2941.629	41534.23

1.211361	1.233935	17701.77	29617.12	5174.566	507509.6	6316.571	2962.169	2945.014	41542.85
1.215383	1.239237	19012	30051.84	5224.879	510804	6240.432	2980.535	2948.337	41376.18
1.219791	1.244623	19808.36	30479.98	5265.895	513933.8	6286.29	2998.959	2951.598	41165.51
1.222754	1.250135	20391.63	30947.93	5286.73	516789.3	5597.769	3017.436	2954.794	41180.03
1.225361	1.255691	21002.31	31465.83	5315.96	519695.6	5304.852	3035.959	2957.925	41218.76
1.227904	1.261055	21813.76	32005.53	5351.428	522524.2	5444.599	3054.539	2960.998	41206.81
1.230134	1.26662	22756.08	32503.68	5393.132	525276.3	5528.735	3073.187	2964.016	41180.52
1.232971	1.272182	22815.29	32608.77	5439.465	527819.3	5115.947	3091.899	2966.985	41580.17
1.23508	1.277911	23537.46	33090.94	5487.791	530536.2	5435.352	3110.669	2969.916	41965.94
1.236856	1.283581	24502.45	33517.45	5537.82	533348	5711.326	3129.485	2972.813	42338
1.23851	1.289231	25468.01	33829.89	5589.639	536176.7	5935.449	3148.34	2975.683	42696.41

Gross Fixe Gross Fixed Capital Formation: Business Residential Construction - Ownership Transfer Cost, Ont
RIBRRO RIBROO

3506.982	474.55
3360.263	770.8678
3704.297	566.7076
3999.949	438.7357
3358.765	467.2778
3194.068	344.9298
3429.672	440.2255
3190.406	731.5194
3210.972	673.9873
3451.231	662.7299
4441.28	635.5427
4429.811	604.9065
4218.895	614.6368
3749.237	736.4267
4448.346	688.6607
4700.347	768.099
5037.897	702.7143
4310.979	735.7781
4470.668	887.1665
4654.761	949.7834

4728.416	819.5148
4757.15	1054.239
5336.351	1180.219
5129.39	1168.099
4855.771	1876.456
4627.124	1606.948
5726.043	1725.585
6381.928	1686.326
7056.78	1516.177
6161.766	2138.787
6824.601	2219.201
6541.063	2292.648
6762.803	3104.359
5652.078	2232.415
7416.154	2546.818
8180.317	2958.994
7207.78	2337.404
5401.891	1493.38
6340.582	1670.503
5322.919	1411.877
5610.122	1578.693
7093.514	2069.389
6819.57	1607.637
5895.322	1410.891
5175.758	1627.542
5654.059	1537.79
6750.22	1647.514
7575.866	1461.356
6257.744	1047.616
6754.423	1064.94
6691.746	1143.615
7007.763	1002.621
6831.767	1188.713
6785.568	1052.022
6211.566	911.4501
6208.15	984.432
5974.491	773.3489
6243.974	895.3037
6283.025	1108.556
6044.007	765.2548
5955.06	1029.922
6357.334	1058.575
6526.905	1138.841
7191.918	1672.532
7166.143	1306.499
6965.639	1233.868
6923.068	1305.489
7150.665	1211.082
7264.387	1247.44
6959.612	1272.39
7013.646	1210.759

6875.76	1223.1
7056.168	1431.261
7532.961	1706.279
7266.128	1584.094
7338.812	1653.487
7946.702	1756.467
7212.268	1645.514
7811.415	2002.331
9061.643	1722.921
9457.15	1623.859
9015.27	1906.181
9998.609	2163.256
10780.09	2108.422
9849.249	2576.256
10327.97	2199.816
10627.89	2026.619
11129.97	2168.988
11172.49	2014.414
11712	1928.636
11888.48	2177.01
13194.88	2257.888
12581.33	1972.173
12379.26	2540.945
14713.82	2204.279
14421.64	2257.357
14717.3	2575.024
15004.76	2454.347
15432.47	2884.794
15768.06	2828.423
16758.38	2878.167
16527.4	2665.717
16854.54	2575.108
18082.75	2445.009
18425.05	3019.141
18762.28	2944.177
19403.12	3144.088
21175.4	3171.178
19859.74	3101.797
20281.61	2913.481
19569.38	2578.62
16778.63	1817.359
18415.12	1881.062
19369.1	2650.918
20857.03	2710.434
22549.01	3451.493
22779.72	3105.733
22093.48	3279.557
20758.46	3682.354
20733.38	3835.09
20138.03	4570.115
21652.38	3976.964

23094.61	4279.208
24851.86	4015.656
24447.09	4988.463
23349	4107.605
22424.05	3797.794
22514.12	4307.028
24645.64	3753.268
24161.02	4064.269
24997.67	4229.989
24406.76	4413.046
25591.42	3670.044
26976.05	4716.564
27801.84	4977.346
28156.25	5142.671
27730.64	6828.368
28103.67	7657.444
26949.78	8112.942
26586.74	10026.65
23548.66	15186.29
27997.13	10884.39
29883	9966.605
31053.47	10844.11
35952.3	11019.01
30259.59	12017.33
28277.45	10874.16
28127.74	11675.76
28043.96	11715.1
31621.95	9532.468
33922.79	11329.09
33748.36	9927.479
34279.47	8693.449
32240.6	10678.72
33774.25	13061.44
34733.26	12901.09
35064.27	12431.55
23230.35	9786.042
39335.53	18167.94
73576.21	22887.4
42049.51	31519.71
48956.94	20122.96
42972.95	16162.17
43946.81	17015.14
44636.86	16971.98
44989.04	16826.2
45291.47	16542.74
45623.56	16229.55
45907.61	15617.44
46557.57	15179.92
47194.3	14805.1
47776.68	14503.98
48357.89	14356.17

48914.67	14401.87
49355.16	14458.4
49782.03	14536.09
50233.27	14619.42
50673.23	14700.63
51072.41	14776.18
51496.9	14846.25
52336.45	15045.39
53183.64	15256.8
54039.17	15469.41
54902.63	15682.08

tario (Millions $)

CONSENSUS FORECASTS BY CONSENSUS ECONOMICS

Attachment has been filed confidentially with the OEB in accordance with the *Practice Direction on Confidential Filings*.

UNIVERSITY OF TORONTO

Attachment has been filed confidentially with the OEB in accordance with the *Practice Direction on Confidential Filings*.

THE CENTRE FOR SPATIAL ECONOMICS

Attachment has been filed confidentially with the OEB in accordance with the *Practice Direction on Confidential Filings*.

O - SCHOOL ENERGY COALITION INTERROGATORY - 245

Reference:

Exhibit O-1-1, Page 2

Interrogatory:

Hydro One states that its investment plans "used a 2% Ontario Consumer Price Index (CPI) assumption for all forecast years." Please provide a reference in the existing evidence, or some other document, where it is shown that the inflation included in the Hydro One investments plan was based on Ontario CPI.

Response:

Please refer to Exhibit B-01-01, SPF Section 1.7, page 9, line 18.

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O - SCHOOL ENERGY COALITION INTERROGATORY - 246

Reference:

Exhibit O-1-1, Page 3

Interrogatory:

Hydro One states the updated Scotiabank inflation forecasts show that inflation will reach 6.3% in 2022 and 3.3% in 2023. Please provide an updated annual revenue requirement for each of transmission and distribution based on these updated forecasts.

Response:

Please see table below for the annual revenue requirements for each of Transmission and Distribution based on the updated forecasts noted in this interrogatory:

Total Revenue Requirement ($M)	**2023**	**2024**	**2025**	**2026**	**2027**
Transmission					
Revenue Requirement - SEC 246 IR	1,858.3	1,978.7	2,075.3	2,197.0	2,283.1
Revenue Requirement - Inflation Update	1,849.3	1,968.2	2,063.0	2,182.5	2,266.6
Change	**9.0**	**10.5**	**12.3**	**14.6**	**16.4**
Distribution					
Revenue Requirement - SEC 246 IR	1,681.7	1,767.9	1,848.5	1,953.4	2,045.3
Revenue Requirement - Inflation Update	1,669.1	1,753.3	1,832.2	1,934.8	2,024.6
Change	**12.7**	**14.5**	**16.3**	**18.6**	**20.6**

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O - SCHOOL ENERGY COALITION INTERROGATORY - 247

Reference:

Exhibit O-1-1, Page 5

Interrogatory:

With respect to the updated load forecast:

a) Please confirm that the IESO 2021 APO included a forecast 2023 to 2027 net energy demand that was higher than that forecast in the 2020 APO.

b) Please provide the difference in forecast net energy demand between the two APOs.

c) Please confirm that Hydro One has not proposed any changes to its load forecast to reflect the IESO higher forecast provincial demand.

Response:

a) Yes, the net annual energy demand forecast in APO 2021 is higher than that in APO 2020.

b) The following table provides the comparison of 2023-2027 net annual energy demand (TWh) forecast in APO2021 and APO2020.

	2023	2024	2025	2026	2027
APO2021	147	150	152	155	156
APO2020-Scenario 1	145	147	149	151	153
APO2020-Scenario 2	140	142	144	145	147

c) For details regarding changes in Hydro One load forecast update compared to the original forecast, please see response to CME-023, part c). For transmission, it is peak forecast that is relevant as opposed to energy. The IESO does not have comparable figures in this regard. As detailed in Exhibit D-4-1 Appendix F, after correcting for the definitional difference between the IESO and the Hydro One peak forecast, Hydro One's forecast is much higher compared to the IESO. For distribution, the IESO does not have a comparable forecast. With respect to the distribution forecast, Hydro One's direct customer (i.e. sub-transmission) load was increased in the evidence update compared to the original forecast as detailed in response to CME-023, part c).

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O - SCHOOL ENERGY COALITION INTERROGATORY - 248

Reference:

Exhibit O-1-2, Page 6, 7

Interrogatory:

Hydro One discussed the significant price escalation in material and services, especially that of steel, copper, aluminum and transportation. Please provide further details regarding Hydro One's strategy to actively manage these commodity related cost increases.

Response:

In addition to the provisions in long-term contracts provided in O-01-02 (i.e. Price Adjustment Frequency and Defined Formula & Industry References),[1] the measures Hydro One has taken to manage the risk of market price changes, include:

- Negotiating long-term supply agreements to lock in supplier capacity and buffer Hydro One against volatile market price fluctuations. Long-term supply agreements are tied to indices so that as indices decrease, prices paid under contract will follow in the next scheduled adjustment period.
- Build and maintain strategic supplier relationships that keep Hydro One at the forefront of production queues and a preferred customer for suppliers.
- Leveraging industry leading approaches to manage supply chain disruptions.
- Engaging in group purchasing consortiums to increase buying power.
- Earlier ordering for future work program needs by Business Units to provide better visibility to suppliers about upcoming requirements.

In the short-term, the contract provisions and the measures listed above help Hydro One manage commodity fluctuation risks that can occur in volatile markets, and to ensure that supplier prices align with broader commodity market indices. However, they cannot ultimately shelter HONI from the significant inflationary pressures that have been described in the updated evidence, as over time, Hydro One's costs are necessarily affected by sustained commodity price inflation.

[1] Please refer to Exhibit O-01-02, Page 7, Lines 6-13

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O - SCHOOL ENERGY COALITION INTERROGATORY - 249

Reference:

Exhibit O-1-2

Interrogatory:

SEC understands that some Ontario electricity utilities have had significant problems sourcing and procuring in a timely fashion certain capital equipment due to supply chain challenges. Please provide Hydro One's experience sourcing necessary equipment, and how this may impact the execution of its proposed transmission and distribution capital plans. In your response, please specify which capital programs have and are forecast to be impacted by any supply chain challenges.

Response:

Hydro One is experiencing supply chain disruptions that have been impacting every utility across the industry. Supply delays have become a significant challenge in several categories, especially electronic equipment such as meters and transportation and work equipment (fleet). For additional details on how Hydro One is managing the impacts on this capital equipment, please refer to Interrogatory O-Staff-365, part d), i) and iii).

Although Hydro One has taken steps to mitigate the impact of supply issues, these measures are not sufficient to protect Hydro One from inflationary pressures. In addition to the assurance of supply strategies outlined in Exhibit E-05-02, there are several measures that Hydro One has taken to manage the risk of the global supply chain issues. Please refer to Interrogatory O-Staff-363, part b).

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O - SCHOOL ENERGY COALITION INTERROGATORY - 250

Reference:

Exhibit O-1-2, Page 7

Interrogatory:

Hydro One discusses that it manages some commodity risk through long-term contracts that often have price adjustment clauses with defined formula and industry references. For each of Hydro One's 5 most significant materials contracts (in terms of monetary value per year), please provide specific details regarding the price adjustment clauses in each of those contracts.

Response:

In alignment with the top categories spend, as provided in SEC-251, the top five material contracts within these categories are as follows.

Category	Contract Description	Contract Price Adjustment Timing	Price Adjustment Formula Index Inputs
Transformers and Components	Power Transformers 100 MVA - 750 MVA – Highest Spend Contract in Category	Quarterly	• Copper • Core Steel • Tank Steel • Winding Insulation • Labour • CPI Transportation • EUR to CAD Foreign Exchange
Transformers and Components	Power Transformers 41.7 MVA - 125 MVA – Second Highest Spend Contract in Category	Quarterly	• Copper • Core Steel • Tank Steel • Winding Insulation • US CPI
Transformers and Components	Distribution Transformers	Annually	• Core Steel • Copper • Aluminum • Fabricated Steel • Oil • Labour • USD to CAD Foreign Exchange
Construction Materials	Wood Poles	Annually	• Whitewood • Chemical and Chemical Additive • Transportation-inbound actual costs • CAD CPI

Category	Contract Description	Contract Price Adjustment Timing	Price Adjustment Formula Index Inputs
Construction Materials	Wire and Cable	Annually	• Copper • Aluminum • Ethylene • Propylene • US Producer Price Index (PPI) • US to CAD Foreign Exchange Rate

O - SCHOOL ENERGY COALITION INTERROGATORY - 251

Reference:

Exhibit O-1-2, Page 7

Interrogatory:

Table 2 provides a list of the inflation risk for the top ten material and service categories. Please provide the annual value of each category of costs, for each of distribution and transmission.

Response:

Category	Top 10 Categories - 2021 Spend (in $M)		
	Tx	**Dx**	**Total**
Electrical T&D Construction (EPC)	204.0	34.4	238.4
Transformers and Components	85.9	34.7	120.6
Facilities Maintenance and Services	66.9	38.1	105.0
IT Services	55.2	49.5	104.7
Rentals & Operated Equipment	93.7	7.9	101.7
Construction Materials	54.8	23.5	78.3
Fleet Management	20.3	48.0	68.3
IT Software	41.1	27.1	68.3
Telecom	38.5	21.9	60.4
Construction Management Services	11.2	46.9	58.0
Total	**671.6**	**332.0**	**1003.6**

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O - SCHOOL ENERGY COALITION INTERROGATORY - 252

Reference:

Exhibit O-1-2, Page 16

Interrogatory:

Hydro One proposed a deferral account mechanism to defer recovery of the impacts of the updated evidence until 2028:

a) Please provide details regarding over what period of time Hydro One proposed to collect the deferred amounts.

b) Please provide updated cost allocation models, rate design, and bill impacts for all rate classes for both distribution and transmission, if the OEB denies the deferral proposal.

c) Please explain any changes to the proposed ESM calculations between 2023 and 2027, in light of the proposed deferral recovery mechanism, which will result in a mismatch in each year between approved costs and revenue. If Hydro One proposes any changes, please provide an illustrative example of the revised calculations.

Response:

a) Hydro One has not proposed a disposition period at this time for the amounts that would be recorded in the deferral accounts and approved by the OEB. Upon requesting disposition of the accounts in its next rebasing application, Hydro One will propose a disposition period that it considers to be appropriate at that time having regard to factors including the size of the balances to be disposed of, the potential bill impacts of disposition on customer rates, as well as regulatory efficiency.

b) **Transmission:**

Table 1 - Transmission Rates Revenue Requirement by Rate Pool ($ Million)

Year	Network	Line Connection	Transformation Connection	Total
2023	$1,046.8	$184.8	$530.3	$1,761.9
2024	$1,138.4	$200.3	$574.7	$1,913.5
2025	$1,195.8	$210.1	$602.7	$2,008.6
2026	$1,268.6	$222.5	$638.2	$2,129.3
2027	$1,319.2	$231.1	$662.8	$2,213.1

Table 2 - Average Bill Impacts on Transmission and Distribution-connected Customers

	2022	2023	2024	2025	2026	2027
Revenue Requirement ($ Millions)	1,816.2	1,849.3	1,968.2	2,063.0	2,182.5	2,266.6
Adjustments to Revenue Requirement ($ Millions) (Note 1)	67.3	-43.9	-54.7	-54.4	-53.1	-53.5
Rates Revenue Requirement ($ millions) (Note 1)	1,883.5	1,805.4	1,913.5	2,008.6	2,129.3	2,213.1
% Increase in Rates Revenue Requirement over prior year		-4.1%	6.0%	5.0%	6.0%	3.9%
% Impact of load forecast change		2.0%	0.0%	0.6%	0.6%	-0.2%
Net Impact on Average Transmission Rates (Note 2)		-2.0%	5.5%	5.1%	6.0%	3.4%
Transmission as a % of Tx-connected customer's Total Bill		7.6%	7.6%	7.6%	7.6%	7.6%
Estimated Average Bill Impact		-0.1%	0.4%	0.4%	0.5%	0.3%
Transmission as a % of Dx-connected customer's Total Bill		6.2%	6.2%	6.2%	6.2%	6.2%
Estimated Average Bill Impact		-0.1%	0.3%	0.3%	0.4%	0.2%

Note 1: *Adjustments include non-rate revenues, export revenues, disposition of regulatory accounts and low voltage switchgear credit. For purpose of estimating rate impacts, adjustments also include historical misallocated Future Tax Savings amounts being recovered in 2022 (+$87.1) and 2023 (+$43.5) per the OEB Decision in proceeding EB-2020-0194. The 2022 rates revenue requirement of $1,883.5 million was approved in EB-2021-0185 on December 16, 2021.*

Note 2: *The calculation of net impact on transmission rates accounts for Hydro One's revenue disbursement allocation factor of 91.4% as approved for 2022 UTR Revenue Requirement (EB-2022-0084 issued April 7, 2022).*

Note 3: *The Adjustments to Revenue Requirement reflects the $27.5M credit for External Revenue Variances in 2023.*

Note 4: *The Impact of load forecast change includes a 1.2% impact in 2023 due to the correction to approved 2022 load forecast charge determinants as per the OEB Decision in proceeding EB-2019-0082, dated April 23, 2020.*

Table 3 - Typical Medium Density (R1) Residential Customer Bill Impacts

	Typical R1 Residential Customer		
	400 kWh	**750 kWh**	**1,800 kWh**
Total Bill as of Jan 1, 2022[1]	$86.17	$130.55	$263.67
RTSR included in 2022 R1 Customer's Bill (Based on July 1, 2021 UTR)	$7.70	$14.45	$34.67
Estimated 2022 Monthly RTSR[2]	$8.14	$15.26	$36.63
2022 change in Monthly Bill	**$0.43**	**$0.82**	**$1.96**
2022 change as a % of total bill	*0.5%*	*0.6%*	*0.7%*
Estimated 2023 Monthly RTSR[3]	$7.98	$14.96	$35.90
2023 change in Monthly Bill	**($0.16)**	**($0.30)**	**($0.72)**
2023 change as a % of total bill	*-0.2%*	*-0.2%*	*-0.3%*
Estimated 2024 Monthly RTSR[3]	$8.42	$15.78	$37.87
2024 change in Monthly Bill	**$0.44**	**$0.82**	**$1.97**
2024 change as a % of total bill	*0.5%*	*0.6%*	*0.7%*
Estimated 2025 Monthly RTSR[3]	$8.84	$16.58	$39.79
2025 change in Monthly Bill	**$0.43**	**$0.80**	**$1.92**
2025 change as a % of total bill	*0.5%*	*0.6%*	*0.7%*
Estimated 2026 Monthly RTSR[3]	$9.37	$17.58	$42.19
2026 change in Monthly Bill	**$0.53**	**$1.00**	**$2.40**
2026 change as a % of total bill	*0.6%*	*0.8%*	*0.9%*
Estimated 2027 Monthly RTSR[3]	$9.69	$18.17	$43.61
2027 change in Monthly Bill	**$0.32**	**$0.59**	**$1.42**
2027 change as a % of total bill	*0.4%*	*0.4%*	*0.5%*

[1]Total bill including HST, based on time-of-use commodity prices effective May 1, 2021 and distribution rates effective January 1, 2022 approved per Distribution Rate Order EB-2021-0032, dated December 14, 2021(includes impacts of all components of the Fair Hydro Plan).
[2]The estimated 2022 Monthly RTSRs reflect Hydro One's 2022 TX Rates Revenue Requirement as included in 2022 Uniform Transmission Rate Schedules issued December 16, 2021 (EB-2021-0276).
[3]The impact on RTSR is assumed to be the net impact on average transmission rates, as per Table 2, adjusted for Hydro One's total revenue disbursement allocator per 2022 UTR Order (EB-2022-0082 dated April 7, 2022)

Table 4 - Typical General Service Energy less than 50 kW (GSe < 50 kW) Customer Bill Impacts

	GSe Customer Monthly Bill		
	1,000 kWh	**2,000 kWh**	**15,000 kWh**
Total Bill as of Jan 1, 2022[1]	$225.11	$416.29	$2,901.63
RTSR included in 2022 GSe Customer's Bill (Based on July 1, 2021 UTR)	$15.34	$30.69	$230.16
Estimated 2022 Monthly RTSR[2]	$16.21	$32.42	$243.16
2022 change in Monthly Bill	**$0.87**	**$1.73**	**$13.00**
2022 change as a % of total bill	*0.4%*	*0.4%*	*0.4%*
Estimated 2023 Monthly RTSR[3]	$15.89	$31.78	$238.35
2023 change in Monthly Bill	**($0.32)**	**($0.64)**	**($4.81)**
2023 change as a % of total bill	*-0.1%*	*-0.2%*	*-0.2%*
Estimated 2024 Monthly RTSR[3]	$16.76	$33.52	$251.41
2024 change in Monthly Bill	**$0.87**	**$1.74**	**$13.06**
2024 change as a % of total bill	*0.4%*	*0.4%*	*0.4%*
Estimated 2025 Monthly RTSR[3]	$17.61	$35.22	$264.15
2025 change in Monthly Bill	**$0.85**	**$1.70**	**$12.74**
2025 change as a % of total bill	*0.4%*	*0.4%*	*0.4%*
Estimated 2026 Monthly RTSR[3]	$18.67	$37.34	$280.06
2026 change in Monthly Bill	**$1.06**	**$2.12**	**$15.91**
2026 change as a % of total bill	*0.5%*	*0.5%*	*0.5%*
Estimated 2027 Monthly RTSR[3]	$19.30	$38.60	$289.50
2027 change in Monthly Bill	**$0.63**	**$1.26**	**$9.44**
2027 change as a % of total bill	*0.3%*	*0.3%*	*0.3%*

[1]Total bill including HST, based on time-of-use commodity prices effective May 1, 2021 and distribution rates effective January 1, 2022 approved per Distribution Rate Order EB-2021-0032, dated December 14, 2021(includes impacts of all components of the Fair Hydro Plan).
[2]The estimated 2022 Monthly RTSRs reflect Hydro One's 2022 TX Rates Revenue Requirement as included in 2022 Uniform Transmission Rate Schedules issued December 16, 2021 (EB-2021-0276).
[3]The impact on RTSR is assumed to be the net impact on average transmission rates, as per Table 2, adjusted for Hydro One's total revenue disbursement allocator per 2022 UTR Order (EB-2022-0082 dated April 7, 2022)

Table 5 - Forecast of Uniform Transmission Rates

Year	Network ($/kW)	Line Connection ($/kW)	Transformation Connection ($/kW)
2023	5.12	0.84	2.85
2024	5.51	0.91	3.08
2025	5.78	0.95	3.25
2026	6.13	1.02	3.46
2027	6.33	1.05	3.58

Distribution:

The 2023 cost allocation model, rate design sheets for 2023-2027, and detailed bill impact calculations for 2023-2027 are provided as Attachments 1-8 to this response. The tables below provide the summary of bill impacts.

Table 6 - 2023 Distribution and Total Bill Impacts

Rate Class	Consumption Level	Monthly Consumption (kWh)	Monthly Peak (kW)	Change in DX Bill ($)*	Change in DX Bill (%)*	Change in Total Bill ($)*	Change in Total Bill (%)*
UR	Low	340		($1.40)	-3.6%	($1.45)	-1.8%
	Typical	750		($1.56)	-4.0%	($1.77)	-1.3%
	Average	690		($1.54)	-4.0%	($1.72)	-1.4%
	High	1,260		($1.76)	-4.5%	($2.16)	-1.1%
R1 (with DRP)	Low	370		($0.29)	-0.8%	($0.38)	-0.5%
	Typical	750		($0.44)	-1.2%	($0.64)	-0.5%
	Average	784		($0.45)	-1.2%	($0.66)	-0.5%
	High	1,650		($0.80)	-2.2%	($1.25)	-0.5%
R1 (without DRP)	Low	370		$0.59	1.0%	$0.44	0.4%
	Typical	750		($1.31)	-2.0%	($1.46)	-0.9%
	Average	784		($1.48)	-2.3%	($1.63)	-1.0%
	High	1,650		($5.81)	-7.8%	($5.97)	-2.1%
R2 (with DRP)	Low	440		($0.47)	-1.3%	($0.71)	-0.8%
	Typical	750		($0.59)	-1.6%	($1.02)	-0.8%
	Average	978		($0.68)	-1.8%	($1.25)	-0.8%
	High	2,110		($1.13)	-3.1%	($2.38)	-0.8%
R2 (without DRP)	Low	440		($13.12)	-16.5%	($12.62)	-9.5%
	Typical	750		($15.64)	-18.5%	($15.18)	-8.6%
	Average	978		($17.48)	-19.8%	($17.06)	-8.1%
	High	2,110		($26.65)	-25.1%	($26.39)	-7.1%
Seasonal-UR	Low	40		($23.88)	-38.9%	($22.51)	-35.4%
	Average	369		($34.24)	-47.8%	($32.60)	-28.4%
	High	1,040		($55.38)	-59.8%	($53.16)	-24.2%
Seasonal-R1	Low	40		($1.20)	-2.0%	($1.14)	-1.8%
	Average	369		($9.79)	-13.7%	($9.24)	-8.0%
	High	1,040		($27.30)	-29.5%	($25.77)	-11.7%
Seasonal-R2	Low	40		$62.24	101.3%	$58.65	92.1%
	Average	369		$54.61	76.2%	$52.08	45.3%
	High	1,040		$39.04	42.2%	$38.70	17.6%
GSe	Low	60		($2.82)	-7.2%	($2.66)	-5.8%
	Typical	2,000		($6.12)	-3.5%	($5.76)	-1.4%
	Average	1,887		($5.93)	-3.5%	($5.58)	-1.4%
	High	5,570		($12.19)	-2.9%	($11.47)	-1.0%
UGe	Low	180		($2.60)	-7.7%	($2.39)	-4.4%
	Typical	2,000		($3.87)	-4.1%	($3.04)	-0.9%
	Average	2,494		($4.22)	-3.8%	($3.22)	-0.8%
	High	6,930		($7.32)	-2.8%	($4.80)	-0.4%
GSd	Low	9,310	55	($47.72)	-3.9%	($43.08)	-1.4%
	Average	34,334	110	($93.82)	-4.0%	($84.33)	-1.0%
	High	75,790	250	($195.60)	-3.8%	($171.73)	-0.9%

Rate Class	Consumption Level	Monthly Consumption (kWh)	Monthly Peak (kW)	Change in DX Bill ($)*	Change in DX Bill (%)*	Change in Total Bill ($)*	Change in Total Bill (%)*
UGd	**Low**	13,900	55	($39.45)	-5.3%	($31.31)	-1.0%
	Average	42,592	111	($77.19)	-5.5%	($60.45)	-0.7%
	High	97,610	280	($168.99)	-5.0%	($123.41)	-0.6%
St Lgt	**Low**	30		($0.82)	-11.2%	($0.78)	-7.4%
	Average	1,274		($5.67)	-3.7%	($5.86)	-1.9%
	High	2,310		($9.71)	-3.5%	($10.09)	-1.8%
Sen Lgt	**Low**	20		($0.77)	-11.0%	($0.74)	-8.1%
	Average	49		($1.30)	-10.6%	($1.26)	-7.2%
	High	80		($1.87)	-10.5%	($1.81)	-6.9%
USL	**Low**	100		($5.90)	-13.6%	($5.55)	-10.5%
	Average	477		($7.90)	-14.7%	($7.43)	-7.0%
	High	550		($8.29)	-14.9%	($7.80)	-6.7%
DGen	**Low**	10	0.03	($7.40)	-3.7%	($8.35)	-3.6%
	Average	1,709	12	($11.87)	-3.6%	($10.54)	-1.6%
	High	8,490	45	($25.66)	-3.7%	($18.24)	-0.8%
ST	**Low**	88,780	500	($418.52)	-18.5%	($408.97)	-2.1%
	Average	1,373,443	2,808	($2,067.88)	-33.8%	($1,977.52)	-0.9%
	High	2,641,420	13,730	($6,505.11)	-26.6%	($5,594.49)	-1.1%
Former Woodstock Hydro Customers to Hydro One Rate Classes							
AUR	**Low**	310		$6.27	26.0%	$7.53	12.5%
	Typical	750		$6.05	24.9%	$9.65	8.5%
	Average	636		$6.10	25.2%	$9.11	9.2%
	High	1,160		$5.84	23.9%	$11.63	7.2%
AUGe	**Low**	190		($3.20)	-9.7%	($2.64)	-4.9%
	Typical	2,000		$7.30	13.1%	$10.77	3.7%
	Average	2,471		$10.03	16.2%	$14.26	4.1%
	High	7,240		$37.69	30.9%	$49.60	5.1%
AUGd	**Low**	9,370	50	$42.08	15.7%	$15.58	0.8%
	Average	47,636	134	$75.09	15.9%	($32.42)	-0.4%
	High	137,890	340	$158.56	16.3%	($142.25)	-0.6%
St Lgt	**Average**	37,079	104	$1,154.05	39.9%	$1,528.24	17.1%
USL	**Average**	1,349		$42.18	200.8%	$46.08	25.2%
ST	**Average**	895,853	3,301	($1,407.03)	-15.4%	$6,656.23	4.2%
Former Norfolk Power Customers to Hydro One Rate Classes							
AR	**Low**	290		($2.44)	-6.2%	$0.07	0.1%
	Typical	750		($3.18)	-7.9%	$3.13	2.5%
	Average	692		($3.09)	-7.7%	$2.74	2.3%
	High	1,230		($3.95)	-9.7%	$6.32	3.4%

Rate Class	Consumption Level	Monthly Consumption (kWh)	Monthly Peak (kW)	Change in DX Bill ($)*	Change in DX Bill (%)*	Change in Total Bill ($)*	Change in Total Bill (%)*
AGSe	**Low**	110		($14.39)	-25.7%	($12.93)	-19.5%
	Typical	2,000		($14.77)	-14.2%	($2.81)	-0.8%
	Average	2,377		($14.85)	-13.1%	($0.79)	-0.2%
	High	6,410		($15.65)	-7.2%	$20.82	2.2%
AGSd	**Low**	13,020	55	($97.50)	-18.6%	($63.21)	-2.3%
	Average	70,294	181	($170.36)	-15.1%	($12.79)	-0.1%
	High	129,420	300	($242.70)	-14.3%	$35.46	0.2%
St Lgt	**Average**	11,389	39	$236.32	23.5%	$272.01	11.4%
Sen Lgt	**Average**	108	0.3	$5.43	38.8%	$5.60	22.1%
USL	**Average**	904		$27.65	107.6%	$31.41	24.5%
Former Haldimand County Hydro Customers to Hydro One Rate Classes							
AR	**Low**	250		$0.25	0.7%	$1.59	2.4%
	Typical	750		($0.25)	-0.7%	$3.84	3.0%
	Average	742		($0.24)	-0.7%	$3.81	3.0%
	High	1,410		($0.91)	-2.4%	$6.81	3.3%
AGSe	**Low**	90		$10.33	34.5%	$9.95	25.1%
	Typical	2,000		$5.55	8.2%	$10.49	3.5%
	Average	2,261		$4.90	6.8%	$10.57	3.1%
	High	5,430		($3.03)	-2.2%	$11.46	1.5%
AGSd	**Low**	10,880	55	$94.32	30.0%	$78.20	3.5%
	Average	57,529	175	$67.25	8.3%	($20.06)	-0.2%
	High	135,160	375	$22.21	1.4%	($183.70)	-0.8%
St Lgt	**Average**	31,001	85	($2,004.82)	-37.2%	($2,118.75)	-19.5%
Sen Lgt	**Average**	61	0.2	($10.16)	-45.5%	($9.45)	-33.5%
USL	**Average**	471		$23.07	107.5%	$22.90	30.9%

** In the pre-filed evidence, 2023 bill impacts were calculated using estimated 2022 distribution rates and RTSRs. In this update 2022 distribution rates and RTSRs have been updated to reflect the OEB's Decisions in EB-2021-0032 and EB-2021-0033.*

Table 7 - 2024 Distribution and Total Bill Impacts

Rate Class	Consumption Level	Monthly Consumption (kWh)	Monthly Peak (kW)	Change in DX Bill ($)	Change in DX Bill (%)	Change in Total Bill ($)	Change in Total Bill (%)
UR	Low	340		$0.97	2.6%	$0.91	1.2%
	Typical	750		$0.97	2.6%	$0.91	0.7%
	Average	690		$0.97	2.6%	$0.91	0.7%
	High	1,260		$0.97	2.6%	$0.91	0.5%
R1 (without DRP)*	Low	370		$3.71	6.0%	$3.49	3.3%
	Typical	750		$1.66	2.6%	$1.56	1.0%
	Average	784		$1.48	2.3%	$1.39	0.9%
	High	1,650		($3.20)	-4.7%	($3.01)	-1.1%
R2 (without DRP)*	Low	440		$6.38	9.6%	$6.00	5.0%
	Typical	750		$3.80	5.5%	$3.58	2.2%
	Average	978		$1.91	2.7%	$1.80	0.9%
	High	2,110		($7.48)	-9.4%	($7.04)	-2.0%
GSe	Low	60		$0.19	0.5%	$0.18	0.4%
	Typical	2,000		$2.32	1.4%	$2.18	0.5%
	Average	1,887		$2.20	1.4%	$2.07	0.5%
	High	5,570		$6.25	1.5%	$5.88	0.5%
UGe	Low	180		$0.25	0.8%	$0.24	0.5%
	Typical	2,000		$1.16	1.3%	$1.09	0.3%
	Average	2,494		$1.41	1.3%	$1.32	0.3%
	High	6,930		$3.63	1.4%	$3.41	0.3%
GSd	Low	9,310	55	$4.17	0.4%	$4.71	0.2%
	Average	34,334	110	$9.23	0.4%	$10.43	0.1%
	High	75,790	250	$22.11	0.4%	$24.98	0.1%
UGd	Low	13,900	55	$2.70	0.4%	$3.06	0.1%
	Average	42,592	111	$6.01	0.5%	$6.79	0.1%
	High	97,610	280	$15.98	0.5%	$18.06	0.1%
St Lgt	Low	30		$0.02	0.4%	$0.02	0.2%
	Average	1,274		$1.39	0.9%	$1.31	0.4%
	High	2,310		$2.53	1.0%	$2.38	0.4%
Sen Lgt	Low	20		($0.07)	-1.1%	($0.06)	-0.7%
	Average	49		($0.10)	-0.9%	($0.10)	-0.6%
	High	80		($0.14)	-0.9%	($0.14)	-0.6%
USL	Low	100		$0.42	1.1%	$0.40	0.8%
	Average	477		$0.53	1.2%	$0.50	0.5%
	High	550		$0.56	1.2%	$0.52	0.5%
DGen	Low	10	0.03	$5.01	2.6%	$5.66	2.6%
	Average	1,709	12	$12.68	3.9%	$14.33	2.2%
	High	8,490	45	$33.82	5.0%	$38.21	1.8%

Rate Class	Consumption Level	Monthly Consumption (kWh)	Monthly Peak (kW)	Change in DX Bill ($)	Change in DX Bill (%)	Change in Total Bill ($)	Change in Total Bill (%)
ST	**Low**	88,780	500	$32.60	1.8%	$36.84	0.2%
	Average	1,373,443	2,808	$99.99	2.5%	$112.99	0.0%
	High	2,641,420	13,730	$418.92	2.3%	$473.38	0.1%
Former Woodstock Hydro Customers to Hydro One Rate Classes							
AUR	**Low**	310		$1.37	4.5%	$1.29	1.9%
	Typical	750		$1.24	4.1%	$1.16	0.9%
	Average	636		$1.27	4.2%	$1.19	1.1%
	High	1,160		$1.11	3.7%	$1.05	0.6%
AUGe	**Low**	190		$0.74	2.5%	$0.70	1.3%
	Typical	2,000		($4.69)	-7.4%	($4.41)	-1.5%
	Average	2,471		($6.10)	-8.5%	($5.74)	-1.6%
	High	7,240		($20.41)	-12.8%	($19.21)	-1.9%
AUGd	**Low**	9,370	50	($20.60)	-6.6%	($23.28)	-1.2%
	Average	47,636	134	($68.11)	-12.4%	($76.96)	-0.9%
	High	137,890	340	($184.62)	-16.3%	($208.63)	-0.9%
St Lgt	**Average**	37,079		$196.62	4.9%	$222.18	2.1%
USL	**Average**	1,349		$2.47	3.9%	$2.33	1.0%
ST	**Average**	895,853	3,301	($1,509.18)	-19.5%	($1,705.38)	-1.0%
Former Norfolk Power Customers to Hydro One Rate Classes							
AR	**Low**	290		$1.66	4.5%	$1.57	2.2%
	Typical	750		$1.48	4.0%	$1.39	1.1%
	Average	692		$1.50	4.1%	$1.41	1.2%
	High	1,230		$1.29	3.5%	$1.21	0.6%
AGSe	**Low**	110		$0.94	2.3%	$0.88	1.7%
	Typical	2,000		($12.48)	-14.0%	($11.74)	-3.6%
	Average	2,377		($15.16)	-15.3%	($14.26)	-3.7%
	High	6,410		($43.79)	-21.8%	($41.21)	-4.2%
AGSd	**Low**	13,020	55	$6.79	1.6%	$7.68	0.3%
	Average	70,294	181	$3.96	0.4%	$4.47	0.0%
	High	129,420	300	$1.28	0.1%	$1.45	0.0%
St Lgt	**Average**	11,389		$60.46	4.9%	$56.89	2.1%
Sen Lgt	**Average**	108		$0.96	5.0%	$0.91	2.9%
USL	**Average**	904		$2.07	3.9%	$1.95	1.2%
Former Haldimand County Hydro Customers to Hydro One Rate Classes							
AR	**Low**	250		$1.71	4.6%	$1.60	2.4%
	Typical	750		$1.56	4.2%	$1.46	1.1%
	Average	742		$1.56	4.2%	$1.47	1.1%
	High	1,410		$1.36	3.7%	$1.28	0.6%

Rate Class	Consumption Level	Monthly Consumption (kWh)	Monthly Peak (kW)	Change in DX Bill ($)	Change in DX Bill (%)	Change in Total Bill ($)	Change in Total Bill (%)
AGSe	Low	90		$1.83	4.5%	$1.72	3.5%
	Typical	2,000		$4.12	5.6%	$3.88	1.2%
	Average	2,261		$4.43	5.7%	$4.17	1.2%
	High	5,430		$8.24	6.3%	$7.75	1.0%
AGSd	Low	10,880	55	$25.65	6.3%	$28.98	1.2%
	Average	57,529	175	$64.08	7.3%	$72.41	0.7%
	High	135,160	375	$128.14	7.7%	$144.80	0.6%
St Lgt	Average	31,001		$164.41	4.9%	$185.78	2.1%
Sen Lgt	Average	61		$0.60	4.9%	$0.56	3.0%
USL	Average	471		$1.68	3.8%	$1.58	1.6%

** In 2024, non-seasonal customers of R1 and R2 rate classes will be fully protected by the DRP credit against any changes in distribution rates and will not see any year-over-year change in their distribution charges.*

Table 8 - 2025 Distribution and Total Bill Impacts

Rate Class	Consumption Level	Monthly Consumption (kWh)	Monthly Peak (kW)	Change in DX Bill ($)	Change in DX Bill (%)	Change in Total Bill ($)	Change in Total Bill (%)
UR	Low	340		$1.65	4.3%	$1.55	2.0%
	Typical	750		$1.65	4.3%	$1.55	1.2%
	Average	690		$1.65	4.3%	$1.55	1.3%
	High	1,260		$1.65	4.3%	$1.55	0.8%
R1 (without DRP)*	Low	370		$2.81	4.3%	$2.64	2.4%
	Typical	750		$2.81	4.3%	$2.64	1.7%
	Average	784		$2.81	4.3%	$2.64	1.6%
	High	1,650		$2.81	4.3%	$2.64	1.0%
R2 (without DRP)*	Low	440		$5.70	7.8%	$5.36	4.3%
	Typical	750		$5.70	7.8%	$5.36	3.2%
	Average	978		$5.70	7.9%	$5.36	2.8%
	High	2,110		$5.70	7.9%	$5.36	1.6%
GSe	Low	60		$1.21	3.3%	$1.14	2.7%
	Typical	2,000		$7.42	4.3%	$6.98	1.7%
	Average	1,887		$7.06	4.3%	$6.64	1.7%
	High	5,570		$18.84	4.5%	$17.73	1.6%
UGe	Low	180		$1.11	3.5%	$1.04	2.0%
	Typical	2,000		$3.84	4.2%	$3.61	1.1%
	Average	2,494		$4.58	4.2%	$4.31	1.1%
	High	6,930		$11.24	4.4%	$10.57	1.0%
GSd	Low	9,310	55	$50.02	4.2%	$56.52	1.9%
	Average	34,334	110	$97.10	4.3%	$109.72	1.3%
	High	75,790	250	$216.94	4.4%	$245.14	1.4%

Rate Class	Consumption Level	Monthly Consumption (kWh)	Monthly Peak (kW)	Change in DX Bill ($)	Change in DX Bill (%)	Change in Total Bill ($)	Change in Total Bill (%)
UGd	Low	13,900	55	$30.20	4.3%	$34.13	1.1%
	Average	42,592	111	$58.04	4.4%	$65.58	0.8%
	High	97,610	280	$142.05	4.4%	$160.51	0.8%
St Lgt	Low	30		$0.22	3.3%	$0.20	2.1%
	Average	1,274		$6.31	4.3%	$5.94	2.0%
	High	2,310		$11.39	4.3%	$10.72	2.0%
Sen Lgt	Low	20		$0.24	3.9%	$0.23	2.7%
	Average	49		$0.46	4.2%	$0.43	2.7%
	High	80		$0.69	4.4%	$0.65	2.7%
USL	Low	100		$1.22	3.2%	$1.15	2.4%
	Average	477		$1.52	3.3%	$1.43	1.4%
	High	550		$1.58	3.3%	$1.49	1.4%
DGen	Low	10	0.03	$5.95	3.0%	$6.72	3.0%
	Average	1,709	12	$14.58	4.4%	$16.47	2.5%
	High	8,490	45	$38.36	5.4%	$43.34	2.0%
ST	Low	88,780	500	$81.55	4.4%	$92.15	0.5%
	Average	1,373,443	2,808	$254.65	6.1%	$287.75	0.1%
	High	2,641,420	13,730	$1,073.80	5.9%	$1,213.39	0.2%
Former Woodstock Hydro Customers to Hydro One Rate Classes							
AUR	Low	310		$1.36	4.3%	$1.28	1.8%
	Typical	750		$1.36	4.3%	$1.28	1.0%
	Average	636		$1.36	4.3%	$1.28	1.2%
	High	1,160		$1.36	4.3%	$1.28	0.7%
AUGe	Low	190		$1.30	4.3%	$1.23	2.3%
	Typical	2,000		$2.39	4.1%	$2.25	0.8%
	Average	2,471		$2.67	4.1%	$2.51	0.7%
	High	7,240		$5.53	4.0%	$5.21	0.5%
AUGd	Low	9,370	50	$12.70	4.4%	$14.35	0.7%
	Average	47,636	134	$21.89	4.6%	$24.74	0.3%
	High	137,890	340	$44.43	4.7%	$50.20	0.2%
St Lgt	Average	37,079		$181.76	4.3%	$205.39	1.9%
USL	Average	1,349		$2.22	3.4%	$2.09	0.9%
ST	Average	895,853	3,301	$291.63	4.7%	$329.54	0.2%
Former Norfolk Power Customers to Hydro One Rate Classes							
AR	Low	290		$1.65	4.3%	$1.55	2.1%
	Typical	750		$1.65	4.3%	$1.55	1.2%
	Average	692		$1.65	4.3%	$1.55	1.3%
	High	1,230		$1.65	4.3%	$1.55	0.8%

Rate Class	Consumption Level	Monthly Consumption (kWh)	Monthly Peak (kW)	Change in DX Bill ($)	Change in DX Bill (%)	Change in Total Bill ($)	Change in Total Bill (%)
AGSe	Low	110		$1.69	4.0%	$1.59	2.9%
	Typical	2,000		$3.20	4.2%	$3.01	0.9%
	Average	2,377		$3.50	4.2%	$3.30	0.9%
	High	6,410		$6.73	4.3%	$6.33	0.7%
AGSd	Low	13,020	55	$20.88	4.8%	$23.59	0.9%
	Average	70,294	181	$52.08	5.4%	$58.85	0.5%
	High	129,420	300	$81.54	5.6%	$92.14	0.4%
St Lgt	Average	11,389		$55.88	4.3%	$52.58	1.9%
Sen Lgt	Average	108		$0.90	4.4%	$0.85	2.7%
USL	Average	904		$1.86	3.4%	$1.75	1.1%
Former Haldimand County Hydro Customers to Hydro One Rate Classes							
AR	Low	250		$1.65	4.3%	$1.55	2.3%
	Typical	750		$1.65	4.3%	$1.55	1.2%
	Average	742		$1.65	4.3%	$1.55	1.2%
	High	1,410		$1.65	4.3%	$1.55	0.7%
AGSe	Low	90		$1.67	4.0%	$1.57	3.1%
	Typical	2,000		$3.20	4.2%	$3.01	0.9%
	Average	2,261		$3.41	4.2%	$3.21	0.9%
	High	5,430		$5.94	4.3%	$5.59	0.7%
AGSd	Low	10,880	55	$20.88	4.8%	$23.59	1.0%
	Average	57,529	175	$50.59	5.4%	$57.17	0.5%
	High	135,160	375	$100.11	5.6%	$113.12	0.5%
St Lgt	Average	31,001		$151.97	4.3%	$171.73	1.9%
Sen Lgt	Average	61		$0.55	4.3%	$0.52	2.7%
USL	Average	471		$1.52	3.3%	$1.43	1.4%

** In 2025, non-seasonal customers of R1 and R2 rate classes will be fully protected by the DRP credit against any changes in distribution rates and will not see any year-over-year change in their distribution charges.*

Table 9 - 2026 Distribution and Total Bill Impacts

Rate Class	Consumption Level	Monthly Consumption (kWh)	Monthly Peak (kW)	Change in DX Bill ($)	Change in DX Bill (%)	Change in Total Bill ($)	Change in Total Bill (%)
UR	Low	340		$2.21	5.5%	$2.08	2.6%
	Typical	750		$2.21	5.5%	$2.08	1.6%
	Average	690		$2.21	5.5%	$2.08	1.7%
	High	1,260		$2.21	5.6%	$2.08	1.1%
R1 (without DRP)	Low	370		$3.14	4.6%	$2.95	2.6%
	Typical	750		$3.14	4.6%	$2.95	1.8%
	Average	784		$3.14	4.6%	$2.95	1.8%
	High	1,650		$3.14	4.6%	$2.95	1.1%
R2 (without DRP)	Low	440		$7.64	9.7%	$7.19	5.5%
	Typical	750		$7.64	9.8%	$7.19	4.2%
	Average	978		$7.64	9.8%	$7.19	3.6%
	High	2,110		$7.64	9.8%	$7.19	2.1%
GSe	Low	60		$1.68	4.4%	$1.58	3.6%
	Typical	2,000		$9.83	5.5%	$9.25	2.2%
	Average	1,887		$9.36	5.5%	$8.80	2.2%
	High	5,570		$24.82	5.7%	$23.36	2.1%
UGe	Low	180		$1.54	4.7%	$1.45	2.7%
	Typical	2,000		$5.36	5.6%	$5.04	1.5%
	Average	2,494		$6.40	5.7%	$6.02	1.5%
	High	6,930		$15.71	5.9%	$14.79	1.3%
GSd	Low	9,310	55	$67.15	5.5%	$75.88	2.5%
	Average	34,334	110	$130.08	5.6%	$146.99	1.8%
	High	75,790	250	$290.29	5.6%	$328.02	1.8%
UGd	Low	13,900	55	$40.54	5.5%	$45.82	1.4%
	Average	42,592	111	$77.72	5.6%	$87.83	1.0%
	High	97,610	280	$189.92	5.7%	$214.61	1.1%
St Lgt	Low	30		$0.32	4.7%	$0.30	3.0%
	Average	1,274		$8.53	5.5%	$8.03	2.7%
	High	2,310		$15.37	5.5%	$14.46	2.6%
Sen Lgt	Low	20		$0.34	5.3%	$0.32	3.7%
	Average	49		$0.63	5.5%	$0.59	3.6%
	High	80		$0.93	5.6%	$0.88	3.5%
USL	Low	100		$2.11	5.4%	$1.99	4.1%
	Average	477		$2.64	5.5%	$2.48	2.5%
	High	550		$2.74	5.5%	$2.58	2.3%
DGen	Low	10	0.03	$8.69	4.2%	$9.82	4.2%
	Average	1,709	12	$19.54	5.6%	$22.08	3.3%
	High	8,490	45	$49.46	6.6%	$55.89	2.5%

Rate Class	Consumption Level	Monthly Consumption (kWh)	Monthly Peak (kW)	Change in DX Bill ($)	Change in DX Bill (%)	Change in Total Bill ($)	Change in Total Bill (%)
ST	Low	88,780	500	$241.28	12.4%	$272.65	1.4%
	Average	1,373,443	2,808	$719.73	16.3%	$813.29	0.4%
	High	2,641,420	13,730	$2,983.86	15.4%	$3,371.76	0.6%
Former Woodstock Hydro Customers to Hydro One Rate Classes							
AUR	Low	310		$1.82	5.5%	$1.71	2.4%
	Typical	750		$1.82	5.5%	$1.71	1.4%
	Average	636		$1.82	5.5%	$1.71	1.5%
	High	1,160		$1.82	5.6%	$1.71	1.0%
AUGe	Low	190		$1.82	5.7%	$1.71	3.2%
	Typical	2,000		$3.45	5.7%	$3.25	1.1%
	Average	2,471		$3.87	5.7%	$3.65	1.0%
	High	7,240		$8.17	5.6%	$7.68	0.8%
AUGd	Low	9,370	50	$19.83	6.6%	$22.40	1.1%
	Average	47,636	134	$34.37	6.8%	$38.83	0.5%
	High	137,890	340	$70.02	7.0%	$79.13	0.3%
St Lgt	Average	37,079		$244.84	5.5%	$276.67	2.5%
USL	Average	1,349		$3.86	5.7%	$3.63	1.6%
ST	Average	895,853	3,301	$821.93	12.6%	$928.78	0.6%
Former Norfolk Power Customers to Hydro One Rate Classes							
AR	Low	290		$2.21	5.5%	$2.08	2.8%
	Typical	750		$2.21	5.5%	$2.08	1.6%
	Average	692		$2.21	5.5%	$2.08	1.7%
	High	1,230		$2.21	5.6%	$2.08	1.1%
AGSe	Low	110		$2.25	5.1%	$2.12	3.8%
	Typical	2,000		$4.33	5.4%	$4.07	1.3%
	Average	2,377		$4.74	5.4%	$4.46	1.2%
	High	6,410		$9.18	5.6%	$8.64	0.9%
AGSd	Low	13,020	55	$27.69	6.1%	$31.29	1.2%
	Average	70,294	181	$68.48	6.7%	$77.38	0.6%
	High	129,420	300	$107.00	6.9%	$120.91	0.5%
St Lgt	Average	11,389		$75.29	5.5%	$70.85	2.6%
Sen Lgt	Average	108		$1.21	5.7%	$1.14	3.5%
USL	Average	904		$3.24	5.6%	$3.04	1.9%
Former Haldimand County Hydro Customers to Hydro One Rate Classes							
AR	Low	250		$2.21	5.5%	$2.08	3.0%
	Typical	750		$2.21	5.5%	$2.08	1.6%
	Average	742		$2.21	5.5%	$2.08	1.6%
	High	1,410		$2.21	5.5%	$2.08	1.0%

Rate Class	Consumption Level	Monthly Consumption (kWh)	Monthly Peak (kW)	Change in DX Bill ($)	Change in DX Bill (%)	Change in Total Bill ($)	Change in Total Bill (%)
AGSe	Low	90		$2.23	5.1%	$2.10	4.0%
	Typical	2,000		$4.33	5.4%	$4.07	1.3%
	Average	2,261		$4.62	5.4%	$4.34	1.2%
	High	5,430		$8.10	5.6%	$7.62	1.0%
AGSd	Low	10,880	55	$27.69	6.1%	$31.29	1.3%
	Average	57,529	175	$66.54	6.7%	$75.19	0.7%
	High	135,160	375	$131.28	7.0%	$148.34	0.6%
St Lgt	Average	31,001		$204.73	5.5%	$231.34	2.5%
Sen Lgt	Average	61		$0.74	5.6%	$0.70	3.5%
USL	Average	471		$2.63	5.5%	$2.47	2.5%

** In 2026, non-seasonal customers of R1 and R2 rate classes will be fully protected by the DRP credit against any changes in distribution rates and will not see any year-over-year change in their distribution charges.*

Table 10 - 2027 Distribution and Total Bill Impacts

Rate Class	Consumption Level	Monthly Consumption (kWh)	Monthly Peak (kW)	Change in DX Bill ($)	Change in DX Bill (%)	Change in Total Bill ($)	Change in Total Bill (%)
UR	Low	340		$1.83	4.3%	$1.72	2.1%
	Typical	750		$1.83	4.3%	$1.72	1.3%
	Average	690		$1.83	4.3%	$1.72	1.4%
	High	1,260		$1.83	4.4%	$1.72	0.9%
R1 (without DRP)	Low	370		$3.09	4.3%	$2.91	2.5%
	Typical	750		$3.09	4.3%	$2.91	1.8%
	Average	784		$3.09	4.3%	$2.91	1.7%
	High	1,650		$3.09	4.3%	$2.91	1.1%
R2 (without DRP)	Low	440		$6.32	7.3%	$5.95	4.3%
	Typical	750		$6.32	7.4%	$5.95	3.3%
	Average	978		$6.32	7.4%	$5.95	2.9%
	High	2,110		$6.32	7.4%	$5.95	1.7%
GSe	Low	60		$1.49	3.8%	$1.40	3.1%
	Typical	2,000		$8.28	4.4%	$7.79	1.8%
	Average	1,887		$7.88	4.4%	$7.42	1.8%
	High	5,570		$20.78	4.5%	$19.55	1.7%
UGe	Low	180		$1.34	3.9%	$1.26	2.3%
	Typical	2,000		$4.25	4.2%	$4.00	1.2%
	Average	2,494		$5.04	4.2%	$4.74	1.1%
	High	6,930		$12.14	4.3%	$11.42	1.0%
GSd	Low	9,310	55	$55.78	4.3%	$63.03	2.0%
	Average	34,334	110	$107.68	4.4%	$121.67	1.4%
	High	75,790	250	$239.78	4.4%	$270.95	1.5%

Rate Class	Consumption Level	Monthly Consumption (kWh)	Monthly Peak (kW)	Change in DX Bill ($)	Change in DX Bill (%)	Change in Total Bill ($)	Change in Total Bill (%)
UGd	Low	13,900	55	$33.75	4.3%	$38.13	1.2%
	Average	42,592	111	$64.33	4.4%	$72.69	0.8%
	High	97,610	280	$156.62	4.4%	$176.98	0.9%
St Lgt	Low	30		$0.27	3.8%	$0.25	2.4%
	Average	1,274		$7.11	4.4%	$6.69	2.2%
	High	2,310		$12.81	4.4%	$12.05	2.1%
Sen Lgt	Low	20		$0.28	4.2%	$0.27	3.0%
	Average	49		$0.52	4.3%	$0.49	2.8%
	High	80		$0.77	4.4%	$0.72	2.8%
USL	Low	100		$1.23	3.0%	$1.16	2.3%
	Average	477		$1.49	3.0%	$1.41	1.4%
	High	550		$1.54	3.0%	$1.45	1.3%
DGen	Low	10	0.03	$7.34	3.4%	$8.30	3.4%
	Average	1,709	12	$16.20	4.4%	$18.31	2.6%
	High	8,490	45	$40.62	5.1%	$45.91	2.0%
ST	Low	88,780	500	$100.56	4.6%	$113.63	0.6%
	Average	1,373,443	2,808	$299.05	5.8%	$337.92	0.1%
	High	2,641,420	13,730	$1,238.34	5.5%	$1,399.32	0.3%
Former Woodstock Hydro Customers to Hydro One Rate Classes							
AUR	Low	310		$1.51	4.3%	$1.42	2.0%
	Typical	750		$1.51	4.3%	$1.42	1.1%
	Average	636		$1.51	4.3%	$1.42	1.3%
	High	1,160		$1.51	4.4%	$1.42	0.8%
AUGe	Low	190		$1.57	4.7%	$1.48	2.7%
	Typical	2,000		$2.84	4.4%	$2.67	0.9%
	Average	2,471		$3.17	4.4%	$2.98	0.8%
	High	7,240		$6.51	4.3%	$6.12	0.6%
AUGd	Low	9,370	50	$14.01	4.3%	$15.83	0.8%
	Average	47,636	134	$24.46	4.6%	$27.64	0.3%
	High	137,890	340	$50.11	4.7%	$56.62	0.2%
St Lgt	Average	37,079		$204.03	4.4%	$230.56	2.1%
USL	Average	1,349		$2.10	2.9%	$1.98	0.8%
ST	Average	895,853	3,301	$341.45	4.6%	$385.83	0.2%
Former Norfolk Power Customers to Hydro One Rate Classes							
AR	Low	290		$1.83	4.3%	$1.72	2.2%
	Typical	750		$1.83	4.3%	$1.72	1.3%
	Average	692		$1.83	4.3%	$1.72	1.3%
	High	1,230		$1.83	4.4%	$1.72	0.9%

Rate Class	Consumption Level	Monthly Consumption (kWh)	Monthly Peak (kW)	Change in DX Bill ($)	Change in DX Bill (%)	Change in Total Bill ($)	Change in Total Bill (%)
AGSe	**Low**	110		$1.80	3.9%	$1.69	2.9%
	Typical	2,000		$3.69	4.4%	$3.47	1.1%
	Average	2,377		$4.07	4.4%	$3.83	1.0%
	High	6,410		$8.10	4.7%	$7.62	0.8%
AGSd	**Low**	13,020	55	$24.82	5.1%	$28.05	1.0%
	Average	70,294	181	$62.72	5.8%	$70.88	0.6%
	High	129,420	300	$98.52	6.0%	$111.33	0.5%
St Lgt	**Average**	11,389		$62.74	4.4%	$59.04	2.1%
Sen Lgt	**Average**	108		$0.99	4.4%	$0.94	2.8%
USL	**Average**	904		$1.79	3.0%	$1.69	1.0%
Former Haldimand County Hydro Customers to Hydro One Rate Classes							
AR	**Low**	250		$1.83	4.3%	$1.72	2.4%
	Typical	750		$1.83	4.3%	$1.72	1.3%
	Average	742		$1.83	4.3%	$1.72	1.3%
	High	1,410		$1.83	4.4%	$1.72	0.8%
AGSe	**Low**	90		$1.78	3.9%	$1.67	3.0%
	Typical	2,000		$3.69	4.4%	$3.47	1.1%
	Average	2,261		$3.95	4.4%	$3.72	1.0%
	High	5,430		$7.12	4.6%	$6.70	0.8%
AGSd	**Low**	10,880	55	$24.82	5.1%	$28.05	1.2%
	Average	57,529	175	$60.92	5.8%	$68.84	0.7%
	High	135,160	375	$121.08	6.0%	$136.82	0.6%
St Lgt	**Average**	31,001		$170.61	4.4%	$192.78	2.1%
Sen Lgt	**Average**	61		$0.61	4.4%	$0.58	2.8%
USL	**Average**	471		$1.49	3.0%	$1.40	1.4%

** In 2027, non-seasonal customers of R1 and R2 rate classes will be fully protected by the DRP credit against any changes in distribution rates and will not see any year-over-year change in their distribution charges.*

c) Hydro One would like to clarify that with respect to the proposed deferral recovery mechanisms, there will not be a mismatch in each year from 2023 to 2027 between approved costs and revenues. Hydro One is requesting the OEB to approve incremental OM&A, capital expenditures, in-service additions and overall revenue requirement for each of Transmission and Distribution so that the net income impacts can be recognized in the appropriate years (2023-2027). It is the recovery of these impacts that is deferred to future years. As the net income impacts will be captured in the appropriate years (2023-2027), there are no changes to the proposed ESM calculation for 2023-2027.

2023 COST ALLOCATION MODEL

This exhibit has been filed separately in MS Excel format.

2023 Rate Design Including 7th Year of Residential Phase-in to All-Fixed Rates for R1 and R2 Rate Classes

	Number of Customers	GWh	kWs	Revenue	Alloc Cost		Misc Rev	Revenue from Rates	2022 R/C Ratio	R/C Ratio from the CAM	Target 2023 R/C Ratio	Total rev to be collected	Shifted Rev	% Change in revenue from rates	Base Fixed Charge ($/month)	Revenue from Fixed Charge	Fixed Rev %	Revenue from Volumetric Charge	Base Volumetric Charge ($/kWh)	Base Volumetric Charge ($/kW)	CSTA Rate Adders ($/kW)	Hopper Foundry Rate Adder ($/kW)	Total Volumetric Charge ($/kW)
				(A)	(B)	(%)	(C)	(D=A-C)	(E)	(F=A/B)	(G)	(H=BxG)	(I=H-A)	(J=I/D)		(K= (H - C) x M)	(M)	(L=H-C-K)					
UR	246,399	2,008	-	$ 113,690,459	$ 108,771,613	6.52%	$ 4,630,445	$ 109,060,014	1.12	1.05	1.05	$ 113,690,459	$ -	0.0%	$ 36.88	$ 109,060,014	100%	$ -	$ -				
R1	544,981	5,041	-	$ 424,174,152	$ 371,064,414	22.23%	$ 12,768,943	$ 411,405,209	1.12	1.14	1.14	$ 424,174,152	$ -	0.0%	$ 58.76	$ 384,285,257	93%	$ 27,119,952	$ 0.0054				
R2	414,577	4,788	-	$ 650,982,533	$ 681,201,661	40.81%	$ 15,915,358	$ 635,067,176	0.97	0.96	0.96	$ 650,982,533	$ -	0.0%	$ 119.68	$ 595,384,429	94%	$ 39,682,746	$ 0.0083				
GSe	88,795	1,978	-	$ 169,497,778	$ 167,055,381	10.01%	$ 3,851,401	$ 165,646,377	0.94	1.01	1.01	$ 169,497,778	$ -	0.0%	$ 31.42	$ 33,479,132	20%	$ 132,167,245	$ 0.0668				
GSd	5,343	2,164	6,937,130	$ 139,193,690	$ 151,610,594	9.08%	$ 2,285,784	$ 136,907,906	0.88	0.92	0.92	$ 139,193,690	$ -	0.0%	$ 100.96	$ 6,472,594	5%	$ 130,435,312		$ 18.8025	$ 0.1293	$ 0.0128	$ 18.9446
UGe	18,432	543	-	$ 23,450,547	$ 24,415,782	1.46%	$ 627,686	$ 22,822,862	0.99	0.96	0.96	$ 23,450,547	$ -	0.0%	$ 24.47	$ 5,411,512	24%	$ 17,411,349	$ 0.0321				
UGd	1,743	876	2,284,824	$ 27,195,347	$ 28,281,435	1.69%	$ 471,352	$ 26,723,996	0.87	0.96	0.96	$ 27,195,347	$ -	0.0%	$ 92.31	$ 1,930,666	7%	$ 24,793,329		$ 10.8513	$ 0.1293		$ 10.9806
St Lgt	5,494	83	-	$ 9,512,077	$ 9,812,382	0.59%	$ 265,796	$ 9,246,281	0.93	0.97	0.97	$ 9,512,077	$ -	0.0%	$ 3.01	$ 198,558	2%	$ 9,047,723	$ 0.1094				
Sen Lgt	19,409	11	-	$ 5,344,077	$ 4,834,512	0.29%	$ 2,746,062	$ 2,598,015	0.94	1.11	1.06	$ 5,141,280	$ (202,797)	-7.8%	$ 2.78	$ 648,599	27%	$ 1,746,619	$ 0.1547				
USL	5,752	32	-	$ 3,539,795	$ 2,988,814	0.18%	$ 93,336	$ 3,446,458	1.11	1.18	1.06	$ 3,178,465	$ (361,329)	-10.5%	$ 34.45	$ 2,377,957	77%	$ 707,172	$ 0.0218				
DGen	1,489	30	208,699	$ 5,749,979	$ 6,919,278	0.41%	$ 82,158	$ 5,667,821	0.86	0.83	0.83	$ 5,749,979	$ -	0.0%	$ 191.95	$ 3,430,443	61%	$ 2,237,378		$ 10.7206	$ 0.1293		$ 10.8499
ST	910	14,983	30,627,361	$ 63,250,241	$ 72,723,633	4.36%	$ 1,345,059	$ 61,905,182	0.99	0.87	0.87	$ 63,250,241	$ -	0.0%	N/A*	$ 11,582,599	19%	$ 50,322,584		N/A*			N/A*
AUR	15,476	118	-	$ 5,932,827	$ 6,351,258	0.38%	$ 276,408	$ 5,656,419	-	0.93	0.93	$ 5,932,827	$ -	0.0%	$ 30.46	$ 5,656,419	100%	$ -	$ -				
AUGe	1,380	41	-	$ 1,061,654	$ 1,364,713	0.08%	$ 35,458	$ 1,026,196	-	0.78	0.80	$ 1,091,770	$ 30,117	2.9%	$ 26.30	$ 435,602	41%	$ 620,711	$ 0.0152				
AUGd	207	118	334,039	$ 1,127,253	$ 1,576,363	0.09%	$ 43,091	$ 1,084,161	-	0.72	0.80	$ 1,261,091	$ 133,838	12.3%	$ 159.51	$ 396,800	33%	$ 821,199		$ 2.4584	$ 0.1293		$ 2.5877
AR	38,991	336	-	$ 18,066,593	$ 21,166,734	1.27%	$ 763,278	$ 17,303,315	-	0.85	0.85	$ 18,066,593	$ -	0.0%	$ 36.98	$ 17,303,315	100%	$ -	$ -				
AGSe	4,223	117	-	$ 4,166,211	$ 4,515,738	0.27%	$ 121,460	$ 4,044,752	-	0.92	0.92	$ 4,166,211	$ -	0.0%	$ 38.74	$ 1,962,921	49%	$ 2,081,830	$ 0.0177				
AGSd	303	231	646,691	$ 3,122,764	$ 4,403,669	0.26%	$ 96,110	$ 3,026,654	-	0.71	0.80	$ 3,522,935	$ 400,172	13.2%	$ 186.87	$ 679,812	20%	$ 2,747,014		$ 4.2478	$ 0.1293		$ 4.3771
	1,413,905	**33,500**	**41,038,745**	**1,669,057,975**	**1,669,057,975**	**100%**	**46,419,183**	**1,622,638,792**				**1,669,057,975**	**0**			**1,180,696,629**		**441,942,163**					

*** ST rates are provided in attachmnet O-SEC-252-03**

Total Rev (K+L)	**$**	**1,622,638,792**
Misc Rev (C)	**$**	**46,419,183**
Total Rev Req	**$**	**1,669,057,975**

2024 Rate Design Including 8th and Final Year of Residential Phase-in to All-Fixed Rates for R1 and R2 Rate Classes

	Number of Customers	GWh	kWs	Revenue - with 2023 Rates and 2024 Charge Determinants	2023 Revenue	2024 Rates Revenue Requirement	2024 Misc Rev	2024 Total Revenue	2024 Allocated Cost	2023 R/C Ratio	2024 R/C Ratio	Target 2024 R/C Ratio	Total rev to be collected	Shifted Rev	% Change in revenue from rates	Base Fixed Charge ($/month)	Revenue from Fixed Charge	Fixed Rev %	Revenue from Volumetric Charge	Base Volumetric Charge ($/kWh)	Base Volumetric Charge ($/kW)	CSTA Rate Adders ($/kW)	Hopper Foundry Rate Adder ($/kW)	Total Volumetric Charge ($/kW)
				(Y)	(Z)	(A=Y*X_{RevReq})	(B=B_{2023}*$X_{MiscRev}$)	(C=A+B)	(D=D_{2023}*$X_{AllocCost}$)	(E)	(F=C/D)	(G)	(H=DxG)	(I=H-C)	(J=I/C)		(K= (H - B) x M)	(M)	(L=H-B-K)					
UR	249,390	2,019	-	$ 110,370,023	$ 113,690,459	$ 115,675,155	$ 4,634,094	$ 120,309,248	$ 114,263,863	1.05	1.05	1.05	$ 120,309,248	$ -	0.0%	$ 38.65	$ 115,675,155	100%	$ -	$ -				
R1	549,783	5,057	-	$ 414,867,318	$ 424,174,152	$ 434,808,654	$ 12,779,005	$ 447,587,659	$ 389,800,722	1.14	1.15	1.15	$ 447,587,659	$ -	0.0%	$ 65.91	$ 434,808,654	100%	$ -	$ -				
R2	416,658	4,763	-	$ 637,861,664	$ 650,982,533	$ 668,521,620	$ 15,927,898	$ 684,449,518	$ 715,597,856	0.96	0.96	0.96	$ 684,449,518	$ -	0.0%	$ 133.71	$ 668,521,620	100%	$ -	$ -				
GSe	88,831	1,957	-	$ 164,260,035	$ 169,497,778	$ 172,155,486	$ 3,854,436	$ 176,009,922	$ 175,490,577	1.01	1.00	1.00	$ 176,009,922	$ -	0.0%	$ 32.64	$ 34,794,701	20%	$ 137,360,784	$ 0.0702				
GSd	5,393	2,156	6,911,301	$ 136,483,195	$ 139,193,690	$ 143,043,503	$ 2,287,585	$ 145,331,087	$ 159,265,930	0.92	0.91	0.91	$ 145,331,087	$ -	0.0%	$ 104.50	$ 6,762,666	5%	$ 136,280,837	$ -	$ 19.7185	$ 0.1295	$ 0.0135	$ 19.8615
UGe	18,524	540	-	$ 22,768,529	$ 23,450,547	$ 23,862,939	$ 628,180	$ 24,491,119	$ 25,648,618	0.96	0.95	0.95	$ 24,491,119	$ -	0.0%	$ 25.45	$ 5,658,124	24%	$ 18,204,815	$ 0.0337				
UGd	1,753	874	2,273,615	$ 26,613,818	$ 27,195,347	$ 27,893,059	$ 471,723	$ 28,364,782	$ 29,709,461	0.96	0.95	0.95	$ 28,364,782	$ -	0.0%	$ 95.78	$ 2,015,125	7%	$ 25,877,933	$ -	$ 11.3818	$ 0.1295		$ 11.5113
St Lgt	5,536	82	-	$ 9,172,400	$ 9,512,077	$ 9,613,288	$ 266,005	$ 9,879,293	$ 10,307,842	0.97	0.96	0.96	$ 9,879,293	$ -	0.0%	$ 3.11	$ 206,439	2%	$ 9,406,849	$ 0.1147				
Sen Lgt	19,086	11	-	$ 2,336,793	$ 5,141,280	$ 2,449,115	$ 2,748,226	$ 5,197,341	$ 5,078,623	1.06	1.02	1.02	$ 5,197,341	$ -	0.0%	$ 2.90	$ 663,193	27%	$ 1,785,921	$ 0.1625				
USL	5,793	33	-	$ 3,104,816	$ 3,178,465	$ 3,254,054	$ 93,410	$ 3,347,464	$ 3,139,730	1.06	1.07	1.06	$ 3,313,516	$ (33,948)	-1.0%	$ 35.71	$ 2,481,995	77%	$ 738,111	$ 0.0227				
DGen	1,576	31	213,944	$ 5,922,957	$ 5,749,979	$ 6,207,655	$ 82,223	$ 6,289,878	$ 7,268,656	0.83	0.87	0.87	$ 6,289,878	$ -	0.0%	$ 198.71	$ 3,757,177	61%	$ 2,450,478	$ -	$ 11.4538	$ 0.1295		$ 11.5833
ST	917	14,998	30,657,357	$ 62,043,592	$ 63,250,241	$ 65,025,828	$ 1,346,119	$ 66,371,946	$ 76,395,697	0.87	0.87	0.87	$ 66,371,946	$ -	0.0%	N/A *	$ 12,166,478	19%	$ 52,859,350		N/A *			N/A *
AUR	15,550	119	-	$ 5,683,769	$ 5,932,827	$ 5,956,970	$ 276,625	$ 6,233,595	$ 6,671,954	0.93	0.93	0.93	$ 6,233,595	$ -	0.0%	$ 31.92	$ 5,956,970	100%	$ -	$ -				
AUGe	1,392	41	-	$ 1,067,085	$ 1,091,770	$ 1,118,376	$ 35,486	$ 1,153,862	$ 1,433,622	0.80	0.80	0.80	$ 1,153,862	$ -	0.0%	$ 27.61	$ 461,195	41%	$ 657,181	$ 0.0159				
AUGd	207	119	334,225	$ 1,218,645	$ 1,261,091	$ 1,277,221	$ 43,125	$ 1,320,347	$ 1,655,959	0.80	0.80	0.80	$ 1,320,347	$ -	0.0%	$ 167.19	$ 416,094	33%	$ 861,127	$ -	$ 2.5765	$ 0.1295		$ 2.7060
AR	39,198	334	-	$ 17,394,445	$ 18,066,593	$ 18,230,540	$ 763,879	$ 18,994,419	$ 22,235,515	0.85	0.85	0.85	$ 18,994,419	$ -	0.0%	$ 38.76	$ 18,230,540	100%	$ -	$ -				
AGSe	4,213	116	-	$ 4,021,209	$ 4,166,211	$ 4,214,496	$ 121,555	$ 4,336,051	$ 4,743,753	0.92	0.91	0.91	$ 4,336,051	$ -	0.0%	$ 40.46	$ 2,045,298	49%	$ 2,169,197	$ 0.0187				
AGSd	306	229	640,641	$ 3,406,927	$ 3,522,935	$ 3,570,687	$ 96,185	$ 3,666,872	$ 4,626,026	0.80	0.79	0.80	$ 3,700,820	$ 33,948	0.9%	$ 194.90	$ 715,086	20%	$ 2,889,549	$ -	$ 4.5104	$ 0.1295		$ 4.6399
	1,424,106	**33,478**	**41,031,084**	**$ 1,628,597,220**	**$ 1,669,057,975**	**$ 1,706,878,644**	**$ 46,455,760**	**$ 1,753,334,405**	**$ 1,753,334,405**				**$ 1,753,334,405**	**$ 0**			**$ 1,315,336,512**		**$ 391,542,132**					

*** ST rates are listed in Exhibit L-02-01, Attachment 4**

2024 Adjustments (from 2023 Revenue Requirement) by Rate Class

	2023	2024	% (X)
Revenue Requirement**	$ 1,628,597,220	$ 1,706,878,644	104.81%
Alloc Cost	$ 1,669,057,975	$ 1,753,334,405	105.05%
Misc Revenue	$ 46,419,183	$ 46,455,760	100.08%

** 2023: Revenue with 2023 rates and 2024 charge determinants
2024: 2024 Revenue before rate design adjustments

Total Rev (K+L) $ 1,706,878,644
Misc Rev (C) $ 46,455,760
Total Rev Req $ 1,753,334,405

2025 Rate Design

2025 Rate Design

	Number of Customers	GWh	kWs	Revenue - with 2024 Rates and 2025 Charge Determinants	2024 Revenue	2025 Rates Revenue Requirement	2025 Misc Rev	2025 Total Revenue	2025 Allocated Cost	2024 R/C Ratio	2025 R/C Ratio	Target 2025 R/C Ratio	Total rev to be collected	Shifted Rev	% Change in revenue from rates	Base Fixed Charge ($/month)	Revenue from Fixed Charge	Fixed Rev %	Revenue from Volumetric Charge	Base Volumetric Charge ($/kWh)	Base Volumetric Charge ($/kW)	CSTA Rate Adders ($/kW)	Hopper Foundry Rate Adder ($/kW)	Total Volumetric Charge ($/kW)
				(Y)	(Z)	(A=Y*X_{RevReq})	(B=B_{2024}*$X_{MiscRev}$)	(C=A+B)	(D=D_{2024}*$X_{AllocCost}$)	(E)	(F=C/D)	(G)	(H=DxG)	(I=H-C)	(J=I/C)		(K= (H - B) x M)	(M)	(L=H-B-K)					
UR	252,344	2,026	-	$ 117,037,108	$ 120,309,248	$ 122,026,931	$ 4,642,205	$ 126,669,136	$ 119,406,061	1.05	1.06	1.06	$ 126,669,136	$ -	0.0%	$ 40.30	$ 122,026,931	100%	$ -	$ -				
R1	554,504	5,060	-	$ 438,567,956	$ 447,587,659	$ 457,266,098	$ 12,801,372	$ 470,067,470	$ 407,342,860	1.15	1.15	1.15	$ 470,067,470	$ -	0.0%	$ 68.72	$ 457,266,098	100%	$ -	$ -				
R2	418,668	4,726	-	$ 671,760,409	$ 684,449,518	$ 700,400,602	$ 15,955,777	$ 716,356,380	$ 747,801,788	0.96	0.96	0.96	$ 716,356,380	$ -	0.0%	$ 139.41	$ 700,400,602	100%	$ -	$ -				
GSe	88,891	1,932	-	$ 170,395,596	$ 176,009,922	$ 177,660,333	$ 3,861,182	$ 181,521,516	$ 183,388,150	1.00	0.99	0.99	$ 181,521,516	$ -	0.0%	$ 33.66	$ 35,907,298	20%	$ 141,753,036	$ 0.0734				
GSd	5,439	2,143	6,868,979	$ 142,267,187	$ 145,331,087	$ 148,332,683	$ 2,291,589	$ 150,624,272	$ 166,433,348	0.91	0.91	0.91	$ 150,624,272	$ -	0.0%	$ 107.44	$ 7,012,723	5%	$ 141,319,960	$ -	$ 20.5736	$ 0.1298	$ 0.0141	$ 20.7175
UGe	18,620	536	-	$ 23,762,919	$ 24,491,119	$ 24,776,040	$ 629,280	$ 25,405,320	$ 26,802,879	0.95	0.95	0.95	$ 25,405,320	$ -	0.0%	$ 26.29	$ 5,874,629	24%	$ 18,901,411	$ 0.0352				
UGd	1,764	869	2,257,070	$ 27,716,906	$ 28,364,782	$ 28,898,603	$ 472,549	$ 29,371,152	$ 31,046,471	0.95	0.95	0.95	$ 29,371,152	$ -	0.0%	$ 98.64	$ 2,087,770	7%	$ 26,810,833	$ -	$ 11.8786	$ 0.1298		$ 12.0084
St Lgt	5,577	81	-	$ 9,515,786	$ 9,879,293	$ 9,921,487	$ 266,471	$ 10,187,958	$ 10,771,725	0.96	0.95	0.95	$ 10,187,958	$ -	0.0%	$ 3.18	$ 213,058	2%	$ 9,708,429	$ 0.1196				
Sen Lgt	18,765	11	-	$ 2,387,304	$ 5,197,341	$ 2,489,086	$ 2,753,036	$ 5,242,122	$ 5,307,176	1.02	0.99	0.99	$ 5,242,122	$ -	0.0%	$ 2.99	$ 674,017	27%	$ 1,815,069	$ 0.1700				
USL	5,832	33	-	$ 3,238,727	$ 3,347,464	$ 3,376,808	$ 93,574	$ 3,470,382	$ 3,281,026	1.06	1.06	1.05	$ 3,439,335	$ (31,047)	-0.9%	$ 36.85	$ 2,578,848	77%	$ 766,914	$ 0.0235				
DGen	1,662	31	218,627	$ 6,466,721	$ 6,289,878	$ 6,742,427	$ 82,367	$ 6,824,794	$ 7,595,766	0.87	0.90	0.90	$ 6,824,794	$ -	0.0%	$ 204.64	$ 4,080,847	61%	$ 2,661,579	$ -	$ 12.1741	$ 0.1298		$ 12.3039
ST	924	14,984	30,628,773	$ 65,069,400	$ 66,371,946	$ 67,843,604	$ 1,348,475	$ 69,192,078	$ 79,833,720	0.87	0.87	0.87	$ 69,192,078	$ -	0.0%	N/A *	$ 12,693,691	19%	$ 55,149,913		N/A *			N/A *
AUR	15,622	119	-	$ 5,983,858	$ 6,233,595	$ 6,238,977	$ 277,110	$ 6,516,087	$ 6,972,211	0.93	0.93	0.93	$ 6,516,087	$ -	0.0%	$ 33.28	$ 6,238,977	100%	$ -	$ -				
AUGe	1,404	42	-	$ 1,128,692	$ 1,153,862	$ 1,176,813	$ 35,548	$ 1,212,361	$ 1,498,139	0.80	0.81	0.81	$ 1,212,361	$ -	0.0%	$ 28.80	$ 485,294	41%	$ 691,519	$ 0.0165				
AUGd	208	119	334,687	$ 1,278,622	$ 1,320,347	$ 1,333,135	$ 43,201	$ 1,376,336	$ 1,730,482	0.80	0.80	0.80	$ 1,376,336	$ -	0.0%	$ 174.42	$ 434,310	33%	$ 898,826	$ -	$ 2.6856	$ 0.1298		$ 2.8154
AR	39,401	332	-	$ 18,326,104	$ 18,994,419	$ 19,107,429	$ 765,216	$ 19,872,645	$ 23,236,176	0.85	0.86	0.86	$ 19,872,645	$ -	0.0%	$ 40.41	$ 19,107,429	100%	$ -	$ -				
AGSe	4,203	115	-	$ 4,192,577	$ 4,336,051	$ 4,371,326	$ 121,768	$ 4,493,094	$ 4,957,236	0.91	0.91	0.91	$ 4,493,094	$ -	0.0%	$ 42.06	$ 2,121,408	49%	$ 2,249,918	$ 0.0195				
AGSd	308	227	635,376	$ 3,587,036	$ 3,666,872	$ 3,739,967	$ 96,354	$ 3,836,321	$ 4,834,210	0.80	0.79	0.80	$ 3,867,368	$ 31,047	0.8%	$ 202.16	$ 748,092	20%	$ 3,022,922	$ -	$ 4.7577	$ 0.1298		$ 4.8875
	1,434,135	**33,387**	**40,943,511**	**$ 1,712,682,908**	**$ 1,753,334,405**	**$ 1,785,702,349**	**$ 46,537,073**	**$ 1,832,239,422**	**$ 1,832,239,422**				**$ 1,832,239,422**	**$ (0)**			**$ 1,379,952,020**		**$ 405,750,329**					

*** ST rates are listed in Exhibit L-02-01, Attachment 4**

2025 Adjustments (from 2024 Revenue Requirement) by Rate Class

	2024	2025	% (X)
Revenue Requirement**	$ 1,712,682,908	$ 1,785,702,349	104.26%
Alloc Cost	$ 1,753,334,405	$ 1,832,239,422	104.50%
Misc Revenue	$ 46,455,760	$ 46,537,073	100.18%

** 2024: Revenue with 2024 rates and 2025 charge determinants
2025: 2025 Revenue before rate design adjustments

Total Rev (K+L) $ 1,785,702,349
Misc Rev (C) $ 46,537,073
Total Rev Req $ 1,832,239,422

2026 Rate Design

2026 Rate Design

	Number of Customers	GWh	kWs	Revenue - with 2025 Rates and 2026 Charge Determinants	2025 Revenue	2026 Rates Revenue Requirement	2026 Misc Rev	2026 Total Revenue	2026 Allocated Cost	2025 R/C Ratio	R/C Ratio	Target 2026 R/C Ratio	Total rev to be collected	Shifted Rev	% Change in revenue from rates	Base Fixed Charge ($/month)	Revenue from Fixed Charge	Fixed Rev %	Revenue from Volumetric Charge	Base Volumetric Charge ($/kWh)	Base Volumetric Charge ($/kW)	CSTA Rate Adders ($/kW)	Hopper Foundry Rate Adder ($/kW)	Total Volumetric Charge ($/kW)
				(Y)	(Z)	(A=Y*X_{RevReq})	(B=B_{2025}*$X_{MiscRev}$)	(C=A+B)	(D=D_{2025}*$X_{AllocCost}$)	(E)	(F=C/D)	(G)	(H=DxG)	(I=H-C)	(J=I/C)		(K= (H - B) x M)	(M)	(L=H-B-K)					
UR	255,172	2,030	-	$ 123,400,947	$ 126,669,136	$ 130,160,433	$ 4,588,372	$ 134,748,805	$ 126,091,856	1.06	1.07	1.07	$ 134,748,805	$ -	0.0%	$ 42.51	$ 130,160,433	100%	$ -	$ -				
R1	558,944	5,060	-	$ 460,927,230	$ 470,067,470	$ 486,175,265	$ 12,652,922	$ 498,828,187	$ 430,150,840	1.15	1.16	1.15	$ 494,673,466	$ (4,154,721)	-0.8%	$ 71.86	$ 482,020,543	100%	$ -	$ -				
R2	420,454	4,687	-	$ 703,386,722	$ 716,356,380	$ 741,915,868	$ 15,770,747	$ 757,686,615	$ 789,672,776	0.96	0.96	0.96	$ 757,686,615	$ -	0.0%	$ 147.05	$ 741,915,868	100%	$ -	$ -				
GSe	88,970	1,905	-	$ 175,731,276	$ 181,521,516	$ 185,357,241	$ 3,816,406	$ 189,173,648	$ 193,656,437	0.99	0.98	0.98	$ 189,173,648	$ -	0.0%	$ 35.09	$ 37,462,936	20%	$ 147,894,306	$ 0.0776				
GSd	5,487	2,128	6,821,354	$ 147,414,327	$ 150,624,272	$ 155,489,185	$ 2,265,015	$ 157,754,200	$ 175,752,300	0.91	0.90	0.90	$ 157,754,200	$ -	0.0%	$ 111.65	$ 7,351,060	5%	$ 148,138,125	$ -	$ 21.7168	$ 0.1300	$ 0.0150	$ 21.8618
UGe	18,720	532	-	$ 24,658,828	$ 25,405,320	$ 26,009,555	$ 621,983	$ 26,631,538	$ 28,303,628	0.95	0.94	0.94	$ 26,631,538	$ -	0.0%	$ 27.45	$ 6,167,107	24%	$ 19,842,449	$ 0.0373				
UGd	1,775	864	2,238,837	$ 28,695,055	$ 29,371,152	$ 30,266,873	$ 467,069	$ 30,733,942	$ 32,784,828	0.95	0.94	0.94	$ 30,733,942	$ -	0.0%	$ 102.67	$ 2,186,620	7%	$ 28,080,252	$ -	$ 12.5423	$ 0.1300		$ 12.6723
St Lgt	5,615	80	-	$ 9,812,429	$ 10,187,958	$ 10,349,921	$ 263,381	$ 10,613,301	$ 11,374,856	0.95	0.93	0.93	$ 10,613,301	$ -	0.0%	$ 3.30	$ 222,258	2%	$ 10,127,663	$ 0.1262				
Sen Lgt	18,439	10	-	$ 2,422,767	$ 5,242,122	$ 2,555,478	$ 2,721,111	$ 5,276,589	$ 5,604,336	0.99	0.94	0.94	$ 5,276,589	$ -	0.0%	$ 3.13	$ 691,995	27%	$ 1,863,483	$ 0.1799				
USL	5,869	33	-	$ 3,363,097	$ 3,470,382	$ 3,547,316	$ 92,488	$ 3,639,805	$ 3,464,738	1.05	1.05	1.05	$ 3,639,805	$ -	0.0%	$ 38.82	$ 2,734,202	77%	$ 813,114	$ 0.0249				
DGen	1,748	32	223,062	$ 7,007,588	$ 6,824,794	$ 7,391,440	$ 81,411	$ 7,472,852	$ 8,021,069	0.90	0.93	0.93	$ 7,472,852	$ -	0.0%	$ 213.30	$ 4,473,662	61%	$ 2,917,778	$ -	$ 13.0806	$ 0.1300		$ 13.2106
ST	931	14,957	30,574,766	$ 67,842,486	$ 69,192,078	$ 71,558,668	$ 1,332,837	$ 72,891,505	$ 84,303,777	0.87	0.86	0.91	$ 76,998,361	$ 4,106,856	5.6%	N/A *	$ 14,157,189	19%	$ 61,508,334		N/A *			N/A *
AUR	15,690	120	-	$ 6,265,770	$ 6,516,087	$ 6,608,988	$ 273,896	$ 6,882,884	$ 7,362,600	0.93	0.93	0.93	$ 6,882,884	$ -	0.0%	$ 35.10	$ 6,608,988	100%	$ -	$ -				
AUGe	1,416	42	-	$ 1,189,360	$ 1,212,361	$ 1,254,510	$ 35,136	$ 1,289,645	$ 1,582,023	0.81	0.82	0.82	$ 1,289,645	$ -	0.0%	$ 30.45	$ 517,334	41%	$ 737,175	$ 0.0174				
AUGd	208	119	334,742	$ 1,333,488	$ 1,376,336	$ 1,406,532	$ 42,700	$ 1,449,232	$ 1,827,375	0.80	0.79	0.80	$ 1,461,900	$ 12,669	0.9%	$ 185.59	$ 462,348	33%	$ 956,852	$ -	$ 2.8585	$ 0.1300		$ 2.9885
AR	39,591	330	-	$ 19,198,258	$ 19,872,645	$ 20,249,874	$ 756,343	$ 21,006,216	$ 24,537,218	0.86	0.86	0.86	$ 21,006,216	$ -	0.0%	$ 42.62	$ 20,249,874	100%	$ -	$ -				
AGSe	4,193	114	-	$ 4,344,345	$ 4,493,094	$ 4,582,314	$ 120,356	$ 4,702,670	$ 5,234,802	0.91	0.90	0.90	$ 4,702,670	$ -	0.0%	$ 44.19	$ 2,223,801	49%	$ 2,358,513	$ 0.0206				
AGSd	311	225	629,258	$ 3,748,165	$ 3,836,321	$ 3,953,476	$ 95,236	$ 4,048,713	$ 5,104,887	0.80	0.79	0.80	$ 4,083,910	$ 35,197	0.9%	$ 212.05	$ 791,271	20%	$ 3,197,403	$ -	$ 5.0812	$ 0.1300		$ 5.2112
	1,443,532	**33,269**	**40,822,018**	**$ 1,790,742,138**	**$ 1,832,239,422**	**$ 1,888,832,937**	**$ 45,997,410**	**$ 1,934,830,346**	**$ 1,934,830,346**				**$ 1,934,830,346**	**$ (0)**			**$ 1,460,397,490**		**$ 428,435,447**					

*** ST rates are listed in Exhibit L-02-01, Attachment 4**

2026 Adjustments (from 2025 Revenue Requirement) by Rate Class

	2025	2026	% (X)
Revenue Requirement**	$ 1,790,742,138	$ 1,888,832,937	105.48%
Alloc Cost	$ 1,832,239,422	$ 1,934,830,346	105.60%
Misc Revenue	$ 46,537,073	$ 45,997,410	98.84%

** 2025: Revenue with 2025 rates and 2026 charge determinants
2026: 2026 Revenue before rate design adjustments

Total Rev (K+L) $ 1,888,832,937
Misc Rev (C) $ 45,997,410
Total Rev Req $ 1,934,830,346

2027 Rate Design

	Number of Customers	GWh	kWs	Revenue - with 2026 Rates and 2027 Charge Determinants	2026 Revenue	2027 Rates Revenue Requirement	2027 Misc Rev	2027 Total Revenue	2027 Allocated Cost	2026 R/C Ratio	2027 R/C Ratio	Target 2026 R/C Ratio	Total rev to be collected	Shifted Rev	% Change in revenue from rates	Base Fixed Charge ($/month)	Revenue from Fixed Charge	Fixed Rev %	Revenue from Volumetric Charge	Base Volumetric Charge ($/kWh)	Base Volumetric Charge ($/kW)	CSTA Rate Adders ($/kW)	Hopper Foundry Rate Adder ($/kW)	Total Volumetric Charge ($/kW)
				(Y)	(Z)	(A=Y*X_{RevReq})	(B=B_{2026}*$X_{MiscRev}$)	(C=A+B)	(D=D_{2026}*$X_{AllocCost}$)	(E)	(F=C/D)	(G)	(H=DxG)	(I=H-C)	(J=I/C)		(K= (H - B) x M)	(M)	(L=H-B-K)					
UR	257,972	2,050	-	$ 131,596,500	$ 134,748,805	$ 137,254,583	$ 4,597,131	$ 141,851,715	$ 131,944,260	1.07	1.08	1.08	$ 141,851,715	$ -	0.0%	$ 44.34	$ 137,254,583	100%	$ -	$ -				
R1	563,326	5,096	-	$ 485,767,074	$ 498,828,187	$ 506,652,968	$ 12,677,077	$ 519,330,045	$ 450,115,780	1.15	1.15	1.15	$ 519,330,045	$ -	0.0%	$ 74.95	$ 506,652,968	100%	$ -	$ -				
R2	422,190	4,681	-	$ 744,995,694	$ 757,686,615	$ 777,027,304	$ 15,800,854	$ 792,828,158	$ 826,324,501	0.96	0.96	0.96	$ 792,828,158	$ -	0.0%	$ 153.37	$ 777,027,304	100%	$ -	$ -				
GSe	89,067	1,892	-	$ 184,413,644	$ 189,173,648	$ 192,342,637	$ 3,823,692	$ 196,166,329	$ 202,644,770	0.98	0.97	0.97	$ 196,166,329	$ -	0.0%	$ 36.37	$ 38,874,768	20%	$ 153,467,869	$ 0.0811				
GSd	5,536	2,129	6,824,946	$ 155,632,898	$ 157,754,200	$ 162,324,443	$ 2,269,339	$ 164,593,781	$ 183,909,634	0.90	0.89	0.89	$ 164,593,781	$ -	0.0%	$ 115.53	$ 7,674,211	5%	$ 154,650,232	$ -	$ 22.6596	$ 0.1301	$ 0.0157	$ 22.8054
UGe	18,824	532	-	$ 26,031,099	$ 26,631,538	$ 27,150,324	$ 623,170	$ 27,773,494	$ 29,617,308	0.94	0.94	0.94	$ 27,773,494	$ -	0.0%	$ 28.50	$ 6,437,594	24%	$ 20,712,730	$ 0.0389				
UGd	1,786	866	2,237,252	$ 30,260,961	$ 30,733,942	$ 31,562,052	$ 467,961	$ 32,030,013	$ 34,306,497	0.94	0.93	0.93	$ 32,030,013	$ -	0.0%	$ 106.38	$ 2,280,190	7%	$ 29,281,862	$ -	$ 13.0883	$ 0.1301		$ 13.2184
St Lgt	5,654	80	-	$ 10,304,371	$ 10,613,301	$ 10,747,414	$ 263,883	$ 11,011,298	$ 11,902,806	0.93	0.93	0.93	$ 11,011,298	$ -	0.0%	$ 3.40	$ 230,794	2%	$ 10,516,620	$ 0.1317				
Sen Lgt	18,117	10	-	$ 2,501,438	$ 5,276,589	$ 2,608,989	$ 2,726,305	$ 5,335,294	$ 5,864,454	0.94	0.91	0.91	$ 5,335,294	$ -	0.0%	$ 3.25	$ 706,486	27%	$ 1,902,504	$ 0.1880				
USL	5,906	33	-	$ 3,570,783	$ 3,639,805	$ 3,724,312	$ 92,665	$ 3,816,977	$ 3,625,550	1.05	1.05	1.04	$ 3,768,993	$ (47,983)	-1.3%	$ 39.98	$ 2,833,642	77%	$ 842,686	$ 0.0256				
DGen	1,834	33	229,085	$ 7,689,853	$ 7,472,852	$ 8,020,483	$ 81,567	$ 8,102,050	$ 8,393,358	0.93	0.97	0.97	$ 8,102,050	$ -	0.0%	$ 220.62	$ 4,854,390	61%	$ 3,166,093	$ -	$ 13.8206	$ 0.1301		$ 13.9507
ST	938	15,023	30,709,901	$ 76,043,795	$ 72,891,505	$ 79,313,351	$ 1,335,382	$ 80,648,732	$ 88,216,637	0.91	0.91	0.91	$ 80,648,732	$ -	0.0%	N/A *	$ 14,839,706	19%	$ 64,473,645		N/A *			N/A *
AUR	15,756	121	-	$ 6,636,434	$ 6,882,884	$ 6,921,772	$ 274,419	$ 7,196,191	$ 7,704,326	0.93	0.93	0.93	$ 7,196,191	$ -	0.0%	$ 36.61	$ 6,921,772	100%	$ -	$ -				
AUGe	1,427	43	-	$ 1,269,723	$ 1,289,645	$ 1,324,316	$ 35,203	$ 1,359,519	$ 1,655,451	0.82	0.82	0.82	$ 1,359,519	$ -	0.0%	$ 31.89	$ 546,121	41%	$ 778,195	$ 0.0181				
AUGd	208	119	334,386	$ 1,418,398	$ 1,449,232	$ 1,479,383	$ 42,781	$ 1,522,165	$ 1,912,191	0.80	0.80	0.80	$ 1,522,165	$ -	0.0%	$ 193.37	$ 481,954	33%	$ 997,429	$ -	$ 2.9829	$ 0.1301		$ 3.1130
AR	39,777	327	-	$ 20,343,779	$ 21,006,216	$ 21,218,474	$ 757,786	$ 21,976,261	$ 25,676,084	0.86	0.86	0.86	$ 21,976,261	$ -	0.0%	$ 44.45	$ 21,218,474	100%	$ -	$ -				
AGSe	4,183	113	-	$ 4,549,508	$ 4,702,670	$ 4,745,118	$ 120,586	$ 4,865,703	$ 5,477,769	0.90	0.89	0.89	$ 4,865,703	$ -	0.0%	$ 45.88	$ 2,302,810	49%	$ 2,442,308	$ 0.0216				
AGSd	313	223	622,315	$ 3,959,804	$ 4,048,713	$ 4,130,058	$ 95,418	$ 4,225,476	$ 5,341,825	0.80	0.79	0.80	$ 4,273,460	$ 47,983	1.1%	$ 220.33	$ 828,838	20%	$ 3,349,204	$ -	$ 5.3819	$ 0.1301		$ 5.5120
	1,452,813	**33,370**	**40,957,884**	**$ 1,896,985,756**	**$ 1,934,830,346**	**$ 1,978,547,982**	**$ 46,085,219**	**$ 2,024,633,200**	**$ 2,024,633,200**				**$ 2,024,633,200**	**$ (0)**			**$ 1,531,966,605**		**$ 446,581,377**					

*** ST rates are listed in Exhibit L-02-01, Attachment 4**

2027 Adjustments (from 2026 Revenue Requirement) by Rate Class

	2026	2027	% (X)
Revenue Requirement**	$ 1,896,985,756	$ 1,978,547,982	104.30%
Alloc Cost	$ 1,934,830,346	$ 2,024,633,200	104.64%
Misc Revenue	$ 45,997,410	$ 46,085,219	100.19%

** 2026: Revenue with 2026 rates and 2027 charge determinants
2027: 2027 Revenue before rate design adjustments

Total Rev (K+L) $ 1,978,547,982
Misc Rev (C) $ 46,085,219
Total Rev Req $ 2,024,633,200

Derivation of ST Common Line Charge

	2023				2024				2025				2026				2027			
Minus	Billing Quantity (Annual)	Rates		Revenue Generated (Annual)	Billing Quantity (Annual)	Rates		Revenue Generated (Annual)	Billing Quantity (Annual)	Rates		Revenue Generated (Annual)	Billing Quantity (Annual)	Rates		Revenue Generated (Annual)	Billing Quantity (Annual)	Rates		Revenue Generated (Annual)
HVDS-high cost allocation	1,121,798	2.8204	$/kW	$ 3,163,919	1,122,897	2.8204	$/kW	$ 3,167,017	1,121,850	2.8204	$/kW	$ 3,164,065	1,119,871	2.8204	$/kW	$ 3,158,485	1,124,821	2.8204	$/kW	$ 3,172,445
HVDS-low cost allocation	65,583	4.7211	$/kW	$ 309,622	65,647	4.8129	$/kW	$ 315,952	65,586	4.8995	$/kW	$ 321,337	65,470	5.1382	$/kW	$ 336,398	65,759	5.2374	$/kW	$ 344,408
LVDS-low cost allocation	677,580	1.9007	$/kW	$ 1,287,875	678,243	1.9925	$/kW	$ 1,351,400	677,611	2.0791	$/kW	$ 1,408,821	676,416	2.3178	$/kW	$ 1,567,797	679,406	2.4170	$/kW	$ 1,642,123
Specific ST lines	723	599.6911	$/kM	$ 433,728	723	629.2887	$/kM	$ 455,134	723	656.0271	$/kM	$ 474,473	723	730.0404	$/kM	$ 528,003	723	764.6504	$/kM	$ 553,035
Plus:				$ -				$ -				$ -								
Service Charge (per Delivery Point)	10,920	794.70	$	$ 8,678,124	11,004	828.38	$	$ 9,115,494	11,088	857.73	$	$ 9,510,545	11,172	949.43	$	$ 10,607,032	11,256	987.78	$	$ 11,118,452
Meter Charge (for Hydro One ownership per Meter Point)	7,296	398.10	$	$ 2,904,538	7,352	414.96	$	$ 3,050,972	7,409	429.66	$	$ 3,183,146	7,465	475.59	$	$ 3,550,136	7,521	494.80	$	$ 3,721,304
Total revenue generated through other delivery charges:				$ 16,777,806				$ 17,455,969				$ 18,062,386				$ 19,747,852				$ 20,551,768
Revenue to be recovered through ST rates				$ 61,905,182				$ 65,025,828				$ 67,843,604				$ 75,665,523				$ 79,313,351
ST Common Line Revenue Requirement (Annual $)				$ 45,127,376				$ 47,569,859				$ 49,781,218				$ 55,917,671				$ 58,761,582
ST Common Line Charge Determinant (Annual kM)	30,084,988				30,114,453				30,086,375				30,033,324				30,166,067			
ST Common Line Charge (Monthly $/kW)	**$ 1.5000**				**$ 1.5796**				**$ 1.6546**				**$ 1.8619**				**$ 1.9479**			

Derivation of Facility Charge for connection to Low Voltage Distribution Station (LVDS Low)

		2023		2024	2025	2025	2027
Proportion of Total Forecast Costs associated with ST share of LVDS-low stations		1.53%					
		Allocation to ST rate class (2023 CAM O4 Sheet)	Proportion of allocation to ST rate class associated with LVDS-low				
USoA	**Account**						
5005	Operation Supervision and Engineering	$ 123,892	$ 1,900				
5012	Station Buildings and Fixtures Expense [exclude - no "bldgs" at LVDSs]	$ -	$ -				
5016	Distribution Station Equipment - Operation Labour	$ 101,690	$ 101,690				
5017	Distribution Station Equipment - Operation Supplies and Expenses	$ 30,243	$ 30,243				
5105	Maintenance Supervision and Engineering	$ 487,362	$ 7,475				
5110	Maintenance of Buildings and Fixtures - Distribution Stations	$ 109,648	$ 109,648				
5114	Maintenance of Distribution Station Equipment	$ 242,168	$ 242,168				
5405 to 5680	25 General Admin. Acc'ts (12 non-zero)	$ 5,459,532	$ 83,732				
	Other ("NIDIT") "expenses"						
3046	Net Inc (Balance Transferred From Income)	$ 15,565,424	$ 238,725				
5705	Amortization Expense - Property, Plant, and Equipment	$ 17,757,089	$ 272,338				
6005	Interest on Long Term Debt	$ 10,925,406	$ 167,561				
6105	Taxes Other Than Income Taxes	$ 313,709	$ 4,811				
6110	Income Taxes	$ 1,797,362	$ 27,566				
**Note: USofA 5016, 5017 & 5114 are wholly recovered by the LVDS Low tariff							
	Change in Service Revenue Requirement allocated to the ST rate class			4.9%	4.2%	11.3%	4.7%
	Total LVDS Low Revenue Requirement (Annual $)		**$ 1,287,857**	**$ 1,351,419**	**$ 1,408,840**	**$ 1,567,787**	**$ 1,642,113**
	Total LVDS Low Charge Determinant (Annual kW)		**677,580**	**678,243**	**677,611**	**676,416**	**679,406**
	LVDS Low Rate (Monthly, $/kW)		1.9007	1.9925	2.0791	2.3178	2.4170

Derivation of Facility Charge for connection to Specific ST Lines

		2023	
		Total	Assigned to Lines
	Costs: di Lines - 50kV to 750V	$ 209,246,059	$ 209,246,059
	Costs: di General + di Remainder	$ 89,511,439	
	Costs: cu group (excluding customer premise costs)	$ 100,293,115	
	Proportion of Total (di+cu) Costs allocated to ST Lines		52.4%
	Expenses		
di	Distribution Costs (di)	$ 298,757,498	$ 209,246,059
cu	Customer Related Costs (cu)	$ 140,512,737	
ad	General and Administration (ad)	$ 183,294,390	$ 96,112,191
dep	Depreciation and Amortization (dep)	$ 465,112,704	$ 243,886,357
INPUT	PILs (INPUT)	$ 36,189,414	$ 18,976,270
INT	Interest	$ 219,980,151	$ 115,348,726
	Direct Allocation	$ 11,805,407	$ -
NI	Allocated Net Income (NI)	$ 313,405,673	$ 164,337,304
	Total Revenue Requirement (includes NI)	$ 1,669,057,975	$ 847,906,908

	2023	**2024**
Change in Service Revenue Requirement allocated to the ST rate class		4.9%
Specific Line Rates Calculation		
Annual costs associated with all HON "50 kV to 750 V" Line Assets	$ 847,906,908	$ 889,755,216
Total Length 44 kV to 13.8 kV inclusive (2020 Actual, kM)	30,016	
Total Length 12.5 to 4.16 kV inclusive (2020 Actual, weighted kM)	87,809	
Total km of 50kV-to-4.16kV line (Actual 2020, kM)	117,826	117,826
ST Specific Line Rate (Monthly, per kM)	$ 599.6911	$ 629.2887

2023 BILL IMPACTS

This exhibit has been filed separately in MS Excel format.

2024 BILL IMPACTS

This exhibit has been filed separately in MS Excel format.

2025 BILL IMPACTS

This exhibit has been filed separately in MS Excel format.

2026 BILL IMPACTS

This exhibit has been filed separately in MS Excel format.

2027 BILL IMPACTS

This exhibit has been filed separately in MS Excel format.

O - SCHOOL ENERGY COALITION INTERROGATORY - 253

Reference:

Exhibit O-1-2, Page 17, 37, 39

Interrogatory:

Hydro One proposes to update the 2022 and 2023 inflation numbers at the DRO stage, but to cap the cumulative inflation for those years at 10%. Please update the Custom IR tables (i.e. Tables 26 and 28) to reflect a 10% cumulative inflation over 2022 and 2023. Please also provide the tables in Excel format.

Response:

Please note, there are various scenarios to achieve the 10% cap depending on the results of inflation at the time of the DRO. Please see below an illustrative example where the 10% inflation cap is met, hypothetically with a 7% inflation in 2022 and 3% inflation in 2023 (consistent with the scenario outlined on Page 17 of Exhibit O-01-02). These tables have been provided in Excel format as Attachment 1 to this response.

Revised Table 26 - Summary of Revenue Requirement Components for Hydro One Transmission ($M)

Line	Transmission	2023	2024	2025	2026	2027
1	Rate Base	14,619.4	15,544.4	16,642.8	17,690.2	18,650.9
2	Return on Debt	340.1	361.7	387.2	411.6	433.9
3	Return on Equity	487.7	518.6	555.2	590.1	622.2
4	Depreciation (note 1)	533.5	564.8	604.1	638.1	662.4
5	Income Taxes	39.4	69.6	58.1	80.0	80.6
6	**Total Capital Related Revenue Requirement**	**1,400.8**	**1,514.6**	**1,604.6**	**1,719.9**	**1,799.2**
7	Less Working Capital Related Revenue Requirement		2.40	2.39	2.47	2.49
8	**Total Capital Related Revenue Requirement (excluding working capital)**	**1,400.8**	**1,512.2**	**1,602.2**	**1,717.4**	**1,796.7**
9	Less Productivity Factor on Capital (0.00%+0.15%)		(2.3)	(2.4)	(2.6)	(2.7)
10	Less Prior Year Productivity Factor on Capital			(2.3)	(4.7)	(7.2)
11	Less Removing Working Capital from Capital Factor		(0.1)	(0.0)	(0.1)	(0.0)
12	**Total Capital Related Revenue Requirement (excluding working capital and Productivity)**	**1,400.8**	**1,512.3**	**1,599.9**	**1,712.6**	**1,789.3**
13	OM&A (note 1)	459.5	468.7	478.0	487.6	497.4
14	**Total Revenue Requirement**	**1,860.3**	**1,980.9**	**2,078.0**	**2,200.2**	**2,286.6**
15	Increase in Capital Related Revenue Requirement		111.5	87.6	112.7	76.7
16	Increase in Capital Related Revenue Requirement as a percentage of Previous Year Total Revenue Requirement		5.99%	4.42%	5.42%	3.49%
17	Less Capital Related Revenue Requirement in I-X		1.51%	1.53%	1.54%	1.56%
18	**Capital Factor**		**4.49%**	**2.90%**	**3.88%**	**1.93%**

Note 1: The OM&A and Depreciation lines reflect the Proposed PCB Treatment

Revised Table 28 - Summary of Revenue Requirement Components for Hydro One Distribution ($M)

Line	Distribution	2023	2024	2025	2026	2027
1	Rate Base	9,404.2	10,060.2	10,815.9	11,551.8	12,198.8
2	Return on Debt	220.2	235.6	253.3	270.5	285.6
3	Return on Equity	313.7	335.6	360.8	385.4	407.0
4	Depreciation (note 1)	467.2	491.2	535.8	574.5	613.1
5	Income Taxes	35.8	53.6	39.6	57.2	67.1
6	**Total Capital Related Revenue Requirement**	**1,036.9**	**1,115.9**	**1,189.5**	**1,287.5**	**1,372.8**
7	Less Working Capital Related Revenue Requirement		17.5	17.6	17.8	18.0
8	**Total Capital Related Revenue Requirement (excluding working capital)**	**1,036.9**	**1,098.4**	**1,171.8**	**1,269.8**	**1,354.8**
9	Less Productivity Factor on Capital (0.30%+0.15%)		(4.9)	(5.3)	(5.7)	(6.1)
10	Less Prior Year Productivity Factor on Capital			(4.9)	(10.2)	(15.9)
11	Less Removing Working Capital from Capital Factor		0.2	0.4	0.6	0.8
12	**Total Capital Related Revenue Requirement (excluding working capital and Productivity)**	**1,036.9**	**1,111.1**	**1,179.7**	**1,272.2**	**1,351.5**
13	OM&A (note 1)	647.5	659.8	672.4	685.2	698.2
14	**Total Revenue Requirement**	**1,684.5**	**1,771.0**	**1,852.1**	**1,957.4**	**2,049.7**
15	Increase in Capital Related Revenue Requirement		74.2	68.5	92.6	79.3
16	Increase in Capital Related Revenue Requirement as a percentage of Previous Year Total Revenue Requirement		4.41%	3.87%	5.00%	4.05%
17	Less Capital Related Revenue Requirement in I-X		1.17%	1.19%	1.21%	1.23%
18	**Capital Factor**		**3.24%**	**2.68%**	**3.79%**	**2.82%**

Note 1: The OM&A and Depreciation lines reflect the Proposed PCB Treatment

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SUMMARY OF REVENUE REQUIREMENT COMPONENTS FOR HYDRO ONE DISTRIBUTION AND TRANSMISSION

This exhibit has been filed separately in MS Excel format.

O - SCHOOL ENERGY COALITION INTERROGATORY - 254

Reference:

Exhibit O-1-2, Page 18

Interrogatory:

For each of Hydro One's transmission and distribution business, and for each of capital and OM&A please provide for, for each year between 2021 and 2027, the annual budgets/actuals broken down into the following categories:

a) Labour costs subject to existing collective agreements

b) All other labour costs

c) Non-labour costs subject to existing fixed price contracts

d) Non-labour costs subject to existing variable price contracts

e) All other costs

Response:

The requested tables for transmission capital, distribution capital, transmission OM&A, and distribution OM&A are provided below in Tables 1 through 4. Hydro One has provided notes on the underlying assumptions for each category grouping below the tables.

Table 1 – Transmission Capital Expenditures by Category for 2021-2027 ($M)

	Actual	Forecast	Forecast with Inflation Update				
Category	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
(a)	411.1	418.0	435.6	447.1	457.0	468.5	480.7
(b)	50.8	60.2	62.5	63.7	65.2	67.2	69.0
(c)+(d)+(e)	825.1	701.5	935.9	953.1	928.3	926.1	898.6
Inflation Update	-	-	75.3	76.8	76.1	76.7	76.0
Total Transmission Capital	**1287.0**	**1179.7**	**1509.3**	**1540.7**	**1526.6**	**1538.5**	**1524.3**

Table 2 – Distribution Capital Expenditures by Category for 2021-2027 ($M)

Category	Actual 2021	Forecast 2022	Forecast with Inflation Update 2023	2024	2025	2026	2027
(a)	346.3	352.8	362.3	370.6	380.3	398.9	407.1
(b)	36.7	42.4	43.8	44.8	45.5	46.8	48.3
(c)+(d)+(e)	379.8	269.4	599.0	612.5	695.1	626.0	615.6
Inflation Update	-	-	52.8	54	58.8	56.2	56.2
Total Distribution Capital	**762.8**	**664.6**	**1057.9**	**1081.9**	**1179.7**	**1127.9**	**1127.2**

Table 3 – Transmission OM&A Expenses ($M)

Category	Actual 2021	Forecast 2022	Forecast with Inflation Update 2023
(a)	148.3	165.2	171.1
(b)	18.3	23.8	24.6
(c)+(d)+(e)	235.2	204.4	224.8
Inflation Update	-	-	22.1
Total Transmission OM&A	**401.8**	**393.4**	**442.6**

Table 4 – Distribution OM&A Expenses ($M)

Category	Actual 2021	Forecast 2022	Forecast with Inflation Update 2023
(a)	333.9	338.6	349.4
(b)	35.3	40.7	42.3
(c)+(d)+(e)	213.1	156.5	205.8
Inflation Update	-	-	31.4
Total Distribution OM&A	**582.3**	**535.8**	**628.9**

Notes by Category:

a)+b)

To capture total compensation costs subject to collective agreements, Hydro One leveraged the data in Exhibit E-06-01-2A. Hydro One compared total costs related to represented workforces (SUP, PWU, Casual Trades) to total costs for Management and Non-Represented employees (all other labour costs) to determine the percentage of total costs that are subject to existing agreements. On average, costs related to unionized employees are approximately 90% of all compensation costs in E-06-01-02A. Hydro One then applied these percentage splits

(unionized & MGT N-R compensation costs), to the total OM&A and Capital compensation dollars to populate rows (a) and (b) in the tables above.

c) + d) + e)

This category grouping represents Hydro One's non-labour costs, including items such as, but not limited to, purchased goods and services, interest capitalized, capitalized depreciation, insurance costs, and property taxes.

Hydro One does not separate its non-labour contract costs by pricing structure, i.e., variable or fixed price. Contracts are fixed price at the time of signing and contain pre-determined price adjustment mechanisms to allow Hydro One to mitigate short-term commodity fluctuation risks. These long-term contracts differ by each category/supplier, however each contract contains:

- Defined Formula & Industry References –
    - All price adjustment clauses contain details regarding the commodity, contributions to overall price, and references to open market indices to manage change.
- Price Adjustment Frequency -
    - Quarterly, Semi-Annual, Annually where price adjustments differ by category and supplier.

Inflation Update

This represents the incremental costs associated with Hydro One's Inflation Update, as presented in Exhibit O-01-02, Section 2.3, Table 3 (OM&A) and Table 4 (Capital).

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O - SCHOOL ENERGY COALITION INTERROGATORY - 255

Reference:

Exhibit O-1-2, Page 37, 39

Interrogatory:

Hydro One has used the 2020 OEB Inflation Factor, in the calculation of the 2024-2027 C-Factor for each of transmission and distribution business:

a) Please explain why Hydro One has not updated the amount to reflect the OEB's more up to date Inflation Factor.

b) Does Hydro One plan to update that Inflation Factor as part of the DRO stage in this proceeding (for example, to reflect the OEB's 2022 Inflation Factor)?

Response:

a) The current inflationary update is reflective of revised 2023-2027 capital and 2023 OM&A amounts that were updated using the inflation forecasts provided by Scotiabank to establish the most appropriate costs for the application period. As Hydro One is not proposing any changes to its Custom IR framework relative to the as-filed application, Hydro One did not update any other parameters of the Custom IR tables at this point.

b) At the time of the DRO, Hydro One intends to update the Custom IR tables to reflect the most recent OEB issued inflation factor to establish 2024-2027 revenue requirement. As part of the annual update for each of 2024-2027, the inflation factor will be updated to reflect the most up to date inflation factor issued by the OEB, as outlined in Exhibit A-04-01.

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O - SCHOOL ENERGY COALITION INTERROGATORY - 256

Reference:

Exhibit O-1-2, Attachment 4A

Interrogatory:

In Attachment 4A (Revised Appendix 2-AB), Hydro One states in a footnote that for the system service category, the 2019-2022 actuals exclude certain new transmission facilities. For each year between 2019 and 2022, please provide the total expenditures for these same new facilities, included in the 'plan' amounts.

Response:

The following 'plan' amounts were included in the EB-2019-0082 filing for the three named transmission facilities. 2019 did not have 'plan' amounts.

($ Millions)	2019	2020	2021	2022
Chatham x Lakeshore (West of Chatham)	-	5.4	7.8	15.3
Lambton x Chatham (West of London)	-	-	-	-
Waasigan (Northwest Bulk)	-	14.0	15.0	14.0

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O - SCHOOL ENERGY COALITION INTERROGATORY - 257

Reference:

Exhibit O-1-2, Attachment 1

Interrogatory:

With respect to the Scotiabank Inflation Report:

a) [p.2] Please provide further details regarding the Scotiabank model used to forecast CPI, including details regarding how to the model calculates the forecast, and a list of all assumptions and input used, and the basis for them.

b) [p.2] Please provide Chart 3 in tabular form.

c) [p.2] Scotiabank states that "the resulting model offers a reasonable statistical 'fit' to actual recent inflation." Please provide the R^2 calculation and other metrics used to measure statistical fit.

d) Please provide Scotiabank's most up to date inflation forecast for each year between 2022 and 2027.

Response:

Responses from Scotiabank:

a) We use our proprietary semi-structural Canada/US Scotiabank Macroeconomic Model to jointly forecast many aspects of the Canadian and US economies including real GDP (and its components for Canada), interest rates, the exchange rate, inflation, and wages. This model is similar to the Bank of Canada's Global IMPACT model, the Bank of Canada's Canadian model LENS and the Board of Governor of the Federal Reserve's US model FRB/US. Our fully estimated Canada/US macroeconomic model includes 300 equations that are jointly determined and forecasted but are estimated separately.

In our Scotiabank Canada/US Macroeconomic Model, we forecast three different measures of Canadian core CPI inflation (CPI excluding food, energy, and taxes, CPI-Common and the average of CPI-Trim, CPI Common and CPI-Median) using our Augmented Phillips Curve Framework. The inputs of this approach are:

i. lagged inflation to account for backward looking expectations,
ii. lead inflation to account for forward looking expectations,
iii. the inflation target to take into account static inflation expectations anchored on the Bank of Canada inflation target,
iv. lagged output gap which captures demand pull inflation,
v. lagged growth of unit labour cost as a measure of cost pushed inflation pressures,
vi. lagged PMI supplier deliveries index to consider issues in the supply chains,
vii. lagged growths of the price of oil (both WTI and WCS) and of the real exchange rate to capture the cost of inputs and imported goods and,
viii. lagged US core PCE inflation in deviation of the inflation target to account for imported inflation pressures.

Total CPI is forecasted using:

ix. contemporaneous values of CPI-Common and CPI excluding food, energy and taxes forecasted as previously described (pass-trough from core to total CPI),
x. lagged growth of the price of oil,
xi. lagged PMI supplier deliveries index.

The Total CPI equation is also fully estimated. It is important to note that other equations of our Macroeconomic Model simultaneously and endogenously forecast various inputs of inflation like the output gap, the exchange rate, Unit labour cost, US core inflation and the PMI supplier deliveries. The price of oil is exogenously forecasted and imposed on the model. Finally, we are assuming that covid related supply chain disruptions (which affect the PMI supplier deliveries) will gradually disappear over the course of 2022. In the model, more persistent supply chains problems will generate more inflation, less household purchasing power, a more aggressive policy rate tightening, and lower growth (mostly in 2023).

b) Please see Attachment 1

c) We use several tools to measure the fit or the forecasting performance of the model. When estimating the various CPI measures we look at the R^2 and more importantly at dynamic simulation exercises of the various inflation equations taken separately over the recent history. At the time of the last re-estimation the R^2 for the total CPI equation was 81%. The R^2 includes the post COVID period which was challenging to forecast. Chart 1 (Attachment 2) shows the dynamic simulations for total CPI. We see that even if we cumulate the forecasting errors across history (dynamic simulation as opposed to fit) our equations do well at tracking the movements of total CPI. This is a more difficult test to pass than a simple fit.

d) Ontario CPI Forecast (April Forecast)

- 2022: 6.2%
- 2023: 3.3%
- 2024: 2.0%
- 2025: 2.0%
- 2026: 2.0%
- 2027: 2.0%

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SCOTIABANK CONSENSUS MEAN

This exhibit has been filed separately in MS Excel format.

SCOTIABANK TOTAL CPI INFLATION DYNAMIC SIMULATION OVER THE 2017-2021

This exhibit has been filed separately in MS Excel format.

O - SCHOOL ENERGY COALITION INTERROGATORY - 258

Reference:

Exhibit O-1-2, Attachment 2

Interrogatory:

Please expand Attachment 2 to include 2017-2022 information (2017-2020 actuals and forecast 2022 information). Please provide an Excel version in your response.

Response:

Data prior to 2018 is not readily available; please refer to Attachment 1 for the 2018-2021 actual amounts and the as-filed 2022 forecast.

Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

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ISD	Investment Name	Historical Actual ($M)				Bridge (As Filed)	Forecast Period (As Filed) $M					Forecast Period (Updated Inflation) $M					Increase from As-Filed Evidence ($M)				
		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2023	2024	2025	2026	2027	2023	2024	2025	2026	2027
System Access																					
T-SA-01	New Customer Connection Station	-	-	-	-	7.2	13.5	13.5	-	-	-	14.2	14.2	-	-	-	0.7	0.7	-	-	-
T-SA-02	IAMGOLD - 115 kV Mine Connection	0.0	(0.0)	1.4	24.2	10.4	10.0	-	-	-	-	10.5	-	-	-	-	0.5	-	-	-	-
T-SA-03	Halton TS: Build a Second 230/27.6kV Station	-	-	-	-	(0.0)	-	1.5	4.5	1.9	0.0	-	1.6	4.8	2.0	0.1	-	0.1	0.2	0.1	0.0
T-SA-04	Connect Metrolinx Traction Substations	0.0	(0.0)	-	-	-	3.5	3.6	0.8	-	-	3.7	3.8	0.9	-	-	0.2	0.2	0.0	-	-
T-SA-05	Future Transmission Load Connection Plans	-	-	-	-	-	3.1	5.2	9.4	10.4	10.4	3.3	5.5	9.9	11.0	11.0	0.2	0.3	0.5	0.5	0.5
T-SA-06	Protection and Control Modifications for Distributed Generation	0.0	(0.0)	0.1	(0.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T-SA-07	Secondary Land Use Projects	3.7	5.0	(1.6)	16.4	5.5	37.8	2.8	2.8	0.8	0.8	39.8	3.0	3.0	0.9	0.9	2.0	0.1	0.1	0.0	0.0
T-SA-08	H29/H30: Reconductor 230kV Circuits	-	-	-	-	-	0.2	0.4	0.3	2.1	2.3	0.2	0.4	0.3	2.2	2.4	0.0	0.0	0.0	0.1	0.1
T-SA-09	New Transformer Station in Northern York Region	-	-	-	-	-	-	-	5.6	3.7	2.4	-	-	5.9	3.9	2.5	-	-	0.3	0.2	0.1
T-SA-10	Build Leamington Area Transformer Stations	-	-	-	0.1	1.0	7.6	40.9	33.5	14.5	32.6	8.0	43.0	35.3	15.3	34.3	0.4	2.1	1.8	0.8	1.7
System Access Projects and Programs Less Than Materiality Threshold		29.9	41.3	19.6	29.1	7.3	3.7	2.9	2.9	3.0	1.5	3.9	3.1	3.0	3.2	1.6	0.2	0.2	0.2	0.2	0.1
Total System Access		**33.7**	**46.2**	**19.5**	**69.9**	**31.5**	**79.4**	**70.9**	**59.8**	**36.5**	**50.1**	**83.6**	**74.6**	**63.0**	**38.4**	**52.8**	**4.2**	**3.7**	**3.1**	**1.9**	**2.6**
System Renewal																					
T-SR-01	Transmission Station Renewal - Network Stations	1.4	3.4	8.5	35.1	121.9	209.4	199.6	213.6	158.4	213.1	220.4	210.1	224.8	166.7	224.3	11.0	10.5	11.2	8.3	11.2
T-SR-02	Transmission Station Renewal - Air Blast Circuit Breakers	51.6	98.5	162.3	176.8	134.4	172.3	153.8	115.8	99.3	34.4	181.3	161.8	121.9	104.5	36.2	9.0	8.1	6.1	5.2	1.8
T-SR-03	Transmission Station Renewal - Connection Stations	8.5	12.0	33.1	109.8	206.5	334.5	357.7	350.1	406.5	428.6	352.0	376.5	368.5	427.8	451.1	17.6	18.8	18.4	21.3	22.5
T-SR-04	Wood Pole Structure Replacements	35.3	39.7	47.0	56.2	52.7	56.5	57.6	58.8	60.0	61.2	59.5	60.7	61.9	63.1	64.4	3.0	3.0	3.1	3.1	3.2
T-SR-05	Steel Structure Coating Program	37.7	11.1	8.1	16.2	22.6	23.6	24.1	24.5	25.0	25.4	24.9	25.3	25.8	26.3	26.8	1.2	1.3	1.3	1.3	1.3
T-SR-06	Tower Foundation Assess/Clean/Coat Program	5.8	13.5	10.4	12.4	17.9	17.3	17.6	17.9	18.3	18.6	18.2	18.5	18.9	19.2	19.6	0.9	0.9	0.9	1.0	1.0
T-SR-07	Transmission Line Shieldwire Replacement	9.3	8.4	4.5	13.4	12.9	12.1	12.3	12.5	12.8	13.0	12.7	12.9	13.2	13.5	13.7	0.6	0.6	0.7	0.7	0.7
T-SR-08	Transmission Line Insulator Replacement	65.5	78.5	57.1	55.9	68.6	78.4	78.1	79.5	81.0	82.5	82.6	82.1	83.7	85.2	86.8	4.1	4.1	4.2	4.3	4.3
T-SR-09	Transmission Station Demand and Spares and Targeted Assets	49.6	66.6	60.8	33.6	41.0	43.9	44.7	45.2	46.2	47.0	46.2	47.0	47.5	48.6	49.4	2.3	2.3	2.4	2.4	2.5
T-SR-10	Protection Relay Replacement Program	-	-	0.3	2.4	4.7	8.8	8.9	9.0	9.1	9.2	9.2	9.3	9.4	9.5	9.6	0.5	0.5	0.5	0.5	0.5
T-SR-11	Legacy SONET System Replacement	3.3	1.5	0.4	0.6	4.6	19.5	29.4	29.2	27.6	8.3	20.5	30.9	30.8	29.0	8.7	1.0	1.5	1.5	1.4	0.4
T-SR-12	Telecom Performance Improvements	-	0.1	0.1	1.0	3.3	4.2	5.8	3.8	-	-	4.4	6.1	4.0	-	-	0.2	0.3	0.2	-	-
T-SR-13	Transmission Complete Line Refurbishment	5.3	2.0	1.3	1.3	45.3	60.1	125.8	190.8	235.9	220.5	63.3	132.4	200.8	248.3	232.1	3.2	6.6	10.0	12.4	11.6
T-SR-14	Mobile Radio System Replacement	-	-	-	-	3.0	5.2	6.7	5.6	2.4	-	5.5	7.0	5.9	2.5	-	0.3	0.4	0.3	0.1	-
T-SR-15	Transmission Line Emergency Restoration	9.7	9.9	12.0	11.2	9.9	10.2	10.4	10.6	10.8	11.0	10.7	10.9	11.2	11.4	11.6	0.5	0.5	0.6	0.6	0.6
T-SR-16	HV UG Cable – Replace/Refurbish Pumping Plants	-	-	-	-	-	-	-	0.1	0.2	5.5	-	-	0.1	0.2	5.8	-	-	0.0	0.0	0.3
T-SR-17	OPGW Infrastructure Projects	0.3	0.3	0.2	0.1	15.1	28.5	27.8	30.4	20.1	10.5	30.0	29.2	32.0	21.2	11.0	1.5	1.5	1.6	1.1	0.5
T-SR-18	C5E/C7E Underground Cable Replacement	0.5	1.0	2.8	2.5	25.1	38.3	23.7	4.6	0.1	-	40.3	24.9	4.9	0.1	-	2.0	1.2	0.2	0.0	-
System Renewal Projects and Programs Less Than Materiality Threshold		492.6	445.9	395.1	342.3	182.1	55.4	44.7	49.6	63.9	75.3	58.3	47.0	52.2	67.3	79.3	2.9	2.3	2.6	3.4	4.0
Total System Renewal		**776.2**	**792.6**	**804.0**	**870.7**	**971.5**	**1,178.0**	**1,228.3**	**1,251.6**	**1,277.3**	**1,264.0**	**1,239.8**	**1,292.8**	**1,317.3**	**1,344.4**	**1,330.4**	**61.8**	**64.5**	**65.7**	**67.0**	**66.3**
System Service																					
T-SS-01	Nanticoke TS: Connect HVDC Lake Erie Circuits	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T-SS-02	St. Lawrence TS: Phase Shifter Upgrade	0.0	0.2	0.2	19.4	18.9	6.0	-	-	-	-	6.3	-	-	-	-	0.3	-	-	-	-
T-SS-03	Merivale TS to Hawthorne TS: 230kV Conductor Upgrade	0.0	0.2	0.3	2.7	9.0	9.0	-	-	-	-	9.5	-	-	-	-	0.5	-	-	-	-
T-SS-04	Richview x Trafalgar 230kV Conductor Upgrade	-	0.0	0.4	1.4	5.1	12.6	16.4	12.1	2.4	-	13.3	17.2	12.7	2.5	-	0.7	0.9	0.6	0.1	-
T-SS-05	Merivale TS: Add 230/115kV Autotransformers	-	-	-	0.5	2.5	25.0	30.0	22.0	-	-	26.3	31.6	23.2	-	-	1.3	1.6	1.2	-	-
T-SS-06	Southwest GTA Transmission Reinforcement	0.3	0.3	0.6	0.2	4.1	6.5	7.5	3.0	-	1.0	6.8	7.9	3.2	-	1.1	0.3	0.4	0.2	-	0.1
T-SS-07	West of Chatham Reinforcement	-	-	-	-	2.0	8.3	20.4	5.2	-	-	8.8	21.4	5.5	-	-	0.4	1.1	0.3	-	-
T-SS-08	Future Transmission Regional Plans	-	-	-	-	-	10.7	20.0	20.4	20.4	20.4	11.3	21.1	21.5	21.5	21.5	0.6	1.1	1.1	1.1	1.1
T-SS-09	West of London Reinforcement	-	-	-	0.3	1.0	4.2	4.2	18.7	60.9	54.8	4.4	4.5	19.6	64.1	57.7	0.2	0.2	1.0	3.2	2.9
System Service Projects and Programs Less Than Materiality Threshold		73.6	84.8	194.7	194.1	79.4	8.5	3.1	4.4	9.4	13.8	9.0	3.3	4.7	9.9	14.5	0.4	0.2	0.2	0.5	0.7
Total System Service		**73.9**	**85.6**	**196.1**	**218.6**	**122.0**	**90.9**	**101.6**	**85.8**	**93.1**	**90.1**	**95.6**	**107.0**	**90.3**	**98.0**	**94.8**	**4.8**	**5.3**	**4.5**	**4.9**	**4.7**

ISD	Investment Name	Historical Actual ($M)				Bridge (As Filed)	Forecast Period (As Filed) $M					Forecast Period (Updated Inflation) $M					Increase from As-Filed Evidence ($M)				
		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2023	2024	2025	2026	2027	2023	2024	2025	2026	2027
System Access																					
D-SA-01	Joint Use and Relocations	20.4	28.8	26.2	31.5	19.1	24.8	29.0	27.0	26.5	27.2	26.1	30.5	28.4	27.9	28.7	1.3	1.5	1.4	1.4	1.5
D-SA-02	New Load Connections, Upgrades, Cancellations	121.2	141.7	146.4	176.0	141.7	150.7	154.6	158.5	162.5	166.7	158.6	162.7	166.8	171.1	175.4	7.9	8.1	8.3	8.6	8.7
D-SA-03	Connecting Distributed Energy Resources	6.7	6.6	2.2	(1.6)	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.5	0.1	0.1	0.1	0.1	0.1
D-SA-04	Metering Sustainment	26.8	20.1	18.8	23.0	18.5	62.6	55.6	40.1	22.2	8.9	65.9	58.6	42.2	23.3	9.4	3.3	3.0	2.1	1.1	0.5
System Access Projects and Programs Less Than Materiality Threshold		0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total System Access		**175.1**	**197.3**	**193.6**	**228.9**	**180.8**	**239.6**	**240.6**	**227.0**	**212.6**	**204.3**	**252.2**	**253.3**	**238.9**	**223.8**	**215.0**	**12.6**	**12.7**	**11.9**	**11.2**	**10.7**
System Renewal																					
D-SR-01	Distribution Stations Demand Capital Program	6.6	5.6	9.8	9.3	5.0	6.2	6.3	6.4	6.5	6.7	6.5	6.6	6.7	6.9	7.0	0.3	0.3	0.3	0.4	0.3
D-SR-02	Mobile Unit Substation Program	1.3	6.9	4.0	1.5	4.3	3.5	4.2	2.9	3.3	4.6	3.7	4.5	3.0	3.4	4.8	0.2	0.3	0.1	0.1	0.2
D-SR-03	Distribution Station Planned Component Replacement Program	5.0	7.7	8.8	8.1	7.1	4.6	3.3	1.1	1.2	1.2	4.8	3.5	1.2	1.2	1.2	0.2	0.2	0.1	0.0	0.0
D-SR-04	Distribution Station Refurbishment	11.7	16.5	7.4	11.7	3.2	44.8	41.5	28.5	32.3	32.1	47.2	43.7	30.0	34.0	33.7	2.4	2.2	1.5	1.7	1.7
D-SR-05	Distribution Lines Trouble Call and Storm Damage Response Program	112.7	74.6	118.4	120.9	93.8	106.0	108.1	110.3	112.5	114.7	111.6	113.8	116.1	118.4	120.8	5.6	5.7	5.8	5.9	6.1
D-SR-06	Distribution Lines PCB Equipment Replacement Program	6.3	8.1	4.8	6.0	9.5	9.4	9.5	9.5	-	-	9.9	9.9	10.0	-	-	0.5	0.4	0.5	-	-
D-SR-07	Pole Sustainment Program	52.0	44.3	43.6	60.6	60.1	107.9	110.6	112.4	114.9	116.8	113.5	116.4	118.3	120.9	122.9	5.6	5.8	5.9	6.1	6.1
D-SR-08	Distribution Lines Minor Component Replacement Program	1.4	4.9	6.3	9.0	12.3	12.4	14.5	13.5	8.6	7.1	13.0	15.3	14.2	9.0	7.5	0.6	0.8	0.7	0.4	0.4
D-SR-09	Submarine Cable Replacement Program	3.2	6.3	6.7	6.6	11.1	12.2	12.5	12.7	13.0	13.2	12.8	13.1	13.4	13.6	13.9	0.6	0.6	0.7	0.6	0.7
D-SR-10	Distribution Lines Sustainment Initiatives	7.8	8.1	11.7	11.7	13.7	31.5	30.3	35.3	43.2	42.7	33.2	31.9	37.1	45.4	45.0	1.7	1.6	1.8	2.2	2.3
D-SR-11	Life Cycle Optimization & Operational Efficiency Projects	9.1	3.9	6.2	5.2	0.2	2.8	6.5	7.1	0.8	0.4	3.0	6.9	7.4	0.9	0.5	0.2	0.4	0.3	0.1	0.1
D-SR-12	Advanced Meter Infrastructure 2.0 (AMI 2.0)	-	-	-	0.1	3.9	30.9	62.0	153.7	154.4	157.3	32.5	65.3	161.7	162.6	165.5	1.6	3.3	8.0	8.2	8.2
System Renewal Projects and Programs Less Than Materiality Threshold		2.6	2.0	0.9	1.2	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	0.0	0.0	0.1	0.1	0.1
Total System Renewal		**219.7**	**189.0**	**228.6**	**252.0**	**224.9**	**373.1**	**410.3**	**494.2**	**491.5**	**497.8**	**392.7**	**431.8**	**520.1**	**517.3**	**524.0**	**19.6**	**21.5**	**25.9**	**25.8**	**26.2**
System Service																					
D-SS-01	System Upgrades Driven by Load Growth	26.5	45.2	50.7	61.2	108.7	98.2	76.3	127.5	76.1	100.2	103.3	80.3	134.2	80.1	105.4	5.1	4.0	6.7	4.0	5.2
D-SS-02	Reliability Improvements	1.7	4.1	4.6	5.2	3.7	7.3	0.1	6.5	18.6	7.5	7.6	0.1	6.8	19.6	7.9	0.3	(0.0)	0.3	1.0	0.4
D-SS-03	Demand Investments	7.9	11.8	14.0	14.7	10.9	13.2	13.4	13.7	13.9	14.2	13.9	14.1	14.4	14.6	15.0	0.7	0.7	0.7	0.7	0.8
D-SS-04	Energy Storage Solutions	0.1	1.6	5.0	5.9	4.2	34.3	35.0	35.6	36.3	36.0	36.1	36.8	37.5	38.2	37.9	1.8	1.8	1.9	1.9	1.9
D-SS-05	Worst Performing Feeders	8.3	21.9	20.7	18.4	22.0	39.6	40.9	42.2	43.0	43.8	41.7	43.0	44.4	45.2	46.1	2.1	2.1	2.2	2.2	2.3
D-SS-06	Power Quality and Stray Voltage	1.0	1.3	1.2	3.3	3.4	3.8	3.9	4.0	4.0	4.1	4.0	4.1	4.2	4.2	4.3	0.2	0.2	0.2	0.2	0.2
System Service Projects and Programs Less Than Materiality Threshold		33.6	26.9	2.0	2.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	(0.0)	0.1	(0.0)
Total System Service		**79.1**	**112.8**	**98.1**	**110.7**	**153.2**	**196.5**	**169.7**	**229.6**	**192.0**	**205.9**	**206.8**	**178.6**	**241.6**	**202.1**	**216.7**	**10.3**	**8.9**	**12.0**	**10.1**	**10.8**

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ISD	Investment Name	Historical Actual ($M)				Bridge (As Filed)	Forecast Period (As Filed) $M					Forecast Period (Updated Inflation) $M					Increase from As-Filed Evidence ($M)				
		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2023	2024	2025	2026	2027	2023	2024	2025	2026	2027
Fleet																					
G-GP-01	Transport and Work Equipment	27.4	39.1	34.0	21.9	34.4	67.2	68.7	69.3	70.4	72.8	70.8	72.3	73.0	74.1	76.7	3.5	3.6	3.6	3.7	3.8
G-GP-02	Helicopter Renewal	-	4.7	0.5	4.1	9.0	9.2	9.4	9.6	9.6	9.8	9.7	9.9	10.1	10.1	10.3	0.5	0.5	0.5	0.5	0.5
Fleet Projects and Programs Less Than Materiality Threshold		-	0.2	4.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-
Total Fleet		**27.4**	**44.0**	**39.2**	**26.0**	**43.4**	**76.4**	**78.0**	**78.9**	**80.0**	**82.6**	**80.4**	**82.1**	**83.0**	**84.2**	**86.9**	**4.0**	**4.1**	**4.1**	**4.2**	**4.3**
Facilities and Real Estate																					
G-GP-03	Facilities and Accommodations	20.7	22.6	51.8	31.6	31.7	78.5	79.3	51.6	48.4	40.8	82.7	83.5	54.3	51.0	42.9	4.1	4.2	2.7	2.5	2.1
G-GP-04	Transmission Facilities	16.4	9.0	12.9	11.2	10.3	12.9	12.8	10.1	9.6	9.7	13.6	13.5	10.6	10.1	10.2	0.7	0.7	0.5	0.5	0.5
Total Facilities and Real Estate		**37.1**	**31.6**	**64.7**	**42.8**	**42.0**	**91.4**	**92.1**	**61.7**	**58.1**	**50.5**	**96.2**	**96.9**	**64.9**	**61.1**	**53.1**	**4.8**	**4.8**	**3.2**	**3.0**	**2.6**
Information Solutions																					
G-GP-05	Information Technology Services Enablement	22.9	27.1	16.2	12.6	23.4	19.5	21.9	27.2	28.9	24.9	20.5	23.0	28.7	30.4	26.2	1.0	1.1	1.4	1.5	1.3
G-GP-06	Corporate Services Enablement	-	0.9	1.5	0.3	3.8	24.4	18.1	18.3	16.9	16.6	25.7	19.1	19.3	17.8	17.4	1.3	1.0	1.0	0.9	0.9
G-GP-07	Customer Service Technology Enablement	-	-	-	-	4.1	4.1	18.7	18.1	35.1	33.0	4.3	19.7	19.1	36.9	34.7	0.2	1.0	1.0	1.8	1.7
G-GP-08	Work and Asset Management Enablement	-	-	-	-	6.0	37.3	42.0	36.1	22.8	16.7	39.3	44.3	38.0	24.0	17.6	2.0	2.2	1.9	1.2	0.9
G-GP-09	Operating Technology Cyber Security Equipment Replacement	-	-	-	-	4.0	5.7	3.4	2.8	6.0	7.9	6.0	3.6	3.0	6.3	8.3	0.3	0.2	0.1	0.3	0.4
G-GP-10	Physical Security Upgrades	-	-	-	-	-	14.0	8.0	8.0	8.0	4.0	14.7	8.4	8.4	8.4	4.2	0.7	0.4	0.4	0.4	0.2
G-GP-11	Security Monitoring	-	-	-	-	-	6.5	4.0	1.0	1.0	1.0	6.8	4.2	1.1	1.1	1.1	0.3	0.2	0.1	0.1	0.1
Information Solutions Projects and Programs Less Than Materiality Threshold		71.4	86.6	100.7	103.4	31.8	8.4	2.0	2.0	3.5	2.0	8.8	2.1	2.1	3.7	2.1	0.4	0.1	0.1	0.2	0.1
Total Information Solutions		**94.4**	**114.6**	**118.4**	**116.4**	**73.0**	**119.9**	**118.1**	**113.6**	**122.1**	**106.1**	**126.2**	**124.3**	**119.5**	**128.5**	**111.7**	**6.3**	**6.2**	**6.0**	**6.4**	**5.6**
System Operations																					
G-GP-12	Common Operating Technology Infrastructure	-	-	-	3.9	4.0	8.0	7.0	5.0	5.5	4.0	8.4	7.4	5.3	5.8	4.2	0.4	0.4	0.3	0.3	0.2
G-GP-13	Operating Technology Facilities Sustainment	-	-	-	-	-	-	-	2.0	-	-	-	-	2.1	-	-	-	-	0.1	-	-
G-GP-14	Integrated Voice Communication Technology Refresh	-	-	-	0.2	6.4	2.3	-	-	-	-	2.4	-	-	-	-	0.1	-	-	-	-
G-GP-15	BU-OGCC Office Remediation	-	-	-	-	-	-	2.0	-	-	-	-	2.1	-	-	-	-	0.1	-	-	-
G-GP-16	Network Management System Investments	-	-	5.0	9.6	16.6	7.6	-	1.2	2.5	2.5	8.0	-	1.3	2.6	2.6	0.4	-	0.1	0.1	0.1
G-GP-17	Outage Response Management System Upgrade	-	-	-	-	-	5.5	5.5	-	-	-	5.8	5.8	-	-	-	0.3	0.3	-	-	-
G-GP-18	Distribution Management System Upgrade	-	-	-	-	-	4.0	4.0	-	-	-	4.2	4.2	-	-	-	0.2	0.2	-	-	-
System Operations Projects and Programs Less Than Materiality Threshold		9.1	10.7	66.6	96.5	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total System Operations		**9.1**	**10.7**	**71.6**	**110.1**	**27.5**	**27.4**	**18.5**	**8.2**	**8.0**	**6.5**	**28.8**	**19.5**	**8.6**	**8.4**	**6.8**	**1.4**	**1.0**	**0.4**	**0.4**	**0.3**
Other General Plant																					
G-GP-19	Grid Control Network Sustainment	3.6	5.6	3.6	4.2	4.4	6.5	6.6	6.8	7.0	7.1	6.8	7.0	7.2	7.3	7.5	0.3	0.3	0.4	0.4	0.4
G-GP-20	Transmission Non-Operational Data Management System	-	-	-	-	5.4	5.5	1.1	-	-	-	5.8	1.2	-	-	-	0.3	0.1	-	-	-
G-GP-21	Remote Terminal Unit Replacement Program	-	-	-	-	3.3	7.7	7.9	8.0	8.2	8.3	8.1	8.3	8.4	8.6	8.8	0.4	0.4	0.4	0.4	0.4
G-GP-22	Hydro One Distribution Capital Contribution to Hydro One Transmission	2.9	(1.0)	(0.7)	2.3	1.0	2.0	2.2	1.1	1.0	-	2.1	2.3	1.2	1.1	-	0.1	0.1	0.1	0.1	-
Other Projects and Programs Less Than Materiality Threshold		(0.1)	0.9	6.0	(2.9)	8.5	5.8	6.8	6.1	7.0	6.8	6.1	7.2	6.4	7.4	7.1	0.3	0.4	0.3	0.4	0.4
Total Other General Plant		**6.3**	**5.5**	**8.9**	**3.6**	**22.6**	**27.5**	**24.6**	**22.0**	**23.2**	**22.3**	**29.0**	**25.9**	**23.1**	**24.4**	**23.4**	**1.4**	**1.3**	**1.2**	**1.2**	**1.2**
Total Net General Plant Capital ($M)		**174.3**	**206.4**	**302.9**	**298.9**	**208.5**	**342.7**	**331.4**	**284.3**	**291.4**	**268.0**	**360.7**	**348.8**	**299.2**	**306.7**	**282.0**	**18.0**	**17.4**	**14.9**	**15.3**	**14.1**
Allocated to Transmission		83.6	92.1	124.7	127.7	102.8	146.8	124.0	114.2	115.9	105.0	154.5	130.6	120.2	122.0	110.5	7.7	6.6	6.0	6.1	5.5
Allocated to Distribution		90.7	114.3	178.2	171.1	105.7	195.9	207.4	170.1	175.5	162.9	206.2	218.2	179.0	184.7	171.5	10.3	10.8	8.9	9.2	8.6

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O - SCHOOL ENERGY COALITION INTERROGATORY - 259

Reference:

https://www.powerflex.com/blog/powerflex-partners-with-hydro-one-limited-to-expand-operations-into-canada/

Interrogatory:

On March 30th, 2022, PowerFlex and Hydro One announced an agreement to co-develop DERs in Ontario, starting with "joint ownership of two Battery Energy Storage Systems (BESS) projects, totaling 20 MWh in Ontario.":

a) Please provide further details regarding the agreement and the two projects motion in the news release.

b) Please explain how projects relate to proposed distribution battery storage projects included in Energy Storage Solution investment (D-SS-04).

Response:

a) & b) The projects discussed in the announcement will be undertaken by Hydro One's unregulated business and have no impact on this application and no impact on D-SS-04.

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O - SCHOOL ENERGY COALITION INTERROGATORY - 260

Reference:

Exhibit O-2-1

Interrogatory:

Please confirm Hydro One is not seeking to update the 2023 transmission or distribution opening rate base to reflect 2021 actuals.

Response:

Confirmed. Hydro One remains committed to the 2023 opening rate base forecasts as originally filed in the evidence.

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O - SCHOOL ENERGY COALITION INTERROGATORY - 261

Reference:

Exhibit O-2-1

Interrogatory:

Has Hydro One undertaken any analysis to determine the actual inflationary impact on its 2021 costs? If so, please provide details and a copy of any such analysis.

Response:

Hydro One has completed an analysis of the inflation experienced in 2021 procurement spend. A summary of the analysis can be seen below in Table 1.

Table 1 – Inflation Analysis for 2021 Procurement Spend

	2021 Procurement Spend ($M)	2021 Procurement Spend before Inflation ($M)	Inflation Impact ($M)	Impact %
Total Transmission	1,065.7	1,033.4	32.3	3%
Total Distribution	583.6	573.1	10.5	2%

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O - SCHOOL ENERGY COALITION INTERROGATORY - 262

Reference:

Exhibit O-2-1, Page 7

Interrogatory:

Hydro One states that its higher then expected transmission OM&A in 2021, "was mostly driven by project write-offs and COVID-19 related expenditures that were not previously forecasted". Please provide both the total, and incremental amounts as compared to budgeted, for each of these two categories of costs.

Response:

The total incremental COVID-19 costs incurred by Hydro One Transmission were $7.9 million. These were not previously planned or budgeted in prior filings.

The total project write-offs incurred by Hydro One Transmission were $14.1 million. These were not previously planned or budgeted in prior filings.

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O - SCHOOL ENERGY COALITION INTERROGATORY - 263

Reference:

Exhibit O-2-1
Exhibit B2-SEC-99
Exhibit JT-1.12

Interrogatory:

Please provide the 2021 Transmission Capital Performance Report based on 2021 Actuals.

Response:

Please see Attachment 1 to this Interrogatory.

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TRANSMISSION CAPITAL PROGRAM PERFORMANCE REPORT – 2021

1.1 INTRODUCTION

This Capital Program Performance Report provides an overview of Hydro One's performance in 2021 in relation to the overall transmission envelope and reviews the performance of individual projects and programs. It addresses both capital expenditures and in-service additions (ISA) delivered by Hydro One.

This report is broken down into two main sections. The first section focuses on performance at the overall envelope and OEB category level, while the second section focuses on performance at the project and program level and outlines the approach used by Hydro One to manage projects and programs. The projects and programs included in this report have material (greater than or equal to $3M) actual or planned ISA in 2021.

1.2 PERFORMANCE AT THE OVERALL ENVELOPE AND OEB CATEGORY LEVEL

At an envelope level, Hydro One's transmission capital expenditures for 2021 were 10.1% above the OEB-approved amount. Hydro One's transmission ISA for 2021 were 5.6% below the OEB-approved amount. Hydro One continues to make every effort to manage the capital expenditures at the envelope level by making reductions or deferrals to discretionary investments to mitigate the impact on the total envelope.

Table 1 below presents a breakdown of the 2021 capital expenditures and ISA by OEB category. The primary focus of this report is on the System Access, System Renewal, and System Service categories. The General Plant category is discussed in 2021 General Plant Capital Program Performance Report (see Interrogatory O-Staff-362, Attachment 1).

Table 1 - 2021 Capital Expenditures and ISA

	Capital Expenditures 2021			ISA 2021		
OEB Category	**DRO Plan[1] ($M)**	**Actuals ($M)**	**Variance (%)**	**DRO Plan[1] ($M)**	**Actuals ($M)**	**Variance (%)**
System Access	11.3	69.9	519.1%	13.8	17.7	29.0%
System Renewal	982.8	870.7	-11.4%	735.9	689.8	-6.3%
System Service	148.2	218.6	47.6%	235.7	150.0	-36.3%
General Plant	94.4	127.7	35.4%	134.5	139.7	3.9%
Subtotal	**1,236.6**	**1,287.0**	**4.1%**	**1,119.8**	**997.2**	**-10.9%**
Productivity	-39.0			-36.3		
Other[2]	-28.4			-27.3		
Grand Total	**1,169.2**	**1,287.0**	**10.1%**	**1,056.2**	**997.2**	**-5.6%**

System Access: In 2021, System Access capital investments were $58.6M above the OEB-approved amount of $11.3M. This variance was primarily driven by the need to respond to load customer connections and upgrades (EB-2019-0082 SS-13 - South Middle Road TS: 230/27.6kV DESN: $9.3M variance [Execution Factors], and EB-2019-0082 SA-01, EB-2021-0110 T-SA-02 - IAMGOLD Mine project: $8.1M variance [Execution Factors]), and third party driven secondary land use and relocation requests (EB-2019-0082 SA-07: $11.6M variance [Emergent Needs]). As these investments are mandatory, Hydro One has limited ability to manage positive variances through offsetting reductions in the System Access cost category. In 2021, System Access ISA were $4.0M above the OEB-approved amount of $13.8M. This variance is primarily due to higher than forecasted investments in externally driven secondary land use asset modifications and property-rights (EB-2019-0082 SA-07: $11.5M variance [Emergent Needs]).

System Renewal: In 2021, System Renewal investments were $112.0M below the OEB-approved amount of $982.8M. The variance was primarily driven by redirections across OEB categories to accommodate emerging, mandatory system growth investments and required system upgrades, as well as General Plant investments. This variance reflects lower than planned investments in

[1] The DRO Plan refers to the OEB approved amounts for capital expenditures and ISA in EB-2019-0082.
[2] Includes OPEB, pension and compensation directive adjustments

transmission line refurbishments including underground cable replacement (EB-2019-0082 SR-27 - C5E/C7E Underground Cable Replacement project: -$18.1M variance [Reprioritization], and EB-2019-0082 SR-19 - D6 Transmission Line Refurbishment: -$17.5M variance [Work Definition]), and lower spend on station reinvestments (EB-2019-0082 SR-05 - Main TS Load Station Transformer Replacement: -$15.8M variance [Execution Factors]). In 2021, System Renewal ISA were $46.1M lower than the OEB-approved amount of $735.9M. This variance is primarily due to the timing of transmission line re-investments such as the A7L circuit refurbishment (EB-20190082 SR-19 - A7L/R1LB/A6P & 57M1 Transmission Line Refurbishment: -$44.0M variance [Execution Factors]) and timing of station reinvestment projects (EB-2019-0082 SR-02 - Gage TS Station Reinvestment: -$23.8M variance [Execution Factors]).

System Service: In 2021, System Service investments were $70.5M above the OEB-approved amount of $148.2M, largely driven by investments in response to system needs identified through bulk system and regional planning processes. The capital variance was primarily caused by the increased scope, complexity, and cost associated with the Lakeshore TS project (EB-2019-0082 SS-13: $72.4M variance [Execution Factors]), increased spend on the St. Lawrence TS Phase Shifter Replacement project (EB-2019-0082 SS-05: $14.0M variance [Work Definition]), as well as, schedule extensions and increased costs associated with delays to NextBridge's East-West Tie Connection project (EB-2019-0082 SS-04: $12.3M variance [Execution Factors]), which were beyond Hydro One's control. In 2021, System Service ISA were $85.6M lower than the OEB-approved amount of $235.7M. This variance is primarily due to an updated schedule provided by NextBridge for the East-West Tie Connection project (EB-2019-0082 SS-04: -$48.4M variance [Execution Factors]), which was outside of Hydro One's control, and the integration of the Wataynikaneyap transmission line into the provincial transmission network (EB-2019-0082 SS-02: -$22.8M variance [Execution Factors]).

1.3 PERFORMANCE AT THE PROJECT AND PROGRAM LEVEL

Hydro One takes an integrated approach to portfolio management and manages to the overall capital envelope. The approach recognizes that, changes at both the project and program levels will occur. Individual variances, be it an annual or project total level are to be expected given the

magnitude and complexity of the work being performed. As explained in TSP Section 2.10, each project involves a unique combination of elements related to the type and scope of work included and site conditions, and is undertaken pursuant to a defined project delivery process with budget tolerance as defined by the AACE class of estimate.[3] Projects are typically released for execution and funded based on a Class 3 estimate as further discussed below.

At Hydro One, projects are managed with a focus on adherence to the total project budget. So long as the project is delivered within its approved budget, adherence to a project's annual budget is viewed as less of a performance indicator because changes in outages, system conditions, resourcing, and other factors can require that project milestones be advanced or delayed without necessarily affecting overall project performance.

Using the project's total budget and schedule is more appropriate than an annual view because the full benefits of the project, in areas such as system capacity and resiliency, are realized at project completion. As such, project performance is shown in this report in reference to project total variances and overall project schedule variances. Programs are different in that they renew annually and are managed against annual budgets. As such, program performance is discussed in the context of adherence to annual budgets.

In summary, the focus of this report is as follows:

- Adherence to the overall capital envelope for the given year as demonstrated and discussed above;
- Project performance in relation to approved project total budgets and scheduled completion, not annual budgets and schedules;
- Program performance in relation to annual budgets.

[3] AACE estimate classification is discussed in TSP Section 2.10.

Figure 1 below illustrates Hydro One's project performance in relation to project total budgets for all projects with material (greater than or equal to $3M) actual or planned ISA in 2021. This figure shows a relatively tight dispersion of variances. This demonstrates Hydro One's overall effectiveness in executing projects within the range anticipated when the project budgets were established. This is particularly true for large projects (>$30M) that are subject to increased rigour and scrutiny as part of the project delivery process. The blue vertical lines in the cost variance chart are placed at -20% and +30% which is the range of expected outcomes for an AACE Class 3 estimate, and representative of the typical project definition work completed at the time of business case approval at Hydro One. Use of a Class 3 estimate to establish the appropriate range for completed projects is reasonable as that is the basis on which the projects are generally funded, and it is consistent with industry usage of Class 3 criteria for budget authorization or control estimates.

As can be seen, the majority of projects (76% = 44 of 58) have project total variances that fall within the upper range of AACE Class 3 expected outcomes (+30% of nominal value) and all but three of the large projects (>$30M) are within this range. Figure 1 shows that the vast majority of projects that fall outside of the AACE Class 3 range are smaller scale projects (i.e. < $30M), as these projects undergo a simpler planning process and a relatively small cost change can lead to a large percentage variance. Examining the fourteen projects that are forecast to exceed their DRO project total budgets by more than 30%, seven of the projects have variances due to work definition issues, which can arise as project details are refined as a project matures, five projects encountered unforeseen execution issues (unexpected site conditions, unexpected sub-surface obstacles, outage issues), and two projects faced emergent needs related to equipment failures which were beyond Hydro One's control.

Similarly, Figure 2 below shows that the majority of projects (84% = 49 of 58) have schedule delays of less than one year. A one year target range is reasonable given that Hydro One's primary outage availability is during the spring and fall due to system conditions and loading, which often leads to project schedule shifts. Examining the nine projects that are delayed by more than one year, four of the projects have schedule variances due to work definition issues

which arise as project details are refined as a project matures, and five projects encountered unforeseen and unavoidable execution issues (unexpected site conditions, unexpected sub-surface obstacles, outage issues, equipment issues, and customer driven delays).

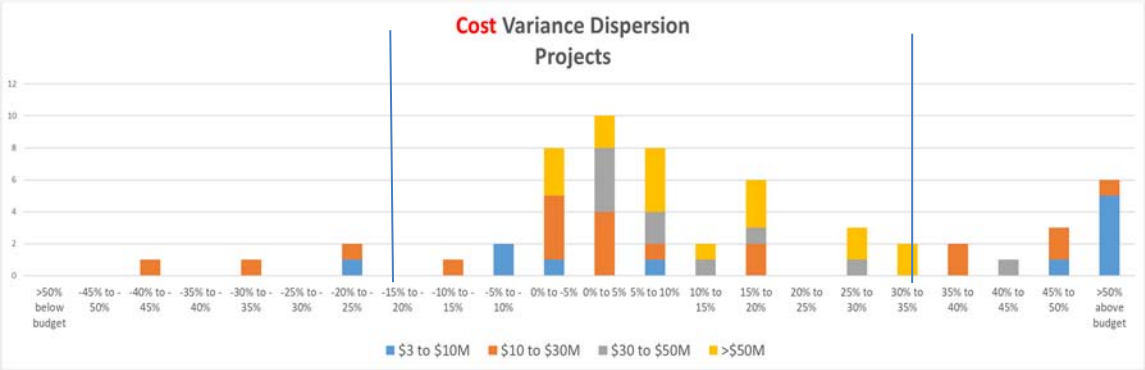


Figure 1: Cost Variance Dispersion for Projects with Planned or Actual ISA in 2021 of $3M or More[4]

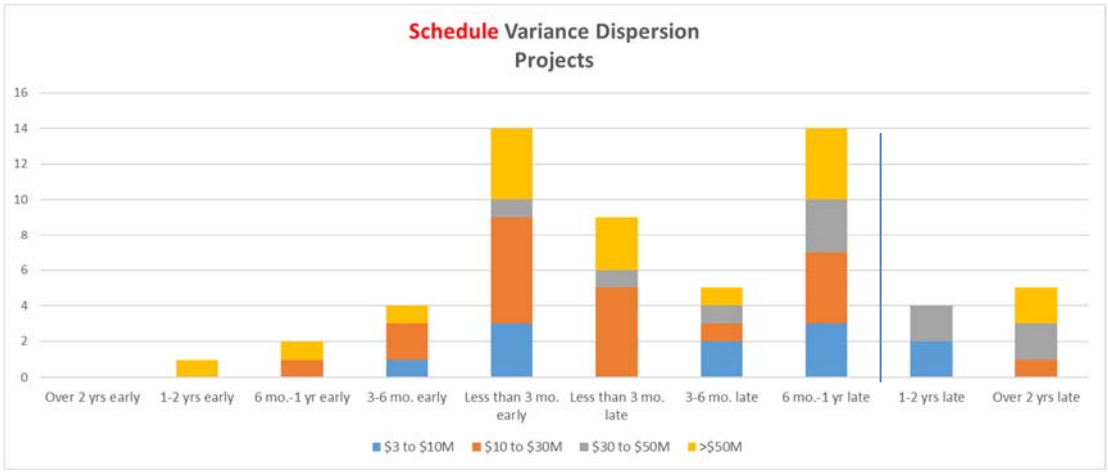


Figure 2: Schedule Variance Dispersion for Projects with Planned or Actual ISA in 2021 of $3M or More[5]

[4] Based on actual cost for completed projects and forecast cost at completion for projects still in progress.

The reasons for variances in individual projects and programs fall mainly into one of four categories: 1) emergent needs, 2) execution factors, 3) work definition, and 4) reprioritization. These categories are used to identify the reasons for variances at the project and program level and are defined below.

EMERGENT NEEDS

- Emergent needs are investments that Hydro One made in response to a change of priority due to equipment condition or failure.

EXECUTION FACTORS

- Execution factors represent changes that arise from changing conditions, risks and priorities that need to be addressed during execution. As risks materialize, project plans are adjusted to accommodate the change and mitigate the overall impact to the project cost and schedule. Some of the main causes for such changes are outage delays or cancellations, material delivery and logistics issues, and customer needs.

WORK DEFINITION

- Work definition variances arise as a project's scope, estimated budget and schedule are refined as the project moves from the high-level planning phase to the detailed execution phase. As the project is refined, there may be increases or decreases to the project cost due to new or changing information that becomes known as the project advances through its lifecycle.

REPRIORITIZATION

- Reprioritization variances include projects that are completed sooner than planned as a result of opportunities that arise during execution or are deferred to later years due to

[5] Based on actual in-service date for completed projects and forecast in-service date for projects still in progress.

competing priorities. Hydro One's redirection process, as described in SPF Section 1.7 allows the company to adjust the work delivered when such changes occur.

The tables below provide a summary of all projects and programs with material (greater than or equal to $3M) planned or actual ISA in 2021. The suite of projects and programs in these tables represent 94% of the 2021 actual ISA that is shown in Table 1 (for the System Access, System Renewal and System Service categories) and as such provide a very strong indication of the overall portfolio performance. A variance category is provided in the below tables to explain the variance on any project or program that meets the following criteria:

- Projects: project total variance exceeding $0.5M and 10%, or an in-service year shift from 2021 to a future year;
- Programs: 2021 capital expenditure or 2021 in-service addition variance exceeding $0.5M and 10%, or unit variance exceeding 20%.

1 **Table 2 - Project Summary**

	Project Phase	ISD Number EB-2019-0082	2021 Capex DRO Plan ($M)	2021 Capex Actual ($M)	2021 ISA DRO Plan ($M)	2021 ISA Actual ($M)	Project Total DRO Plan ($M)	Project Total Actual / Forecast ($M)	Project Total Variance ($M)	In-Service Year DRO Plan	Actual / Forecast In-Service Year	In-Service Year Variance (Years)	Variance Category
System Access													
Load Customer Connection													
Seaton MTS Load Customer Connection	**Executing**	Other	0.5	0.3	7.9	0.0	7.9	8.5	0.6	2021	2022	1	Execution Factors
System Renewal													
Information Solutions													
Physical Security ISL Application Replacement	**Complete**	SR-29	1.0	3.4	0.0	4.8	11.8	14.1	2.3	2021	2021	0	Work Definition
PSIT Cyber Equipment Replacement	**Executing**	SR-18	0.0	1.4	0.0	3.1	2.0	4.6	2.6	2020	2022	2	Work Definition
Integrated Station Investment													
Alexander SS Integrated Station Investment	**Executing**	Other	3.0	2.5	8.5	4.5	28.9	29.6	0.7	2022	2022	0	Not a material variance
Algoma TS Transmission Station Renewal	**Executing**	Other	0.0	9.9	0.0	5.0	6.5	16.1	9.6	2022	2022	0	Emergent Needs
Beck #1 SS ABCB Replacement	**Executing**	SR-01	8.9	3.3	0.0	6.7	31.1	44.0	12.9	2023	2026	3	Execution Factors
Beck #2 TS ABCB Replacement	**Executing**	SR-01	13.4	11.4	12.8	15.7	132.4	126.0	-6.4	2023	2023	0	Not a material variance
Belleville TS Station Reinvestment	**Complete**	SR-02	8.0	7.0	11.2	10.7	11.2	10.9	-0.3	2022	2021	-1	Not a material variance
Bridgman TS Load Station Transformer Replacement	**Executing**	SR-05	8.3	11.5	0.0	3.4	60.8	65.6	4.7	2023	2024	1	Not a material variance
Bruce A TS ABCB Replacement	**Complete**	SR-01	3.5	4.2	13.2	4.2	118.6	118.2	-0.4	2021	2020	-1	Not a material

	Project Phase	ISD Number EB-2019-0082	2021 Capex DRO Plan ($M)	2021 Capex Actual ($M)	2021 ISA DRO Plan ($M)	2021 ISA Actual ($M)	Project Total DRO Plan ($M)	Project Total Actual / Forecast ($M)	Project Total Variance ($M)	In-Service Year DRO Plan	Actual / Forecast In-Service Year	In-Service Year Variance (Years)	Variance Category
													variance
Cherrywood TS 230kV ABCB Replacement	**Executing**	SR-01	12.2	7.1	7.8	16.4	90.3	107.7	17.4	2023	2023	0	Execution Factors
Cherrywood TS 500kV ABCB Replacement Phase 3-1	**Executing**	SR-01	0.0	22.2	2.9	4.1	74.9	75.2	0.3	2025	2025	0	Not a material variance
Claireville TS Bulk Station Switchgear and Ancillary Equipment Replacement	**Executing**	SR-04	4.5	8.5	0.0	3.4	28.9	22.2	-6.8	2022	2023	1	Work Definition
Detweiler TS Bulk Station Transformer Replacement	**Complete**	SR-03	3.5	5.1	10.1	10.5	21.2	22.8	1.7	2021	2021	0	Not a material variance
Ear Falls TS Integrated Station Investment	**Executing**	Other	3.0	2.7	4.0	4.2	29.1	29.2	0.1	2022	2022	0	Not a material variance
Elgin TS Station Reinvestment	**Executing**	SR-02	4.0	5.4	4.1	6.1	75.1	74.2	-0.9	2021	2022	1	Execution Factors
Essa TS T4 Tertiary Equipment Integrated Station Investment	**Complete**	Other	0.0	3.1	2.5	5.2	3.2	5.3	2.0	2021	2021	0	Work Definition
Frontenac TS Protection and Automation Replacement	**Complete**	SR-07	3.0	3.3	10.9	10.2	11.0	10.6	-0.4	2022	2021	-1	Not a material variance
Gage TS Station Reinvestment	**Executing**	SR-02	12.5	13.3	23.8	0.0	53.6	72.1	18.5	2021	2023	2	Execution Factors
Hanlon TS Load Station Transformer Replacement	**Executing**	SR-05	4.7	6.5	0.6	12.2	20.4	17.8	-2.6	2023	2022	-1	Execution Factors
Hanmer TS Station Reinvestment	**Complete**	SR-02	3.5	5.0	6.6	4.2	83.4	91.5	8.1	2022	2021	-1	Not a material variance
Kenilworth TS Station Reinvestment	**Executing**	SR-02	3.0	9.2	18.7	21.4	36.8	39.8	3.0	2021	2022	1	Execution Factors

	Project Phase	ISD Number EB-2019-0082	2021 Capex DRO Plan ($M)	2021 Capex Actual ($M)	2021 ISA DRO Plan ($M)	2021 ISA Actual ($M)	Project Total DRO Plan ($M)	Project Total Actual / Forecast ($M)	Project Total Variance ($M)	In-Service Year DRO Plan	Actual / Forecast In-Service Year	In-Service Year Variance (Years)	Variance Category
King Edward TS Load Station Transformer Replacement	**Complete**	SR-05	7.2	5.8	8.5	9.2	15.9	16.3	0.4	2022	2021	-1	Not a material variance
Leaside TS BULK Integrated Station Investment	**Complete**	Other	0.5	4.4	8.2	9.2	57.9	62.1	4.1	2021	2021	0	Not a material variance
Leaside TS 27.6kV Load Station Switchgear and Ancillary Equipment Replacement	**Complete**	SR-06	1.1	4.1	7.8	10.4	36.3	46.2	9.9	2020	2021	1	Execution Factors
Lennox TS ABCB Replacement	**Executing**	SR-01	8.7	10.8	24.0	17.9	108.6	141.6	33.0	2024	2026	2	Work Definition
Manby TS Integrated Station Investment	**Complete**	Other	0.1	2.9	3.0	5.0	29.8	35.1	5.3	2021	2021	0	Execution Factors
Martindale TS Station Reinvestment	**Complete**	SR-02	3.1	6.1	8.8	8.6	73.8	74.2	0.4	2021	2021	0	Not a material variance
Middleport TS ABCB Replacement	**Executing**	SR-01	17.1	21.1	21.0	29.3	113.4	142.3	28.9	2025	2025	0	Execution Factors
Minden TS Load Station Transformer Replacement	**Complete**	SR-05	3.2	8.4	5.9	11.3	33.2	37.7	4.5	2021	2021	0	Execution Factors
Nanticoke TS ABCB Replacement	**Executing**	SR-01	13.7	13.6	8.9	2.5	61.2	79.2	18.0	2025	2026	1	Execution Factors
Newton TS Load Station Transformer Replacement	**Complete**	SR-05	0.0	5.2	3.5	5.9	3.5	11.5	8.0	2021	2021	0	Emergent Needs
Orangeville TS Load Station Transformer Replacement	**Executing**	SR-05	6.3	12.7	8.0	0.0	32.3	35.0	2.7	2024	2023	-1	Not a material variance
Pine Portage SS Station Reinvestment	**Executing**	SR-02	5.8	2.7	11.0	0.0	23.4	37.2	13.8	2022	2024	2	Work Definition
Richview TS ABCB Replacement	**Complete**	SR-01	2.1	5.5	6.1	11.3	104.8	110.6	5.8	2021	2021	0	Not a material variance

	Project Phase	ISD Number EB-2019-0082	2021 Capex DRO Plan ($M)	2021 Capex Actual ($M)	2021 ISA DRO Plan ($M)	2021 ISA Actual ($M)	Project Total DRO Plan ($M)	Project Total Actual / Forecast ($M)	Project Total Variance ($M)	In-Service Year DRO Plan	Actual / Forecast In-Service Year	In-Service Year Variance (Years)	Variance Category
Runnymede TS Station Reinvestment	**Complete**	SR-02	2.8	7.4	10.3	12.4	30.2	35.8	5.6	2021	2021	0	Execution Factors
Sheppard TS Station Reinvestment	**Complete**	SR-02	1.6	4.6	1.6	8.1	40.2	42.0	1.8	2021	2021	0	Not a material variance
Stanley TS Load Station Transformer Replacement	**Complete**	SR-05	8.5	9.7	26.9	26.4	26.9	26.4	-0.5	2022	2021	-1	Not a material variance
Strachan TS Load Station Transformer Replacement	**Executing**	SR-05	1.7	4.0	0.0	6.5	13.7	20.2	6.5	2022	2022	0	Execution Factors
Stratford TS Load Station Transformer Replacement	**Complete**	SR-05	5.7	9.2	6.8	8.6	6.8	12.0	5.2	2021	2021	0	Work Definition
Trafalgar TS Bulk Station Switchgear and Ancillary Equipment Replacement	**Executing**	SR-04	5.8	7.6	0.0	14.8	17.3	23.9	6.6	2022	2022	0	Execution Factors
Overhead Lines Refurbishment Projects, Component Replacement Programs and Secondary Land Use Projects													
A7L/R1LB/A6P & 57M1 Transmission Line Refurbishment	**Executing**	SR-19	31.9	23.2	44.0	0.0	67.9	75.9	8.0	2022	2022	0	Execution Factors
A8/9K Transmission Line Refurbishment	**Executing**	SR-19	11.6	1.1	13.9	0.0	58.5	69.9	11.4	2024	2023	-1	Work Definition
D6 Transmission Line Refurbishment	**Executing**	SR-19	24.6	7.1	28.5	9.2	41.3	42.7	1.3	2021	2024	3	Work Definition
D6V/D7V Transmission Line Refurbishment	**Complete**	Other	1.2	2.1	0.0	3.3	12.4	7.0	-5.4	2021	2021	0	Work Definition
N21W/N22W Transmission Line Refurbishment	**Complete**	SR-19	0.0	10.3	0.0	10.6	27.0	37.5	10.5	2022	2021	-1	Work Definition
Protection and Automation													
Install DDRs for NERC Compliance	**Executing**	Other	4.1	4.1	0.0	3.4	9.3	9.1	-0.3	2022	2022	0	Not a material

	Project Phase	ISD Number EB-2019-0082	2021 Capex DRO Plan ($M)	2021 Capex Actual ($M)	2021 ISA DRO Plan ($M)	2021 ISA Actual ($M)	Project Total DRO Plan ($M)	Project Total Actual / Forecast ($M)	Project Total Variance ($M)	In-Service Year DRO Plan	Actual / Forecast In-Service Year	In-Service Year Variance (Years)	Variance Category
													variance
Q25BM/Q29HM ADSS Fibre Optic Cable Replacements	**Executing**	SR-13	0.0	2.4	3.6	3.0	4.6	4.3	-0.3	2021	2022	1	Execution Factors
Tx Transformers Demand and Spares													
Longwood TS T4 & Component Replacement	**Complete**	Other	6.9	6.1	10.1	8.7	14.4	14.4	0.0	2021	2021	0	Not a material variance
System Service													
Inter Area Network Capability													
East-West Tie Connection	**Executing**	SS-04	24.1	36.4	146.4	98.0	155.5	179.1	23.6	2023	2023	0	Execution Factors
Lennox TS: Install 500kV Shunt Reactors	**Executing**	SS-01	20.6	16.0	23.9	21.9	46.2	48.4	2.2	2021	2023	2	Execution Factors
Watay Line to Pickle Lake Connection	**Executing**	SS-02	10.1	7.6	22.8	0.0	22.8	33.3	10.5	2021	2022	1	Execution Factors
Local Area Supply Adequacy													
Aylmer-Tillsonburg Area Transmission Reinforcement	**Complete**	SS-12	3.6	3.3	0.0	4.4	6.1	4.6	-1.5	2022	2021	-1	Work Definition
Hawthorne TS Transformer Replacement	**Complete**	Other	1.0	3.4	1.1	11.3	20.9	20.7	-0.1	2021	2021	0	Not a material variance
Kapuskasing Area Transmission Reinforcement	**Executing**	SS-10	3.3	4.9	18.3	0.0	33.7	34.9	1.2	2022	2023	1	Not a material variance
M6E/M7E Sectionalizing Disconnect Switches	**Complete**	Other	0.6	0.3	3.6	1.4	3.7	3.4	-0.3	2021	2021	0	Not a material variance

	Project Phase	ISD Number EB-2019-0082	2021 Capex DRO Plan ($M)	2021 Capex Actual ($M)	2021 ISA DRO Plan ($M)	2021 ISA Actual ($M)	Project Total DRO Plan ($M)	Project Total Actual / Forecast ($M)	Project Total Variance ($M)	In-Service Year DRO Plan	Actual / Forecast In-Service Year	In-Service Year Variance (Years)	Variance Category
South Nepean Transmission Reinforcement	**Complete**	SS-11	7.5	3.5	9.9	8.7	13.0	8.7	-4.3	2021	2021	0	Execution Factors
Risk Mitigation													
L7S Reliability Performance Mitigation	**Complete**	Other	0.8	0.4	3.6	0.4	3.6	5.3	1.7	2021	2020	-1	Work Definition

1 **Table 3 - Program Summary**

	ISD umber EB-2019-0082	2021 Capex DRO Plan ($M)	2021 Capex Actual ($M)	2021 Capex Variance	2021 ISA DRO Plan ($M)	2021 ISA Actual ($M)	2021 ISA Variance	2021 Unit DRO Plan	2021 Unit Actual	2021 Unit Variance	Reportable Unit	Variance Category
System Access												
Secondary Land Use Projects												
Property Rights	SA-07	0.0	11.6	11.6	0.3	11.8	11.5	0	1	1	# of permits acquired	Emergent Needs
System Renewal												
IT Security												
NERC CIP-014 Physical Security Implementation	SR-16	20.6	24.2	3.6	16.4	41.9	25.5	6	12	6	# of sites	Execution Factors
Overhead Lines Refurbishment Projects, and Component Replacement Programs												
Steel Structure Coating Program	SR-22	22.1	16.2	-5.9	23.5	22.9	-0.6	540	467	-73	# of Structures	Execution Factors
Tower Foundation Assess/ Clean/ Coat & Life Extension Program	SR-23	15.6	10.4	-5.3	12.4	10.6	-1.8	994	973	-21	# of Structures	Execution Factors
Transmission Line Emergency Restoration	SR-26	9.7	11.2	1.5	8.8	12.3	3.5	108	190	82	# of work orders	Emergent Needs
Transmission Line Insulator Replacement	SR-25	71.4	61.8	-9.6	72.6	61.6	-11.0	3936	3690	-246	# of circuit structures	Execution Factors
Transmission Line Shieldwire Replacement	SR-24	12.6	14.5	1.9	13.6	15.3	1.7	329	352	23	# of km	Reprioritization
Wood Pole Structure Replacements	SR-21	51.6	59.9	8.4	50.7	59.5	8.8	1041	1003	-38	# of Structures	Execution Factors
Tx Transformers Demand and Spares												
Transmission Station Demand, Spares and	SR-09	38.8	31.6	-7.2	32.8	31.6	-1.2	-	-	-	Various	Work Definition

	ISD umber EB-2019-0082	2021 Capex DRO Plan ($M)	2021 Capex Actual ($M)	2021 Capex Variance	2021 ISA DRO Plan ($M)	2021 ISA Actual ($M)	2021 ISA Variance	2021 Unit DRO Plan	2021 Unit Actual	2021 Unit Variance	Reportable Unit	Variance Category
Targeted Assets												
Grand Total		**242.5**	**241.5**	**-1.0**	**231.0**	**267.4**	**36.4**					

As evidenced in Table 2 above, projects are well managed with a focus on adherence to the overall project total budget and project schedule. In terms of the larger project total variances, the Lennox TS ABCB Replacement Project is forecasted to exceed its total budget by $33.0M as a result of work definition issues that resulted in scope evolution and additions subsequent to the project's funding approval, as well as, a reprioritization of resources for customer driven work. The Middleport TS ABCB Replacement Project is forecasted to exceed its total budget by $28.9M because of multiple execution factors including equipment failure, outage availability issues and project staging challenges. The East-West Tie Connection project is forecasted to exceed its total budget by $23.6M due to multiple execution factors including an externally driven delay. In terms of projects that have had material schedule variances (i.e. delays from 2021 to a future year), the D6 Transmission Line Refurbishment project had a delay from 2021 to 2024 due to a Department of National Defense relocation request which delayed the project schedule, the Gage TS Station Reinvestment project had a delay from 2021 to 2023 due to execution issues involving sub-surface challenges, a change in construction methods due to site constraints, and equipment issues, and the Seaton MTS Load Customer Connection project had a customer driven delay from 2021 to 2022.

Table 3 above shows program performance in relation to annual budgets. Overall, program spending in 2021 was inline with the annual budget amount, with an overall capital expenditure variance of -$1.0M. The two programs with the largest capital expenditure variances above plan are the Property Rights and Wood Pole Structure Replacements programs. Property Rights had higher expenditures due to externally driven demand for secondary land use property rights work. Wood Pole Structure Replacements experienced execution factors such as outage issues, as well as, higher than planned costs in Northern Ontario caused by access issues, helicopter use, and rock drilling. The 2021 program ISA were above the annual budget amount by $36.4M. This was primarily due to the above-mentioned property rights work and increased accomplishment in the NERC CIP-014 Physical Security Upgrades program caused by the completion of carryover sites from 2020.

1.4 CONCLUSION

This Capital Program Performance Report intended to highlight Hydro One's 2021 performance through the following three lenses:

- Adherence to the overall capital envelopes for the year
- Project performance in relation to approved project execution budgets and schedules
- Program performance in relation to annual budgets

At an envelope level, Hydro One performed well both in terms of capital expenditure and ISA in 2021. Project performance in relation to project total budgets was very good with 76% of projects having total cost variances within the upper range of AACE Class 3 expected outcomes (+30% of nominal value), and 84% of projects having schedule delays of less than one year. Program performance in relation to the overall annual capital expenditure budget was also very good, resulting in a non-material variance. In addition, as discussed in TSP Section 2.10, Hydro One is working to continuously improve its delivery of its capital program. Overall, this report demonstrates Hydro One's effective capital portfolio management practices and ability to deliver its capital program.

O - SCHOOL ENERGY COALITION INTERROGATORY - 264

Reference:

Exhibit O-2-1
Exhibit B2-SEC-145
Exhibit JT-2.24

Interrogatory:

Please provide the 2021 Distribution Capital Performance Report based on 2021 Actuals.

Response:

Please see attached the 2021 Distribution Capital Performance Report based on 2021 Actuals.

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DISTRIBUTION - CAPITAL PROGRAM PERFORMANCE REPORT - 2021

1.0 INTRODUCTION

This distribution Capital Program Performance Report is provided in response to the Ontario Energy Board's (OEB) Decision and Order in EB-2017-0049, which directed Hydro One to submit with this application a comprehensive report detailing the Company's actual performance in the execution of its capital program relative to plan.[1]

This report is divided into two main sections. Section 2.0 focuses on performance at the overall envelope and OEB category level, demonstrating Hydro One's ability to successfully manage to the overall capital envelope in terms ISAs. Section 3.0 focuses on performance at the project and program level. That section outlines the approach used by Hydro One to manage projects and programs and provides an overview of performance. The projects and programs included in this report have material (greater than or equal to $3 million) actual or planned ISA in 2021.

2.0 PERFORMANCE AT THE OVERALL ENVELOPE AND OEB CATEGORY LEVEL

Hydro One's Distribution capital portfolio is comprised of investments designed to address existing assets as well as install new assets to address system needs. The Distribution capital envelope is predominantly program-based with smaller scale projects. Distribution is also required to respond to a high volume of demand work with short turnaround times, which can impact work completed within the capital envelope annually.

A summary of the Distribution capital envelope for 2021 is shown below in Table 1, organized according to the categories defined by the OEB Filing Requirements.

[1] EB-2017-0049, Decision and Order, March 7, 2019, Appendix 2. The TSP and GSP Capital Program Performance Reports are filed in this application as TSP Section 2.9, Attachment 2 and GSP Section 4.9, Attachment 2 respectively.

Table 1 - OEB Category Performance 2021($M)[2]

OEB Category	Capital Expenditures 2021			In-Service Additions 2021		
	DRO Plan	Actuals	Variance	DRO Plan	Actuals	Variance
1. System Access	150.9	228.9	52%	160.8	226.1	41%
2. System Renewal	237.3	252.0	6%	241.9	253.3	5%
3. System Service	144.1	110.7	-23%	138.8	80.5	-42%
Subtotal Categories 1, 2, and 3	**532.3**	**591.6**	**11%**	**541.4**	**559.9**	**3%**
4. General Plant Allocated to Distribution	95.3	171.1	80%	164.1	151.2	-8%
Grand Total	**627.6**	**762.8**	**22%**	**705.5**	**711.1**	**1%**

Excluding General Plant, 2021 Distribution capital totalled $591.6M, which is an overage of 11% relative to the prior plan. Distribution in-service additions were 3% higher than plan at $559.9M. Total Distribution capital expenditures including General Plant were $762.8M (22% higher than the approved envelope), and total in-service additions were $711.1M (1% higher than the approved envelope). Details on the capital and in-service additions for General Plant Allocated to Distribution are provided in the Capital Program Performance Report for General Plant in I-01-O-Staff-362, Attachment 1. The remainder of this report focuses on the capital and in-service performance of System Access, System Renewal, and System Service Investments attributable wholly to Distribution.

The overall increase in Hydro One's Distribution capital expenditure was largely due to non-discretionary investments in the System Access (i.e., customer driven) and, to a lesser extent, the System Renewal (i.e., trouble calls and storm response) categories. Hydro One was able to partially offset these areas of overspending by reductions in System Service and some discretionary investments in System Renewal. Although the timing of some System Renewal and System Service work is more flexible than System Access investments, there are circumstances where work in these categories is urgently needed to address assets that pose a high risk. Accordingly, System Renewal and System Service work can require increased capital expenditure. The OEB categories and associated variance explanations are outlined below.

[2] Does not include Acquired Utilities of Haldimand, Norfolk, and Woodstock.

System Access: The largest category-level variance in 2021 was in the System Access category, with capital expenditures and in-service additions higher than budget by $78.0M or 52% and $65.3M or 41% respectively. The main driver of this overage compared to previously planned expenditures was increased demand for New Load Connections and Service Upgrades including more complex large connections projects. The increase in non-discretionary project spending also impacted costs associated with design and estimation due to increased project complexity and varying scope compared to historical requests. In addition, increased demand within the Joint Use and Relocations program was driven by an influx of requests for third party attachments primarily related to broadband internet access.

System Renewal: Capital expenditures and in-service additions for System Renewal were higher than budget by $14.7M or 6% and $11.4M or 5% respectively. The increase in expenditures was largely a result of costs incurred within the Distribution Lines Trouble Call and Storm Damage Response program, which exceeded capital expenditure budget by $32.4M and in-service additions budget by $30.7M. Hydro One was able to partially offset these increases, primarily through reductions to other planned system renewal work such as Distribution Lines Sustainment Initiatives and Lines PCB Equipment Replacements. However, due to the nature of work that is required to maintain a safe and reliable distribution network, there are limits on Hydro One's ability to make reductions within this category.

System Service: System Service capital expenditures and in-service additions were lower than budget by $33.3M or 23% and $58.2M or 42% respectively. This was primarily the result of deferring discretionary investments in response to an increase in non-discretionary externally-driven System Access and System Renewal work. This was partially offset by increased investment to modernize the worst performing feeders and demand system investments.

As shown in Table 1, and as was generally the case in previous years, the pattern of heightened non-discretionary spending was generally offset by reprioritization of other important but ultimately discretionary work. This reflects Hydro One Distribution's active management of a

large capital portfolio which includes large proportion of non-discretionary, externally-driven spending. Circumstances may change throughout the year and the organization must adapt accordingly. In many cases, Hydro One is required to meet legal, contractual or statutory obligations, and as such there are no alternatives other than to fund demand work as required. As a consequence, in-year fluctuations and re-direction occurs resulting in variances between planned and actual capital expenditures.

3.0 PERFORMANCE AT THE PROGRAM AND PROJECT LEVEL

Hydro One's Distribution expenditures consist of programs and projects. Programs involve work that is repeatable in nature on a specific asset type that recurs every year and the assets are in-serviced in the same fiscal year. Projects are stand-alone jobs with a discrete beginning and end which may span over more than one fiscal year and in-service does not occur until energization occurs. Capital expenditure variances at the program-level are discussed in Section 3.1, and project-level variances are discussed in Section 3.2.

Programs and projects with a total budgeted cost of greater than $3M have been summarized in the following sub-sections along with variance explanations. The thresholds used by Hydro One to identify "material variances" were determined using the following criteria:

- **Scope Variances** – For programs, material scope variances arise if the unit accomplishment filed in the rate application varied from the actual unit accomplishment by 20%. For projects, material scope variances arise if the project required internal approval for a scope change.
- **Cost Variances** – Material cost variances were identified where the in-year variance in cost is greater than or equal to $0.5M and the cost is 10% over or under budget.
- **Date Variances** – Material date variances were identified where the actual or projected in-service year changed from the year proposed.

Capital programs and projects that met at least one of these criteria were deemed to be material variances for the purposes of this report. Material variances are presented in four categories:

- **Emergent Needs**: Emergent needs are investments that Hydro One made and in-serviced in 2021 in response to a change of priority due to equipment condition or failure, as well as customer needs.
- **Reprioritization**: Reprioritization includes investments that are accelerated or deferred. Accelerated investments can include projects or programs that need to be completed sooner than planned. As described in SPF Section 1.7, Hydro One adjusts its capital investments through annual planning and in-year redirection processes. In some cases, this results in the acceleration of work when resources are redirected from another delayed project. Alternatively, deferral can occur as a result of increased demand for non-discretionary investments and planned discretionary work is reprioritized as a result.
- **Execution Factors**: Execution factors represent delays encountered during the execution phase of work which can include timing delays that arise as a result of changing conditions, risks and priorities that need to be addressed during execution. As risks materialize, plans are adjusted to accommodate the change and mitigate the overall impact to cost, schedule and resources. This can change the year in which the project goes in-service but does not necessarily result in a material change to the in- service amount or affect the volume of work completed. Some of the main causes for delays are outage delays or cancellations, material delivery and logistics factors as well as customer needs.
- **Work Definition**: Work definition variances naturally arise as a project's scope, estimated budget and schedule are refined and the project moves from the high-level planning phase to design and estimate followed by execution. As the project is refined, there may be increases or decreases to the project cost as a result of new or changing information that becomes known during the design and estimation phase or in the execution stage of work.

As is described in the Distribution Capital Work Execution Strategy (DSP Section 3.10), Hydro One Distribution continues to improve its planning and estimating processes, tools and technology to minimize work definition issues. As a result, the in-service addition amounts and

project expenditures are more accurate, although changes may still arise during the planning process. Drivers of change include:

- prudent scope changes or additions made as project plans mature;
- assumptions made in earlier project phases that are later clarified as site-specific conditions are addressed; and
- risks that either materialize or are mitigated during execution that impact the amount of contingency spent.

3.1 PROGRAM VARIANCES

A large portion of Distribution's capital work program includes investments that are driven by demand and require action in a specified period as part of Hydro One's obligations under the Distribution System Code. While Distribution makes every effort to work within its budget, there are times when an influx of demand work results in a reprioritization of resources away from planned work. Hydro One has a robust redirection process that provides the flexibility necessary to reprioritize investments to respond to fluctuations in emergent work while trying to minimize as best it can the impacts of deferring planned investments that can introduce additional risks to the system in future years. In addition, the COVID-19 pandemic continues to affect program performance in 2021. While Hydro One was able to quickly adapt to the changing work environment challenges introduced by COVID-19, certain modified work procedures implemented to maintain employee safety remained in place for much of 2021. For example, implementing one person per vehicle has a slight impact on cost per unit. This section will speak to material program variances in 2021.

Table 2 - Distribution Program Variances 2021

OEB Category	ISD[3]	ISD Description	Net DRO Plan ($M)	Net Actual ($M)	Net Variance ($M)	ISA DRO Plan ($M)	ISA Actual ($M)	ISA Variance ($M)	Units DRO Plan	Units Actual	Units Variance	Variance Type
System Access	SA-01	Joint Use and Line Relocations Program # of poles	17.7	31.5	13.8	17.7	28.7	11.0	1,475	1,355	-120	Emergent Needs
	SA-02	Meter Infrastructure Sustainment # of Devices or Meters	17.7	23.0	5.3	17.7	22.6	4.9	20,110	35,816	15,706	Emergent Needs
	SA-03	AMI Network Expansion # of Devices	9.2	0.0	-9.2	18.5	0.0	-18.5	242	0	-242	Work Definition
	SA-04	New Load Connections, Service Upgrades, Cancellations and Metering # of Connections, Designs, Upgrades, Cancellations, or Subdivisions	104.6	176.0	71.4	104.7	173.7	69.1	40,666	47,543	6,877	Emergent Needs
System Renewal	SR-01	Distribution Station Demand Program n/a	4.8	9.3	4.4	4.8	10.9	6.1	n/a	n/a	n/a	Emergent Needs
	SR-02	Mobile Unit Substations Program # of MUSs	4.8	1.5	-3.3	4.3	0.1	-4.1	2	0	-2	Execution Factors
	SR-04	Distribution Station Component Planned Replacement Program # of Components	5.2	7.0	1.8	5.1	7.8	2.7	282	257	-25	Work Definition
	SR-06	Distribution Station Refurbishments # of Stations	3.4	9.9	6.5	1.2	11.2	10.0	1	4	1	Work Definition
	SR-07[4,5]	Distribution Lines Trouble Call and Storm Damage Response Program # of poles/equipment, transformers, or occurrences	78.7	110.0	31.9	78.7	109.4	30.7	9,926	1,207,383	1,197,457	Emergent Needs
	SR-08	Distribution Lines PCB Equipment Replacement Program # of Transformers	12.4	6.0	-6.4	12.4	6.0	-6.4	3,450	1,165	-2,285	Reprioritization
	SR-09[6]	Pole Replacement Program # of Poles	58.8	60.6	1.8	58.8	60.4	1.6	9,333	5,344	-3,989	Work Definition
	SR-10	Distribution Lines Planned Component Replacement # of crossarms replaced, nest relocated, transformers, or sentinel lights	7.2	9.0	1.9	7.2	9.0	1.8	4,098	3,885	-213	Work Definition
	SR-11	Component Replacement Submarine Cable # of Submarine Cables	9.8	6.6	-3.2	9.8	6.6	-3.2	230	292	62	Reprioritization
	SR-12	Distribution Lines Sustainment Initiatives n/a	1.5	10.8	9.3	4.4	12.5	8.2	n/a	n/a	n/a	Reprioritization

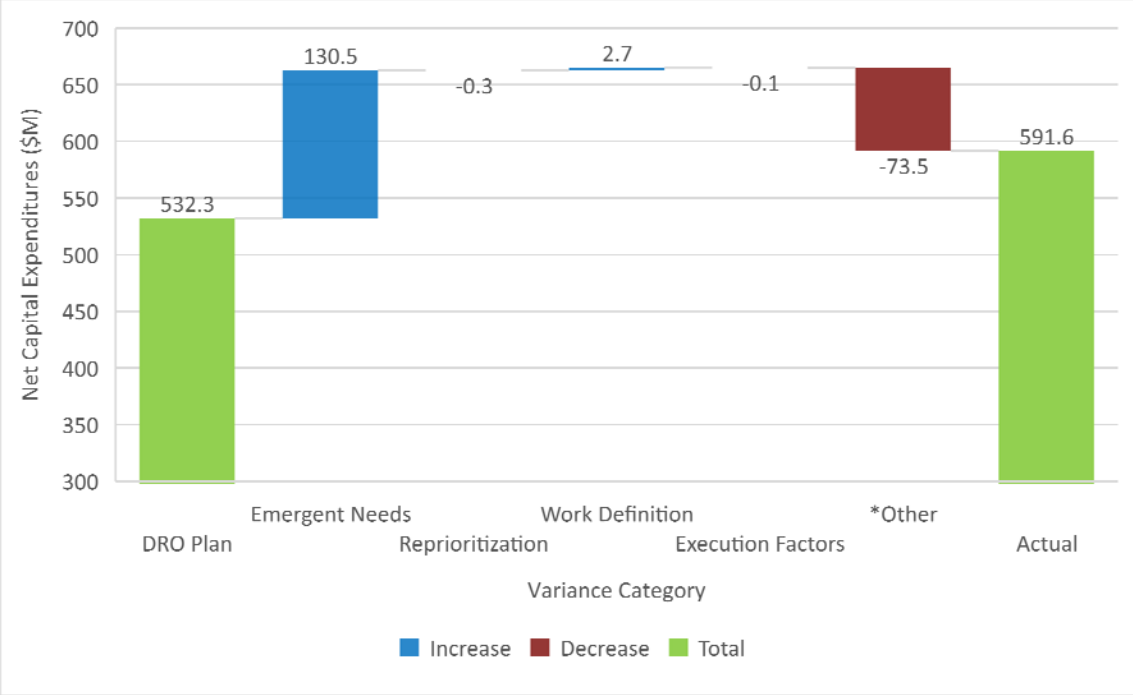
[3] The ISD numbers presented are the ISD numbers presented in the last distribution application.
[4] A portion of SR-07 funding is reported in System Service which includes Distribution Capital Post Trouble Call and Distribution Capital Power Quality & Stray Voltage.
[5] The unit of measure for storms damaged was changed from occurrences to customers impacted. Please see variance explanation SR-07.
[6] Unit of measure for this ISD expanded to include Pole Test and Treat and Pole Refurbishments.

Witness: NG Chong Kiat

System Service	SR-07[7]	Distribution Lines Trouble Call and Storm Damage Response Program # of occurrences	13.2	13.6	0.4	13.2	13.4	0.2	842	546	-296	Emergent Needs
	SS-04	Demand Investments n/a	3.5	5.2	1.7	3.5	4.1	0.6	n/a	n/a	n/a	Emergent Needs
	SS-05	Distribution System Modifications n/a	7.1	9.2	2.1	5.1	10.2	5.1	n/a	n/a	n/a	Emergent Needs
	SS-06	Worst Performing Feeders Program # Devices (Mix of Remotely Operable and Fault Location Devices)	15.2	18.4	3.2	15.2	24.2	9.1	773	716	-57	Work Execution

[7]A portion of SR-07 funding is reported in System Service which includes Distribution Capital Post Trouble Call and Distribution Capital Power Quality & Stray Voltage.

The impact of each variance category from a capital expenditure perspective is demonstrated below in Figure 1.



(*Note: Other includes non-material program variances and total project variances)

Figure 1: Waterfall chart highlighting the contributions to the 2021 Distribution capital expenditures variance by variance category

- **Joint Use and Lines Relocations Program (D-SA-01):** The Joint Use and Lines Relocations program represented a $13.8M variance to support the influx of requests to access Hydro One's support structure network for the expansion of Telecommunication attachments as well as private customer relocation requests. The variance was categorized as Emergent Needs as Hydro One is required to meet contractual obligations to third parties through Joint Use agreements and to maintain compliance with Hydro One's distributor licence.
- **Meter Infrastructure Sustainment (D-SA-02):** The Meter Infrastructure Sustainment program experienced increased capital expenditures of $5.3M compared to plan. The

primary driver for higher than forecast costs was higher AMI 1.0 meter failures resulting in additional material and labour cost.

- **Meter Infrastructure Expansion Program (D-SA-03):** This planned investment of $9.2M to continue to expand the AMI 1.0 network to reach additional customers through leveraging ongoing Telecommunications Carrier upgrades was cancelled. Following detailed field investigation and testing it was determined that the cost per new customer added to the network was not economic.
- **New Load Connection, Service Upgrades, Cancellations and Metering program (D-SA-04**): The New Load Connection, Service Upgrades, Cancellations and Metering program variance accounted for the largest increase within System Access, totalling $71.4M due to higher demand compared to historical trends on which the DRO budget was based. This increase in spend was categorized as Emergent Needs. The additional capital expenditure was required to support an increased volume of connections, including more complex large connections which require additional labour hours and therefore more expensive to design and construct. There was also an increase in the volume and size of subdivision construct projects although the connections within those subdivisions will be realized over their five-year connection horizon.
- **Distribution Station Demand Program (D-SR-01):** Capital expenditures exceeded plan by $4.4M due to the demand nature of the work required. This program involves addressing equipment failures and demand-driven system upgrades that require immediate equipment replacement. As a result, the variance is categorized as emergent needs.
- **Mobile Unit Substations Program (D-SR-02):** The Mobile Unit Substations (MUS) program expenditures were underspent by $3.3M primarily due to procurement delays associated with MUS manufacturers.
- **Distribution Station Component Planned Replacement (D-SR-04):** The Distribution Station Planned Component Replacement investment addresses the need to replace individual components in distribution stations on a planned basis. Prior to 2019, this investment primarily focused on the replacement of MUS Structures and replacement of station switches. In 2019, Hydro One added the replacement of oil hydraulic reclosers

with vacuum hydraulic reclosers to this investment, which is expected to lower the lifecycle cost of these reclosers. Overall, the program was overspent by $1.8M. Most of the overage was due to the addition of the hydraulic recloser replacements to the scope.

- **Distribution Station Refurbishments (D-SR-06):** Distribution Station refurbishments aim to correct deficiencies in power transformers or other station equipment to prevent significant outages from occurring. The program incurred a $6.5M increase in 2021, primarily due to site-specific conditions not captured in early budgetary estimating stages as well as reprioritization of projects.
- **Distribution Lines Trouble Call and Storm Damage (D-SR-07)[8]:** This portion of SR-07 includes the following investments: Dx Capital Trouble Call Poles & Equipment, Dx Capital Storm Damage, Dx Capital Trouble Sub and UG Cable and Dx Capital Trouble Call Damage Claims. An increase of $31.9M to Distribution Lines Trouble Call and Storm Damage was required mainly due to significant storm activity in December totaling $32.5M, which was $27.3M above the three-year historical average for December.
- **Distribution Lines PCB Equipment Replacement Program (D-SR-08):** The PCB Equipment Replacement program was $6.4M below plan primarily due to fewer complex transformer replacements and, to a lesser extent, fewer proactive transformer replacements. Program unit costs depend on the complexity of the transformer replacement, which itself depends on individual design requirements. If a replacement transformer is functionally equivalent, unit costs are relatively low. However, if the replacement is not like-for-like (e.g., it requires replacement of the pole and transformer), the cost can be significantly higher.
- **Pole Replacement (D-SR-09):** The Pole Replacement program came within 3% of budget however the composition of units had changed significantly compared to the DRO since the introduction of Pole Test & Treat and Pole Refurbishments. Originally budgeted

[8] The unit of measure for storm damage was changed in 2020 to the number of customers impacted as opposed to number of occurrences that was used historically. The number of customers impacted in 2020 was approximately 1.1M compared to approximately 1.2M customers in 2021.

units included the replacement of 9,333 poles with no Pole Test & Treat or Pole Refurbishments. In 2021, 5,344 poles were replaced, approximately 60,280 Poles underwent Test & Treat and approximately 1,877 poles were refurbished. Like 2020, higher unit costs for pole replacements were the result of targeting replacement of high reliability impact poles.

- **Distribution Lines Planned Component Replacement (D-SR-10):** Overall program expenditures were higher than plan by $1.9M because of a change in the scope of work for sentinel lights and cross arms replacements. This was partially offset by lower spend in transformer replacements due to lower than budgeted unit costs.
- **Component Replacement Submarine Cable (D-SR-11):** Capital expenditures for submarine cable replacement was below plan by $3.2M. This was because of higher priority demand work that limited resource availability, outage limitations and emergent submarine cable replacement. Higher volume of units was completed due to a higher proportion of lower cost units compared to the budget.
- **Distribution Lines Sustainment Initiatives (D-SR-12):** This investment includes projects that have historically been categorized into a program. Expenditures for Distribution Lines Sustainment Initiatives were higher than plan by $9.3M in 2021. This was a result of reprioritization of program investments associated with relocation and/or refurbishment of distribution assets.
- **Distribution Lines Trouble Call and Storm Damage (D-SR-07) – System Service:** This portion of SR-07 is reported within System Service and accounts for two work programs: Dx Capital Post Trouble Call and Dx Capital Power Quality & Stray Voltage. Post Trouble Calls involve a return trip to permanently repair a temporary fix completed during the initial trouble call. This also includes follow-up activities to field-initiated requests that field personnel have determined require replacement immediately due to potential safety or reliability concerns. Units reported in this program can vary in size and scope depending on the type of post trouble incident, power quality or stray voltage investigation.
- **Demand Investments (D-SS-04):** Demand Investments involve minor distribution system modifications that ensure adequate supply of electricity to customers by addressing

system needs identified by customer power quality complaints, feeder studies and system impact assessments. Increased demand in 2021 resulted in an increase of $1.7M to program expenditures. Variances in these investments reflect an emergent need, as the work is high-priority in nature with short turn around times that require Hydro One to promptly respond to system needs related to growth and effective operation of the distribution system.

- **Distribution System Modifications (D-SS-05):** Distribution System Modifications is another investment that is driven by customer needs which is focused on correcting feeder load balance, power quality and protection coordination issues that arise due to load growth. In 2021, the program experienced higher demand than anticipated resulting in an additional $2.1M in capital expenditures associated with customer connections that had to be completed in-year.
- **Worst Performing Feeders Program (D-SS-06):** In 2021, program spend was higher than plan levels by $3.2M due to the limited historical costing data available for this program at the time of the 2018-2022 Distribution Rate Order. Some execution challenges also affected the actual cost of this work, such as defects associated with some of the newly acquired devices.

3.2 PROJECT VARIANCES

The Distribution capital envelope is predominantly program-based, with smaller scale projects. However, some large System Service investments are required to ensure the system can accommodate load growth. Accordingly, Hydro One focuses on adherence to the total project cost rather than adherence to in-year expenditures.

Table 3 summarizes the projects that met the criteria of a material variance for either timing, scope or cost with detailed explanations for each listed below. As the Distribution capital work program is largely comprised of programs and smaller projects, few projects meet the $3M variance threshold. Only those projects in Table 3 that are identified either in the Execution or Completed phase require variance explanations. Those projects identified as Planning have yet to be approved by Asset Planning in order to proceed to Execution.

1

Table 3 - Capital Project Variances 2021

OEB Category	AR Name	Project Phase ($M)	2021 Net DRO Plan ($M)	2021 Net Actual ($M)	2021 ISA DRO Plan ($M)	2021 ISA Actual ($M)	Net DRO Plan Project Total ($M)	Net Project End Forecast ($M)	Project End Variance ($M)	Net LTD Actual ($M)*	DRO Plan IS Year	Forecast/Actual IS Year	Date Variance (Years)
System Renewal – SR-12 Distribution Lines Sustainment Initiatives	Douglas Point TS 44kV U/G Cables 25721	Planning	4.0	0	4.3	0	4.3	2.5	0	0	2021	2025	4
	Dymond TS M3 Rebuild - Stage 2 25907	Planning	2.6	0	5.5	0	5.5	6.7	1.2	0	2021	2028	7
System Service – Unassigned	Nakina DS F2 BESS 25451	Completed	0	3.3	0	9.5	8.1	10.2	2.1	9.5	2019	2021	2
System Service – SS-02 System Upgrades Driven by Load Growth	Kirkland Lake Voltage Conversion - Stage 1 23080	Completed	0	1.3	0	6.4	4.6	6.4	1.8	6.1	2019	2021	2
	Stouffville 10th Line DS New T3 & feeders 23273	Execution	8.3	1.8	9.5	0	9.6	7.3	-2.3	3.1	2021	2022	1
	Armitage TS M12 Load Relief 23667	Completed	0	1.2	0	4.7	2.0	4.7	2.7	4.7	2020	2021	1
	Dundas TS #2 New Feeders 24420	Planning	7.1	0	7.3	0	7.3	7.3**	0	0	2021	After 2027	N/A
	Dresden Area Load Relief 25283	Planning	10.2	0	10.2	0	10.2	11.1	0.9	0	2021	2026	5
	Ancaster Area Load Relief 25288	Planning	4.9	0	4.9	0	4.9	8.4	0	0	2021	2028	7
	Listowel Load Relief - Load Growth 25701	Execution	4.9	0	5.2	0	5.2	3.5	-1.7	0.1	2021	2023	2
	Saugeen Shores DS and Port Elgin Load Growth 25719	Planning	4.7	0	5.1	0	5.1	5.3	0.2	0	2021	2024	3
	Elmhurst Beach DS 25861	Planning	4.8	0	4.8	0	4.8	5.4	0.6	0	2021	2025	4
	Pelham Load Relief 25282	Planning	7.9	0	7.9	0	7.9	7.9**	0	0	2021	After 2027	N/A
System Service – SS-03 Demand System Modifications	Muskoka TS M1-M5 New Tie Line 25791	Planning	5.7	0	5.9	0	5.9	10.6	4.7	0	2021	2024	3

Notes: *All forecast and LTD (Life to Date) values are as of December 2021
**Cost will be updated if project is within the planning period.

Nakina DS F2 BESS: This project investment is a pilot initiative for a Hydro One owned and operated Battery Storage facility in rural Ontario which is intended to provide backup power to the Aroland First Nation community where the community has been susceptible to prolonged outage durations. The project incurred increased costs as a result of complexities in finalization of the engineering design, COVID-19 restrictions, construction, commissioning and in-servicing which has also resulted in delays to the original in-service date.

Kirkland Lake Voltage Conversion Stage 1: The overall project scope involves the conversion of the Goodfish Distribution Station feeders and refurbishment of the existing station to meet load growth needs in the area and address end-of-life assets. After the completion of a detailed design, Hydro One determined that the project costs would be higher than the approved investment as outlined in the 2018-2022 Distribution Rate Order due to site specific design requirements. Given the significant forecasted load growth and condition of existing assets, the increased costs of the investment were addressed through Hydro One's redirection process to minimize the risk of overloading feeders, unsupplied load and reliability issues.

Stouffville 10th Line DS New T3 & feeders: Since the time of the 2018-2022 Distribution Rate Order, Hydro One revised this investment's scope of work to lower the project cost and address additional load growth expected to materialize in the area. This change in scope has resulted in a capital expenditure and ISA variance to budget as well as an in-service date deferral to 2022.

Armitage TS M12 Load Relief: This project was completed and in-serviced in 2021, with minor clean up and demobilization planned for 2022. The majority of the project work consisted of overhead construction and was completed in 2020. The assets did not enter service until 2021 due to the timing of permits required to complete the underground construction portion of the project. After the completion of a detailed design, Hydro One determined that the project costs would be higher than the approved investment as outlined in the 2018-2022 Distribution Rate Order due to site specific design requirements.

Listowel Load Relief - Load Growth: This project is currently in the detailed design stage. The project requires the construction of a new sub transmission line through the town of Listowel and the installation of a new 44kV pad-mounted distribution station. Due to delays associated with land acquisition and reprioritization, the forecast in-service date for this project has been revised to 2023.

4.0 CONCLUSION

Hydro One Distribution has demonstrated the ability to deliver a large and complex capital work program and has the capability of adjusting to meet the needs of its customers. The overage in capital expenditures over approved levels in 2021 was the result of non-discretionary, externally-driven spending associated with new customer connections, trouble calls, storm damage, and joint use and relocations. The organization adapted to the significant increases in demand requests and weather events to minimize the overall impact to the capital portfolio. This required prioritization of planned work to maintain a safe and reliable distribution network within the year while addressing future year risk and opportunities. As demand investments continue to experience fluctuating volumes, the organization remains focused on improving its planning strategies while leveraging flexibility within its workforce. Through its robust oversight over the distribution work portfolio, Hydro One Distribution has and will continue to execute the work portfolio in a safe and efficient manner.

O - SCHOOL ENERGY COALITION INTERROGATORY - 265

Reference:

Exhibit O-2-1

Interrogatory:

Please update the following interrogatories and undertaking responses to include 2021 year-end actuals and any changes to the 2022 forecast:

a) B2-SEC-83
b) B2-SEC-84
c) B2-SEC-85
d) B2-SEC-86
e) B2-SEC-109
f) B2-SEC-111
g) B2-Staff-59
h) B1-AMPCO-14
i) JT-1.13

Response:

Hydro One is providing the requested information as it is readily available notwithstanding that it is not directly related to the direction provided in Procedural Order 5 and the 2021 financial information included in Hydro One's updated evidence.

Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

a) B2-SEC-83: Please see Attachment 1.
b) B2-SEC-84: Please see Attachment 2.
c) B2-SEC-85: Please see Attachment 3.
d) B2-SEC-86: Please see Attachment 4.
e) Please refer to Interrogatory O-AMPCO-120.
f) Please refer to Interrogatory O-AMPCO-120, part k).
g) B2-Staff-59: Please see Attachment 5.
h) Please see part i) below.
i) JT-1.13: Please see Attachment 6.

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B2 - SCHOOL ENERGY COALITION INTERROGATORY - 083

Reference:

Exhibit B-2-1, TSP Section 2.5, Page 2

Interrogatory:

For each of the Asset & Project Management and Cost Control measures, please provide a forecast 2021 and 2022 score and how the amount is derived.

Response:

Please see table below for the 2021 results for the Asset & Project Management and Cost Control measures.

Performance Categories	Measures	2021
Asset & Project Management	Transmission System Plan Implementation Progress (%)	99%
	CapEx as % of Budget	112%
	OM&A Program Accomplishment (composite index)	105%
	Transmission Capital Accomplishment Index (TCAI) - (%)	99%
Cost Control	Total OM&A and Capital per Gross Fixed Asset Value (%)	8.3%
	OM&A per Gross Fixed Asset Value (%)	2.0%
	Line Clearing Cost per kilometer ($/km)	$2,211
	Brush Control Cost per Hectare ($/Ha)	$1,807

Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed.

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B2 - SCHOOL ENERGY COALITION INTERROGATORY - 084

Reference:

Exhibit B-2-1, TSP Section 2.5, Page 13-17

Interrogatory:

With respect to T-SAIFI-S, T-SAIFI-M, and T-SAIDI, please provide Figures 2, 3, 4 requested in tabular format.

Response:

This interrogatory has been updated to include the requested information for 2021.

Data table for Figure 2, Transmission System Average Interruption Frequency Index – Sustained (# of interruptions per DP per year)

T-SAIFI-S	Equipment	Foreign	Unknown	Weather	Other	Total	Average
2016	0.14	0.07	0.07	0.11	0.08	0.46	0.61
2017	0.17	0.07	0.04	0.23	0.13	0.65	0.61
2018	0.21	0.07	0.06	0.29	0.20	0.83	0.61
2019	0.18	0.06	0.05	0.19	0.11	0.59	0.61
2020	0.13	0.04	0.08	0.17	0.08	0.50	0.61
2021	0.07	0.04	0.08	0.16	0.13	0.49	

Data table for Figure 3, Transmission System Average Interruption Frequency Index – Momentary (# of interruptions per DP per year)

T-SAIFI-M	Equipment	Foreign	Unknown	Weather	Other	Total	Average
2016	0.01	0.00	0.07	0.22	0.02	0.33	0.43
2017	0.03	0.00	0.07	0.31	0.06	0.47	0.43
2018	0.03	0.00	0.10	0.28	0.07	0.50	0.43
2019	0.02	0.00	0.08	0.28	0.05	0.43	0.43
2020	0.02	0.00	0.09	0.26	0.03	0.40	0.43
2021	0.01	0.01	0.08	0.30	0.02	0.42	

Data table for Figure 4, Transmission System Average Interruption Duration Index (interruption minutes per DP per year)

T-SAIDI	Equipment	Foreign	Unknown	Weather	Other	Total	Average
2016	63.9	9.0	0.7	2.6	4.6	80.8	58.7
2017	21.6	6.5	0.4	9.1	5.2	42.8	58.7

Witness: JESUS Bruno

2018	27.3	6.8	1.0	25.5	9.3	70.0	58.7
2019	26.8	3.6	0.4	2.4	5.7	38.9	58.7
2020	26.8	22.0	1.6	6.4	4.5	61.3	58.7
2021	8.2	1.9	2.1	3.9	4.8	21.0	

B2 - SCHOOL ENERGY COALITION INTERROGATORY - 085

Reference:

Exhibit B-2-1, TSP Section 2.5, Page 13-17

Interrogatory:

With respect to defective equipment contributions to T-SAIFI-S, T-SAIFI-M, and T-SAIDI:

a) Please provide a table that shows for each year between 2016 and 2020, a breakdown of T-SAIFI-S cause by defective equipment by equipment type, both as a percentage and by number of interpretations per delivery point.

b) Please provide a table that shows for each year between 2016 and 2020, a breakdown of T-SAIFI-M cause by defective equipment by equipment type, as a percentage and by number of interpretations per delivery points.

c) Please provide a table that shows for each year between 2016 and 2020, a breakdown of T-SAIDI cause by defective equipment by equipment type, as a percentage and by number of interruption minutes per delivery points.

Response:

This interrogatory has been updated to include the requested information for 2021.

a) T-SAIFI-S due to defective equipment by equipment types

T-SAIFI-S	Breaker	Bus	Line	P&C equip.	Transformer	Other	Total
2016	0.004	0.004	0.087	0.031	0.014	0.001	0.14
2017	0.018	0.021	0.095	0.022	0.017	0.001	0.17
2018	0.008	0.012	0.096	0.063	0.025	0.003	0.21
2019	0.016	0.017	0.108	0.016	0.021	0.003	0.18
2020	0.006	0.013	0.085	0.010	0.007	0.011	0.13
2021	0.022	0.011	0.013	0.012	0.010	0.007	0.07

Percentage contribution to T-SAIFI-S due to defective equipment by equipment types

T-SAIFI-S (%)	Breaker	Bus	Line	P&C equip.	Transformer	Other	Total
2016	3.1%	3.1%	60.9%	21.9%	10.2%	0.8%	100%
2017	10.3%	12.2%	54.5%	12.8%	9.6%	0.6%	100%
2018	3.8%	5.9%	46.5%	30.3%	11.9%	1.6%	100%
2019	8.6%	9.3%	59.9%	8.6%	11.7%	1.9%	100%

Witness: JESUS Bruno

2020	4.2%	10.1%	64.7%	7.6%	5.0%	8.4%	100%
2021	29.4%	14.7%	17.6%	16.2%	13.2%	8.8%	100%

b) T-SAIFI-M due to defective equipment by equipment types

T-SAIFI-M	Breaker	Bus	Line	P&C equip.	Transformer	Other	Total
2016	0.000	0.000	0.008	0.001	0.001	0.002	0.01
2017	0.007	0.000	0.019	0.001	0.002	0.000	0.03
2018	0.000	0.000	0.020	0.015	0.000	0.000	0.03
2019	0.000	0.000	0.016	0.008	0.000	0.000	0.02
2020	0.000	0.000	0.015	0.003	0.002	0.000	0.02
2021	0.000	0.000	0.003	0.008	0.000	0.000	0.01

Percentage contribution to T-SAIFI-M due to defective equipment by equipment types

T-SAIFI-S (%)	Breaker	Bus	Line	P&C equip.	Transformer	Other	Total
2016	3.1%	3.1%	60.9%	21.9%	10.2%	0.8%	100%
2017	10.3%	12.2%	54.5%	12.8%	9.6%	0.6%	100%
2018	3.8%	5.9%	46.5%	30.3%	11.9%	1.6%	100%
2019	8.6%	9.3%	59.9%	8.6%	11.7%	1.9%	100%
2020	4.2%	10.1%	64.7%	7.6%	5.0%	8.4%	100%
2021	0.0%	0.0%	30.0%	70.0%	0.0%	0.0%	100%

c) T-SAIDI due to defective equipment by equipment types

T-SAIDI	Breaker	Bus	Line	P&C equip.	Transformer	Other	Total
2016	0.58	0.01	17.90	1.81	43.56	0.02	63.9
2017	1.15	2.69	15.39	0.55	1.81	0.00	21.6
2018	0.23	0.57	19.62	4.04	2.86	0.04	27.3
2019	0.26	1.06	20.69	1.38	2.54	0.90	26.8
2020	0.10	0.66	25.20	0.08	0.45	0.28	26.8
2021	0.84	0.23	4.89	0.16	1.13	0.98	8.2

Percentage contribution to T-SAIDI due to defective equipment by equipment types

T-SAIDI (%)	Breaker	Bus	Line	P&C equip.	Transformer	Other	Total
2016	0.9%	0.0%	28.0%	2.8%	68.2%	0.0%	100%
2017	5.3%	12.5%	71.2%	2.6%	8.4%	0.0%	100%
2018	0.8%	2.1%	71.7%	14.8%	10.5%	0.1%	100%
2019	1.0%	3.9%	77.1%	5.1%	9.5%	3.4%	100%
2020	0.4%	2.5%	94.1%	0.3%	1.7%	1.0%	100%
2021	10.2%	2.8%	59.4%	1.9%	13.7%	11.9%	100%

Witness: JESUS Bruno

B2 - SCHOOL ENERGY COALITION INTERROGATORY - 086

Reference:

Exhibit B-2-1, TSP Section 2.5, Page 19

Interrogatory:

With respect to System Unavailability, please provide a breakdown of Table 12 by equipment type.

Response:

This interrogatory has been updated to include the requested information for 2021.

	2016	2017	2018[1]	2019	2020	2021
Capacitor	0.01%	0.02%	0.11%	0.10%	0.15%	0.12%
Breaker	0.37%	0.32%	0.39%	0.52%	0.38%	0.36%
Line	0.12%	0.09%	0.05%	0.07%	0.04%	0.03%
Reactor	0.03%	0.05%	0.06%	0.00%	0.05%	0.04%
Series Capacitor	0.01%	0.00%	0.01%	0.00%	0.00%	0.02%
Transformer	0.18%	0.19%	0.20%	0.16%	0.16%	0.11%
SVC	0.00%	0.02%	0.00%	0.04%	0.05%	0.01%
Total System Unavailability	0.71%	0.69%	0.83%	0.89%	0.83%	0.69%

[1] In EB-2019-0082, the 2018 system unavailability measure was updated to 0.83% when a data error was discovered in 2019. This 2018 correction was not reflected in TSP Section 2.5 p. 19.

Witness: JESUS Bruno

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I-01-B2-Staff-059

Please fill in the shaded cells

As discussed in EB-2019-0082 the information herein cannot be used to determine unitized costs

	EB-2016-0160 Application/Proposal					EB-2016-0160 DR0		EB-2019-0082 Application/Proposal							EB-2019-0082 DRO			EB-2021-0110 Application/Proposal								
	2014A	2015A	2016F	2017F	2018F	2017F	2018F	2016A	2017A	2018A	2019F	2020F	2021F	2022F	2020F	2021F	2022F	2019A	2020A	2021A	2022F	2023F	2024F	2025F	2026F	2027F
Transformer Portfolio																										
# Replacements	24	24	19	27	22	27	22	18	15	28	20	9	23	19	6	23	15	24	10	10	19	30	18	27	21	24
% of Fleet	3.3%	3.3%	2.6%	3.7%	3.1%	3.7%	3.1%	2.5%	2.1%	3.6%	2.8%	1.3%	3.2%	2.7%	0.8%	3.2%	2.1%	3.3%	1.4%	1.4%	2.6%	4.6%	2.5%	3.7%	2.9%	3.3%
Capital ($M)[2]	132.0	132.0	104.5	148.5	121.0	148.5	121.0	77.3	75.7	193.6	110.3	50.6	131.9	111.1				94.6	69.9	67.4						
Circuit Breaker Portfolio																										
# Replacements	83	31	43	66	132	66	132	73	108	155	88	135	105	88	91	204	44	72	67	98	130	88	107	98	146	154
% of Fleet	1.8%	0.7%	0.9%	1.5%	2.9%	1.5%	2.9%	1.5%	2.4%	3.3%	1.9%	2.8%	2.2%	1.9%	1.9%	4.3%	0.9%	1.5%	1.4%	2.1%	2.7%	1.9%	2.2%	2.1%	3.1%	3.5%
Capital ($M)[2]	58.1	21.7	30.1	46.2	92.4	46.2	92.4	42.4	54.7	77.9	47.5	74.3	58.9	50.3				59.1	73.0	55.0						
Protection Systems Portfolio																										
# Replacements	610	266	367	449	528	449	528	627	298	325	453	465	370	503	203	657	252	322	242	137	412	443	278	366	456	554
% of Fleet	5.0%	2.2%	3.0%	3.7%	4.4%	3.7%	4.4%	5.1%	2.5%	2.6%	3.6%	3.7%	3.0%	4.0%	1.6%	5.3%	2.0%	2.6%	1.9%	1.0%	3.3%	3.5%	2.2%	2.9%	3.6%	4.4%
Capital ($M)[2]	76.3	33.3	45.9	56.1	66.0	56.1	66.0	57.3	42.8	60.5	64.7	67.8	54.9	76.2				53.9	72.6	79.5						
Conductor Portfolio																										
Replacements (km)	93	201	183	192	440	192	440	183	119	51	140	64	483	795	22	298	314	82	81	31	515	19	300	338	235	679
% of Fleet	0.3%	0.7%	0.6%	0.6%	1.5%	0.6%	1.5%	0.6%	0.4%	0.2%	0.5%	0.2%	1.7%	2.7%	0.1%	1.0%	1.1%	0.3%	0.3%	0.1%	1.8%	0.1%	1.1%	1.2%	0.8%	2.4%
Capital ($M)[1]	40.7	58.4	76.9	67.1	143.1	67.1	143.1	68.0	36.5	52.0	137.6	150.8	191.4	211.7	58.6	91.4	96.9	64.6	54.6	47.3						
Wood Pole Portfolio																										
# Replacements	897	845	850	850	850	935	850	761	966	735	560	800	800	800	800	800	800	827	796	1,003	1,024	1,076	1,076	1,078	1,082	1,084
% of Fleet	2.2%	2.0%	2.0%	2.0%	2.0%	2.2%	2.0%	1.8%	2.3%	1.8%	1.3%	1.9%	1.9%	1.9%	2.0%	2.0%	2.0%	2.1%	2.0%	2.5%	2.6%	2.7%	2.7%	2.7%	2.7%	2.7%
Capital ($M)	43.6	38.5	38.3	35.3	35.3	38.8	33.9	42.8	41.2	35.3	34.8	51.0	52.0	53.0	51.0	52.0	53.0	39.8	46.9	60.0	52.7	56.5	57.6	58.8	60.0	61.1
Steel Structure Portfolio																										
# Renewal	153	371	462	1250	1600	1145	1600	86	725	1050	220	260	500	500	260	500	500	245	222	467	487	500	500	500	500	500
% of Fleet	0.3%	0.7%	0.9%	2.4%	3.1%	2.2%	3.0%	0.2%	1.4%	2.0%	0.4%	0.5%	1.0%	1.0%	0.5%	1.0%	1.0%	0.5%	0.5%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Capital ($M)	3.8	5.1	8.8	42.5	54.4	39.0	26.2	2.3	42.1	37.7	9.3	11.4	21.8	22.3	11.4	21.8	22.3	11.1	8.1	16.2	22.6	23.6	24.1	24.5	25.0	25.4
Underground Cable Portfolio																										
Replacements (km)	3.1	0	0	0	4.7	0	4.7	2.3	0	0	4.7	0	0	0	0	0	0	0	4.7	0	0	0	0	7.2	0	0
% of Fleet	1.1%	0.0%	0.0%	0.0%	1.8%	0.0%	1.8%	0.9%	0.0%	0.0%	1.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.7%	0.0%	0.0%	0.0%	0.0%	2.6%	0.0%	0.0%
Capital ($M)	20.6	3.5	1.4	2.3	22.5	2.3	22.5	1.7	10.7	16.5	15.0	7.1	32.5	33.6	7.1	32.5	33.6	14.9	7.1	3.9	27.6	41.1	27.4	6.4	1.9	6.6

Notes

[1] EB-2019-0082 Hydro One's Reply Argument, pp105-109.

[2] The capital in-service additions for these asset-types do not reflect a 1:1 ratio to the in-serviced units because additional costs pertaining to the installation may or may not be reflected. This is because the scope of each installation may vary depending on the nature of the integrated investment or failure replacement that is undertaken. A unit cost cannot be derived from these two quantities.

UNDERTAKING JT-1.13

Reference:

I-03-B1-AMPCO-014

Undertaking:

To provide on a best-efforts basis the same table for Q4, so end of year 2019 and 2020.

Response:

This interrogatory has been updated to include the requested information for 2021.

Please see below for the project and portfolio metric results as of Q4 2019 and Q4 2020 for the metrics identified in EB-2019-0082 Exhibit JT 1.16.

Project Level Metrics	Q4 2019	Q4 2020	Q4 2021
On-time: Project In-Service Date Forecast versus Current Approved	82%	88%	83%
On-time: Project In-Service Date Forecast versus Original Approved	41%	60%	60%
On-budget: Gross Project Total Forecast versus Current Approved	94%	100%	100%
On-budget: Gross Project Total Forecast versus Original Approved	82%	80%	77%
Portfolio Level Metrics	**Q4 2019**	**Q4 2020**	**Q4 2021**
In-Service Additions: Annual Forecast versus Budget	101%	101%	99%
Capital Expenditures: Annual Forecast versus Budget	99%	104%	112%
Portfolio Risk: Number of Projects Forecasting a Major Variance (+/- 10%) to Budget	21 of 194	16 of 177	11 of 169
Portfolio Risk: Value of Projects Forecasting a Major Variance (+/- 10%) to Budget	15%	14%	9%
Project Cost Performance: Number of Projects complete within AACE Estimate Class Range documented in original approval	29 of 31	19 of 21	15 of 18
Project Cost Performance: Value of Projects complete within AACE Estimate Class Range documented in original approval	99%	93%	78%
Cost Variance Distribution: Portion of Project Portfolio Delivered On Budget, Over Budget, Under Budget	94%	90%	83%
Cost Variance Distribution: Standard Deviation of Project Cost Performance represented as a percentage of original Budgets	13%	24%	29%
Schedule Variance Distribution: Portion of Project Portfolio Delivered On-time, Late, Early	55%	52%	56%
Schedule Variance Distribution: Standard Deviation of Schedule Variance in Days	670	341	635

Project level performance on Hydro One's largest and strategic projects has been very strong over the 2019 – 2021 period, with very strong cost performance relative to current approved budgets, and timeliness relative to originally approved in-service date commitments.

Witness: SPENCER Andrew

On a portfolio basis, the number of projects forecasting a major variance has decreased over the 2019 – 2021 period, which demonstrates the effectiveness of Hydro One's project delivery practices that have been in place over the past several years. Correspondingly, the portion of the overall portfolio that is represented by projects with major variances has also decreased. In addition, the vast majority of projects completed in the 2019 – 2021 period have been below the upper range of the AACE Estimate Class Range. The standard deviation of schedule variances has increased in 2021 relative to 2020, primarily due to the Leaside TS Bulk Integrated Station Investment project which was completed in Q4 2021. This project faced numerous scope changes, outage and staging constraints, and other project related complexities. In the absence of this project, the standard deviation of schedule variances for 2021 would have been closer to the 2020 result.

Overall, the 2021 project and portfolio metric results shown above demonstrate strong cost and schedule performance and the effectiveness of Hydro One's project delivery practices.

O - SCHOOL ENERGY COALITION INTERROGATORY - 266

Reference:

Exhibit O-2-1

Interrogatory:

Please update the following interrogatory responses to include 2021 year-end actuals and any changes to the 2022 forecast:

a) B3-SEC-131
b) B3-SEC-132
c) B3-SEC-133
d) B3-SEC-150
e) B3-SEC-151
f) B3-AMPCO-95

Response:

Hydro One's updated evidence filed on March 31, 2022 (Exhibit O-01 and updated Interrogatories) and April 8, 2022 (Exhibit O-02-01) did not include the 2022 bridge year consistent with Procedural Order Number 4, and the forecast in evidence remains as filed. As discussed in Exhibit O-02-01, notwithstanding external pressures including demand and inflation, Hydro One intends to manage within the planned total envelopes reflected in its pre-filed evidence for both transmission and distribution. To the extent demand and financial pressures on the 2022 work program prevent Hydro One from remaining within the 2020-2022 envelope, adjustments will be made over the 2023-2027 rate period to maintain forecast capital expenditure levels.

a) Please see Attachment 1.
b) Please see Attachment 2.
c) Please see Attachment 3.
d) Please see Attachment 4.
e) Please see Attachment 5 and Attachment 6.
f) The referenced interrogatory addresses costs for Alternatives 1 and 3 for DS-SR-07 for the period 2023-2027. There are no 2021 values provided in this interrogatory.

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B3 - SCHOOL ENERGY COALITION INTERROGATORY - 131

Reference:

Exhibit B-3-1, DSP Section 3.5, Page 20-22

Interrogatory:

With respect to SAIDI and SAIFI, please provide the revised version of Figures 2 and 3 a tabular format.

Response:

SAIDI	2016	2017	2018	2019	2020	2021
Adverse Environment	0.03	0.05	0.02	0.00	0.01	0.01
Defective Equipment	1.92	2.32	2.08	2.51	2.29	2.09
Foreign Interference	0.39	0.56	0.38	0.44	0.40	0.41
Human Element	0.05	0.06	0.06	0.09	0.09	0.15
Scheduled	1.46	0.84	1.07	1.31	1.05	0.83
Tree Contacts	2.98	3.55	2.76	2.36	3.08	2.71
Unknown/Other	1.01	0.56	0.44	0.31	0.35	0.30
Total	***7.8***	***7.9***	***6.8***	***7.0***	***7.3***	***6.5***
5 Year Average	**7.4**	**7.4**	**7.4**	**7.4**	**7.4**	**7.1**

SAIFI	2016	2017	2018	2019	2020	2021
Adverse Environment	0.00	0.01	0.00	0.00	0.00	0.00
Defective Equipment	0.61	0.74	0.76	0.96	0.86	0.82
Foreign Interference	0.16	0.19	0.18	0.17	0.18	0.17
Human Element	0.03	0.05	0.08	0.09	0.11	0.10
Scheduled	0.56	0.38	0.40	0.44	0.42	0.37
Tree Contacts	0.60	0.59	0.51	0.53	0.59	0.55
Unknown/Other	0.51	0.37	0.28	0.30	0.38	0.34
Total	***2.5***	***2.3***	***2.2***	***2.5***	***2.5***	***2.4***
5 Year Average	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**

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B3 - SCHOOL ENERGY COALITION INTERROGATORY - 132

Reference:

Exhibit B-3-1, DSP Section 3.5, Page 20-22

Interrogatory:

With respect to defective equipment contributions to SAIDI and SAIFI:

a) Please provide a table that shows for each year between 2016 and 2020, a breakdown of SAIDI cause by defective equipment by equipment type, both as a percentage and by hours.

b) Please provide a table that shows for each year between 2016 and 2020, a breakdown of SAIFI cause by defective equipment by equipment type, as a percentage and by number of interpretations.

Response:

a) Breakdown of SAIDI cause by defective equipment by equipment type by hours

Equipment Type	2016	2017	2018	2019	2020	2021
Cross Arm	0.054	0.093	0.096	0.080	0.045	0.081
Station Transformer	0.016	0.023	0.018	0.010	0.019	0.004
Overhead Conductor	0.194	0.217	0.303	0.326	0.247	0.214
Overhead Transformer	0.011	0.012	0.012	0.011	0.011	0.011
Pole	0.218	0.170	0.208	0.186	0.276	0.271
Station Recloser	0.006	0.026	0.005	0.000	0.003	0.009
Submarine Conductor	0.040	0.031	0.036	0.017	0.038	0.026
Underground Conductor	0.006	0.013	0.014	0.021	0.006	0.007
Underground Transformer	0.002	0.002	0.002	0.002	0.002	0.003
Other	1.373	1.731	1.388	1.860	1.644	1.466
Equipment Total	**1.92**	**2.32**	**2.08**	**2.51**	**2.29**	**2.09**

The 'Other' category consists of equipment types outside of the types listed in the table that contributed to SAIDI defective equipment, such as insulators and surge arrestors.

Breakdown of SAIDI cause by defective equipment by equipment type by percentage

Equipment Type	2016	2017	2018	2019	2020	2021
Cross Arm	2.8%	4.0%	4.6%	3.2%	2.0%	3.9%
Station Transformer	0.9%	1.0%	0.8%	0.4%	0.8%	0.2%
Overhead Conductor	10.1%	9.3%	14.6%	13.0%	10.8%	10.2%
Overhead Transformer	0.6%	0.5%	0.6%	0.4%	0.5%	0.5%
Pole	11.4%	7.3%	10.0%	7.4%	12.0%	13.0%
Station Recloser	0.3%	1.1%	0.2%	0.0%	0.1%	0.4%
Submarine Conductor	2.1%	1.3%	1.7%	0.7%	1.7%	1.2%
Underground Conductor	0.3%	0.6%	0.7%	0.8%	0.3%	0.3%
Underground Transformer	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%
Other	71.5%	74.7%	66.7%	74.0%	71.7%	70.1%
Equipment Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

b) Breakdown of SAIFI cause by defective equipment by equipment type

Equipment Type	2016	2017	2018	2019	2020	2021
Cross Arm	0.020	0.023	0.027	0.022	0.018	0.027
Station Transformer	0.005	0.004	0.004	0.001	0.005	0.006
Overhead Conductor	0.051	0.061	0.098	0.084	0.067	0.058
Overhead Transformer	0.002	0.002	0.002	0.002	0.002	0.002
Pole	0.035	0.039	0.050	0.042	0.045	0.053
Station Recloser	0.004	0.012	0.002	0.000	0.001	0.002
Submarine Conductor	0.002	0.002	0.003	0.002	0.002	0.002
Underground Conductor	0.001	0.007	0.003	0.004	0.003	0.002
Underground Transformer	0.000	0.000	0.000	0.001	0.001	0.001
Other	0.487	0.587	0.570	0.803	0.714	0.671
Equipment Total	**0.61**	**0.74**	**0.76**	**0.96**	**0.86**	**0.82**

Breakdown of SAIFI cause by defective equipment by equipment type by percentage

Equipment Type	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Cross Arm	3.3%	3.1%	3.6%	2.3%	2.0%	3.2%
Station Transformer	0.8%	0.6%	0.6%	0.2%	0.6%	0.8%
Overhead Conductor	8.4%	8.2%	12.9%	8.7%	7.8%	7.0%
Overhead Transformer	0.3%	0.3%	0.3%	0.2%	0.3%	0.3%
Pole	5.8%	5.2%	6.6%	4.4%	5.3%	6.5%
Station Recloser	0.6%	1.6%	0.2%	0.0%	0.2%	0.2%
Submarine Conductor	0.4%	0.3%	0.4%	0.2%	0.3%	0.3%
Underground Conductor	0.2%	1.0%	0.3%	0.5%	0.4%	0.2%
Underground Transformer	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Other	80.1%	79.6%	75.1%	83.5%	83.1%	81.5%
Equipment Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

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B3 - SCHOOL ENERGY COALITION INTERROGATORY - 133

Reference:

Exhibit B-3-1, DSP Section 3.5, Page 35

Interrogatory:

Please update Hydro One's OEB distribution scorecard to include 2021 and 2022 forecast results for each measure.

Response:

Hydro One forecasts year-end results for a subset of the measures on the Distribution OEB Scorecard, as shown below. For 2022, Hydro One is managing to the targets provided in DSP Section 3.5, p. 35, Figure 4.

Measure	2021
Vegetation Management – Gross Defect Correction (OCP) Cost per km $	$4,019
Number of Line Equipment Caused Interruptions****	9,978
Number of Vegetation Caused Interruptions****	8,361
Number of Substation Caused Interruptions****	53
SAIDI for Equipment Caused Interruptions	2.1
SAIDI for Vegetation Caused Interruptions	2.7
SAIDI - Rural - duration in hours	7.5
SAIFI - Rural - frequency of outages	2.6
SAIDI - Urban - duration in hours	2.8
SAIFI - Urban - frequency of outages	1.4
Large Customer Interruption Frequency (LDA's) - Interruptions per LDA	1.3

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B3 - SCHOOL ENERGY COALITION INTERROGATORY - 150

Reference:

Exhibit B-3-1, DSP Section 3.11, D-SR-05

Interrogatory:

With respect to Distribution Lines Trouble Call and Storm Damage Response program, Hydro One states: "The forecast expenditures for this demand program are projected from historical costs and trends. Storm response expenditures are based on an inflation-adjusted average of annual expenditures since 2005, with "outlier" years of unusually high expenditures (i.e. due to more severe storms) removed from the forecast – namely, 2006, 2013, and 2018. The expenditures for other categories of activities are guided by an inflation adjusted three-year historical average.

a) Please provide a breakdown of the program by each categories of activities/spending in this program for each between 2018 and 2027.

b) For the demand program category, please provide the total expenditures between 2005 to 2027.

c) Please explain what type of work in this category would require a capital contribution.

d) For each year between 2018 and 2021, and for each category of spending/activities provided in part (a), please detail the number and type of assets replaced.

Response:

a)

($M)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Emergency pole and equipment replacements	18.9	27.3	25.0	27.4	21.4	24.5	25.0	25.5	26.0	26.5
Emergency submarine and underground cable replacements	6.1	7.9	8.0	9.8	7.7	8.2	8.3	8.5	8.7	8.8
Storm damage response	86.0	35.7	70.9	70.5	46.6	53.1	54.2	55.3	56.4	57.5
Post-trouble response*	0.0	0.0	12.7	10.1	15.2	17.3	17.6	18.0	18.3	18.7
Damage claims	1.6	3.8	1.7	3.0	2.8	3.0	3.0	3.1	3.1	3.2

**In 2018/2019 Post-trouble response is included in SS-Other.*

b) Note, this date range is only applicable to Storm damage response.
See part a) for 2018-2027:

(in $ millions)	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Storm damage response	$34.5	$82.9	$28.2	$50.4	$34.6	$27.8	$63.7	$40.2	$93.2	$39.9	$52.2	$47.1	$56.4

c) Capital contribution is required for Damage Claims.

d) Hydro One does not internally report on specific number of assets replaced. Reporting is focused on the objectives of the capital program. The table below outlines the portion of the program and the unit reported:

Categories of Activities	Reporting Unit	2018	2019	2020	2021
Emergency pole and equipment replacements	Poles/Equipment Replaced	2734	3951	3846	3261
Emergency submarine and underground cable replacements	Submarine/UG Cable Replaced (m)	20750	37872	23529	44141
Storm damage response	Number of Customers Restored	N/A*	N/A*	1101234	1158860
Post-trouble response	Number of instances 2018/2019, Poles/Equipment Replaced 2020+	1140	1195	453**	446
Damage claims	Number of instances	984	1038	1202	1221

**Number of customers restored began being tracked as an objective for storm response starting in 2020.*
***Post-trouble response moved from reporting number of instances to poles/equipment replaced starting in 2020. This is a transition year for the change and does not represent a full year.*

Witness: FALTAOUS Peter

B3 - SCHOOL ENERGY COALITION INTERROGATORY - 151

Reference:

Exhibit B-3-1, DSP Section 3.11, D-SR-07

Interrogatory:

With respect to the Pole Sustainment Program:

a) [p.1] For each year between 2018 and 2027, please provide a table includes the total cost of the program, broken down each of test and treat, pole refurbishment, and pole replacement.

b) [p.8] Please expand Table 1 to include 2018 to 2022.

c) [p.9] Figure 6 shows the total number of poles in poor condition in each year between 2023 to 2027. Is the Figure based on current poles in poor condition adjusted for the number of poles to be replaced and refurbished during the test period, or does it include poles that are currently not in poor condition but are expected to become poor? If it is the latter, please explain how Hydro One methodology. If a similar methodology exists for other assets, please provide them.

d) [p.12] Did Hydro One consider as an alternative anything between alternatives 1 and 2. For example, addressing on a proactive basis an amount between 0 (alternative 1) and what is proposed in alternative 2.

Response:

a) Please see B3-AMPCO-094

b) Table 1 – Planned Volumes (D-SR-07)

	2018 Actuals	2019 Actuals	2020 Actuals	2021 Actuals	2022	2023	2024	2025	2026	2027
Test and Treat			10,884	60,280	100,000	103,000	103,000	103,000	103,000	103,000
Pole Refurbishment			96	1,877	4,000	2,800	2,800	2,800	2,800	2,800
Pole Replacement	5,982	3,984	4,519	5,344	5,050	10,300	10,300	10,300	10,300	10,300

Witness: FALTAOUS Peter

c) Based on historical volumes of poles found to be in poor condition, approximately 10,000 poles per year are assumed to become in poor condition and require replacement or refurbishment.

d) During the Customer Engagement process, Hydro One presented a slower paced replacement option which involved replacing 32,500 poles over 5 years. This alternative was not supported by the majority of customers as part of customer engagement.

B3 - ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO
INTERROGATORY - 094

Reference:

DSP Section 3.11, D-SR-07, Page 11

Interrogatory:

Please complete the following table on the basis of Gross Investment Cost:

D-SR-07	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Test and Treat										
Pole Refurbishment										
Pole Replacement										
Removals										
Total										

Response:

D-SR-07

($M)	**2018**	**2019**	**2020**	**2021**	**2022**	**2023***	**2024***	**2025***	**2026***	**2027***
Test and Treat	0.0	0.0	1.3	6.2	7.7	8.4	8.6	8.7	8.9	9.2
Pole Refurbishment	0.0	0.0	0.0	2.6	8.2	6.2	6.3	6.4	6.5	6.6
Pole Replacement	59.0	50.3	48.2	60.1	52.5	114.4	117.5	119.2	122.0	123.9
Removals	-7.0	-6.0	-5.9	-8.3	-8.2	-15.5	-15.9	-16.1	-16.5	-16.7
Total	**52.0**	**44.3**	**43.6**	60.6	**60.1**	**113.5**	**116.4**	**118.3**	**120.9**	**122.9**

** The 2023-2027 forecast reflects updated inflation assumptions calculated using the methodology described in Section 2.3 of Exhibit O-1-2.*

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O - SOCIETY OF UNITED PROFESSIONALS INTERROGATORY - 018

Reference:

Exhibit O-1-1

Exhibit O-1-1, Section 1.4 "Deferred Recovery Mechanism" Page 5 ln 25-29, Page 6 ln 1-4

> *As noted above, Hydro One is proposing to defer recovery, until after the 2023 to 2027 rate period, of: (i) the transmission and distribution approved revenue requirement increases arising from the use of updated, higher inflation assumptions, and (ii) the transmission and distribution approved revenue requirement equal to the revenue deficiencies arising from the changes in billing determinants because of the transmission and distribution updated load forecasts. For each of transmission and distribution, the incremental revenue requirement associated with both of these factors will be recorded in a newly proposed deferral account (tracked in separate Sub-accounts for inflation and load forecast for greater transparency) for recovery commencing in 2028.*

Exhibit O-1-2, Attachment 1.1, Page 2, Scotiabank Inflation Forecast dated 2022-03-31

"Our forecast is for Canadian inflation to equal 5.9% in 2022, 3.1% in 2023, 21⁄2% in 2024 and then return toward the Bank of Canada's 2% inflation target in subsequent years."

Interrogatory:

a) HONI is proposing to defer the effects of forecast inflation to a future rate period (i.e. 2028 +). Given the level of disruption in the international economy and rapidly changing expectations, is HONI's proposed Deferred Recovery Mechanism not a throw of the dice? For instance, it is quite possible that annual inflation in excess of +2% may continue past the period currently forecast by Scotiabank as well as others and recovery of this deferral could make things even more difficult in the next five year rate period. Admittedly no one has a crystal ball but can HONI comment on the degree of confidence it has that its proposed deferral strategy is the best for all ratepayer generations.

b) HONI's proposed Deferred Recovery Mechanism requires 2028 to 2032 ratepayers to pay increased costs due to inflation which 2023 to 2027 ratepayers should really bear. In light of this, can HONI comment on how the proposed Deferred Recovery Mechanism contributes to meeting the regulatory goal of intergenerational equity?

c)

i. Everything else held equal, please confirm that in the 2028 to 2032 period, HONI customer's base rates will be increased to the rate levels they would otherwise have started paying in January 2027 if HONI had not put in place the proposed Deferred Recovery Mechanism [plus any further annual base rate increase HONI may apply for in the 2028 base year].

ii. If this is not correct, please provide a detailed explanation.

d) As per the second reference provided above, HONI has proposed that recovery of the newly proposed deferral will commence in 2028.

i. Please confirm that if this proposed deferral account is recovered over a default three year period beginning in 2028, which is typical for recovery of deferral accounts, would this along with the rate increase outlined in b) above result in the rate increase between 2027 December 31st and 2028 January 1st being roughly doubled? Stephen

ii. If this is not correct, please provide a detailed explanation.

e) In light of HONI's replies to b), c) and d) above, please explain what alternatives HONI considered to recover these rate impacts prior to 2028 rather than roughly double the 2028 rate increase. Please provide a detailed explanation.

f) As per Scotiabank in the third reference above, they are projecting that inflation would return toward the Bank of Canada's 2% inflation target in 2025 and subsequent years. Further to HONI's forecast annual additions to the proposed deferral account in 2023 to 2027, what would the estimated high level rate impact be in:

i. 2025 if 50% of the forecast annual addition to the deferral account was reflected in rates instead.

ii. 2026 if 75% of the forecast annual addition to the deferral account was reflected in rates instead.

iii. 2027 if 100% of the forecast annual addition to the deferral account was reflected in rates instead.

iv. If HONI is incapable of providing the simple estimates requested in parts (i), (ii) and (iii) above, please provide a detailed explanation as to why this is the case.

g) Further to f) parts (i), (ii) and (iii) above, what is the estimated high level impact upon the proposed deferral account balance as of December 31 2027 in dollar and percentage terms.

Response:

Parts a) and b)

Hydro One believes that its proposed deferred recovery mechanism is in the best interests of its customers. The proposal is based on use of the current information available, including information to be updated at the time of the DRO. Moreover, the proposal will enable customers to benefit from the deferral of these costs during a period in which many other cost increases facing customers cannot be deferred.

Please refer to interrogatory response O-Staff-384, part a) for further discussion with respect to intergenerational considerations.

c) Hydro One confirms that with respect to base rates, the 2028 bill impact will constitute a combination of an increase attributable to the deferred revenue that was not built into the 2027 rates (when comparing 2028 rates relative to 2027 rates), as well as any potential incremental asks at that time. However, the specific amount of the increase to future base rates cannot be confirmed. Future rates are based on many factors which are unknown at this time including the cost of capital, future investment requirements and future expectations regarding load which can have an offsetting impact to rate increases.

d) As noted in the interrogatory response to O-SEC-252 part a), Hydro One has not proposed in this proceeding a disposition period for which to collect the deferred revenues. As the bill impacts in 2028 and beyond will include the combined impacts from the proposed capital and OM&A envelopes to be approved by the OEB in the next rebasing application and other items including revenue offsets, the total bill impacts would be indeterminate at this time.

e) Please refer to interrogatory response O-CME-22, part c).

f) Please see below for high level rate impact estimates for transmission and distribution based on the adjustments mentioned in part i) to iii). These estimates reflect 50%, 75%, and 100% of the deferred revenue requirement from the inflation and load update being reflected in the revenue requirement in 2025, 2026, and 2027, respectively.

Transmission		2022	2023	2024	2025	2026	2027	5-year Avg
Total Revenue Requirement per March Evidence Update (O-1-2, Table 26)($M)	**A**		**1,849.3**	**1,968.2**	**2,063.0**	**2,182.5**	**2,266.6**	
Deferred Revenue Related to Inflation Update (O-1-4, Table 1) ($M)	**B**		26.1	30.4	35.5	42.2	47.6	
Deferred Revenue Related to Load Forecast Update (O-1-4, Table 3) ($M)	**C**		3.3	10.9	24.8	42.6	41.3	
Total Revenue Requirement with Deferred Inflation and Load Impacts ($M)	**D=A-B-C**		**1,819.9**	**1,926.9**	**2,002.7**	**2,097.7**	**2,177.7**	
Requested % of Deferred Revenue to be added back to the Revenue Requirement	**E**		0%	0%	50%	75%	100%	
Revenues to be added back ($M)	**F=(B+C)*E**		0.0	0.0	30.2	63.6	88.9	
Adjusted Total Revenue Requirement per Requested Scenario ($M)	**G=D+F**	**1,816.2**	**1,819.9**	**1,926.9**	**2,032.9**	**2,161.3**	**2,266.6**	
Offsets* ($M)	**H**	-19.8	-87.4	-54.7	-54.4	-53.1	-53.5	
Rates Revenue Requirement per Requested Scenario ($M)	**I=G+H**	**1,796.4**	**1,732.5**	**1,872.2**	**1,978.5**	**2,108.1**	**2,213.1**	
Annual Y-O-Y Impact, excl. Load			-3.6%	8.1%	5.7%	6.6%	5.0%	
Estimated Y-O-Y Load Impact			2.0%	0.0%	0.6%	0.6%	-0.2%	
Annual Rate Impact			**-1.6%**	**8.1%**	**6.3%**	**7.1%**	**4.7%**	**4.9%**

**Offsets include non-rate revenues, export revenues, disposition of regulatory accounts and low voltage switchgear credit, as well as the $27.5M credit for External Revenue Variances in 2023.*

Distribution		2022	2023	2024	2025	2026	2027	5-year Avg
Total Revenue Requirement per March Evidence Update (O-1-2, Table 28) ($M)	**A**		**1,669.1**	**1,753.3**	**1,832.2**	**1,934.8**	**2,024.6**	
Deferred Revenue Related to Inflation Update (O-1-4, Table 2) ($M)	**B**		36.7	42.0	47.2	53.7	59.7	
Deferred Revenue Related to Load Forecast Update (O-1-4, Table 4) ($M)	**C**		6.3	7.3	10.3	14.0	15.0	
Total Revenue Requirement with Deferred Inflation and Load Impacts ($M)	**D=A-B-C**		**1,626.1**	**1,704.0**	**1,774.7**	**1,867.1**	**1,950.0**	
Requested % of Deferred Revenues to be added back to the Total Revenue Requirement	**E**		0%	0%	50%	75%	100%	
Revenues to be added back ($M)	**F=(B+C)*E**		0.0	0.0	28.7	50.8	74.6	
Adjusted Total Revenue Requirement per Requested Scenario ($M)	**G=D+F**	**1,692.1**	**1,626.1**	**1,704.0**	**1,803.5**	**1,917.9**	**2,024.6**	
Offsets* ($M)	**H**	-44.9	-46.4	-46.5	-46.5	-46.0	-46.1	
Rates Revenue Requirement per Requested Scenario ($M)	**I=G+H**	**1,647.2**	**1,579.7**	**1,657.5**	**1,757.0**	**1,871.9**	**1,978.5**	
Annual Y-O-Y Impact, excl. Load			-4.1%	4.9%	6.0%	6.5%	5.7%	
Estimated Y-O-Y Load Impact			0.4%	-0.4%	-0.4%	-0.3%	-0.5%	
Annual Rate Impact**			**-3.7%**	**4.5%**	**5.6%**	**6.3%**	**5.2%**	**3.6%**

** Offsets include external revenues.*

*** Excludes the impact of Deferral and Variance Account disposition as these amounts are recovered through separate charges.*

g) If the rates revenue requirement was updated based on the scenario requested in part f) above, the combined Transmission deferral accounts balance, reflecting inflation and load update, as of December 31, 2027, will be $122.1M, which is 60% lower than the total deferred amounts for the 2023-2027 period as shown in Exhibit O-01-04, Tables 1 and 3. The combined Distribution deferral accounts balance as of December 31, 2027, will be $138.0M, which is 53% lower than the total deferred amounts for the 2023-2027 period as shown in Exhibit O-01-04, Tables 2 and 4. Hydro One notes that these high-level calculations do not consider carrying charges.

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O - SOCIETY OF UNITED PROFESSIONALS INTERROGATORY - 019

Reference:

Exhibit O-1-2, Section 2.5.2, "Confirmation and Adjustment of Inflation Forecast" Pages 16, 17
Exhibit O-1-4, Page 6

Interrogatory:

a) If inflation impacts are adjusted at the DRO date as proposed by HONI, there will be no opportunity for intervenor or Board review. SUP presumes that this adjustment will be entirely mechanical. Will detailed calculations be made available for interested parties and Board staff to review? Please confirm or explain why this will not be the case.

b) HONI proposes that the deferral account balances will be approved in this proceeding (ref. O-1-4 p6). Hence no future prudence review or authorization for post 2028 recovery will be necessary. Please comment on this observation.

c) It is quite possible that 2023-2027 annual inflation may exceed Scotiabank's March 31 forecast.
   i. Has HONI considered deferring actual inflationary impacts on revenue requirement and load forecast in a variance account rather than forecast increases in a deferral account?
   ii. Please explain in detail why this option was rejected.
   iii. If this option was not considered by HONI please explain in detail why this was the case.

Response:

a) Please see interrogatory response to O-CCC-053 part (1). Hydro One will make best efforts to provide all calculations used to update the inflation forecast and to adjust the approved revenue requirements as part of the Confirmation and Adjustment process in its DRO submission.

b) As outlined in Exhibit O-01-04, at the time of the DRO, Hydro One will update the revenue requirements for which it seeks approval based on the actual and most recent inflation forecast for 2022 and 2023, as well as any other updates required at the DRO stage, which would then be applied to the final approved Capital and OM&A amounts. At that time, the incremental revenue requirements arising from the difference in inflation assumptions (i.e. the final inflation rate confirmed at the DRO process and the 2.0% original inflation rate used in the plan per year) will be recorded in the proposed Inflation Updates Sub-accounts, within the Transmission Approved Revenue Requirement Deferral Account or the Distribution

Approved Revenue Requirement Deferral Account, as applicable. As the OEB will be approving all amounts to be recorded in the revenue deferral accounts in the current proceeding, Hydro One does not believe that a further prudence review in the next proceeding will be required. However, the OEB (at time of disposition) may want to confirm that the carrying costs have been appropriately calculated and recorded in the accounts.

c) The purpose of the evidence update is not to account and adjust for all changes that will occur over the test period (i.e. true-up for actuals). Rather, the purpose of Hydro One's current evidence update is to reflect the most appropriate inflation assumptions in its Transmission and Distribution capital and OM&A forecasts during the test period. In the normal course, OEB approved capital and OM&A would include inflationary assumptions and such approval would form the basis of revenue requirement. Once established, Hydro One would then manage within that funding envelope over the rate-setting period. As such, Hydro One has requested that the OEB provide an approved revenue requirement (inclusive of the updated inflation assumption) and the incremental inflationary impact on that revenue requirement be deferred to mitigate the impact to customers.

O - SOCIETY OF UNITED PROFESSIONALS INTERROGATORY - 020

Reference:

Exhibit O-1-1, Section 1.2, "Inflation Update", Pages 1-4
Exhibit O-1-2, "Inflation Update"
Exhibit O-1-2, Attachment 1.1, Page 3, Scotiabank Inflation Forecast dated 2022-03-31

> While the year-over-year [inflation] rate is projected to gradually decelerate (chart 1), this assumes that the Bank of Canada will raise its policy interest rate as aggressively as we forecast. We expect a total of 2.0 percentage points of Bank of Canada rate hikes this year [2022] including the already delivered 0.25% increase followed by another 0.5% in 2023 with the policy rate peaking at 3%. Should policy not tighten accordingly, we would probably raise our inflation forecast for a longer period of time.

Interrogatory:

a) Please confirm that HONI has not updated its Cost of Capital forecast, including its cost of debt and the capitalized interest for its investment program, in its evidence update referenced above.

b) Please confirm whether or not HONI's expected Cost of Capital, including its cost of debt and the capitalized interest for its investment program, would increase if the Bank of Canada rates are expected to be hiked.

c) Please provide HONI's rationale for NOT updating its Cost of Capital forecast, including its cost of debt and the capitalized interest for its investment program, in light of Scotiabank's position regarding expected Bank of Canada rate hikes in 2022 and 2023 provided in the above reference.

Response:

a) Hydro One has not updated its Cost of Capital forecast in its evidence update referenced above. With respect to capitalized interest, please refer to interrogatory response to O-SUP-021.

b) The deemed short-term debt rate is most correlated with the Bank of Canada's overnight interest policy rate. Hence, the deemed short-term debt rate to be incorporated in the DRO could rise if the Bank of Canada increases its target for the overnight interest rate. It is difficult

at this time to forecast the impact of Bank of Canada interest rate increases on the other parameters of the Cost of Capital to be incorporated in the Draft Rate Order.

c) Hydro One did not update the forecast rates for Cost of Capital because, as stated in Exhibit O-01-02 Page 31 and Exhibit F-01-01:

Hydro One anticipates updating the revenue requirements for the 2023 to 2027 test years when the Board releases its 2023 cost of capital parameters, reflecting: (a) the Board-approved 2023 return on equity and deemed short term debt rate; and (b) long-term debt rates based on Hydro One's actual 2021 and 2022 debt issuances to-date and forecasted debt issues in 2023 with coupon rates based on the September 2022 Consensus Forecast. Hydro One proposes that the 2023 cost of capital parameters established at that time be used to determine the final revenue requirements for 2023 to 2027 test years.

With respect to capitalized interest, please refer to interrogatory response to O-SUP-021.

O - SOCIETY OF UNITED PROFESSIONALS INTERROGATORY - 021

Reference:

Exhibit O-1-2, Section 2.3, "Description of Inflationary Update to Evidence", Pages 8-10
Exhibit O-1-2, Section 2.4, "Impact of Inflation on HONI's Investment Plan", Pages 11-15
Exhibit O-1-2, Pages 11, ln 8-11

> To successfully achieve the outcomes and benefits of Hydro One's proposed plan, the forecast costs must be updated to include the impacts of inflation. If current inflation levels are not accounted for, Hydro One will not be able to complete the work included in the investment plan.

Interrogatory:

a) In light of the rationale provided by HONI as referenced above for updating its forecast costs for inflation, please explain how its investment plan can be completed if HONI has chosen not to update its Cost of Capital forecast and not reflect expected increased capitalized interest costs for its investment plan. Please provide a detailed explanation.

Response:

a) Hydro One did not update the forecast rates for Cost of Capital because, as stated in Exhibit O-01-02 Page 31 and Exhibit F-01-01:

Hydro One anticipates updating the revenue requirements for the 2023 to 2027 test years when the Board releases its 2023 cost of capital parameters, reflecting: (a) the Board-approved 2023 return on equity and deemed short term debt rate; and (b) long-term debt rates based on Hydro One's actual 2021 and 2022 debt issuances to-date and forecasted debt issues in 2023 with coupon rates based on the September 2022 Consensus Forecast. Hydro One proposes that the 2023 cost of capital parameters established at that time be used to determine the final revenue requirements for 2023 to 2027 test years.

With respect to capitalized interest, the process Hydro One undertook to update costs in this application is described in Section 2.3 of Exhibit O-01-02. Specifically, the investment plans were de-escalated for initial inflation assumptions, and re-escalated for the revised Scotia forecast. Capitalized interest would have been reflected in the capital expenditures that were updated with the revised inflation rates.

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O - SOCIETY OF UNITED PROFESSIONALS INTERROGATORY - 022

Reference:

Exhibit O-1-2, Section 5.5, "Regulatory Taxes", Pages 34-36

Preamble:

As outlined in the referenced section, due to the impact of inflation on rate base (due to In-Service Addition increases), CCA deductions also increase in all years, which reduces regulatory taxes. HONI proposes to reflect these forecast lower regulatory taxes in 2023 to 2027 rates. This is inconsistent with the HONI's proposal to pickup all 2023 to 2027 increased inflation impacts in deferral accounts.

Interrogatory:

a) Why has HONI chosen to inconsistently treat these increased CCA deductions in this manner?

b) Why should 2023 to 2027 ratepayers benefit from these increased CCA deductions which result from inflation, whereas 2028 to 2032 ratepayers must pay the increased costs resulting from inflation in 2023 to 2027 which HONI proposes to place in deferral accounts?

c) Please confirm that HONI's proposed treatment of increased CCA deductions in 2023-2027 resulting from inflation is theoretically inconsistent with its proposed Deferred Recovery Mechanism.

Response:

a) Hydro One disagrees with the premise of the question. Hydro One's proposed treatment of increased CCA deductions in 2023-2027 resulting from inflation is consistent with the proposed deferred recovery mechanism. It is Hydro One's intention to defer the regulatory tax impact for recovery commencing in 2028. By virtue of the deferred revenue mechanism, Hydro One plans to reflect, record, and recover the lower regulatory tax impact arising from inflation on rate base through the proposed transmission and distribution revenue deferral accounts. As such, the increased CCA deductions over the 2023-2027 period will be deferred until 2028, consistent with the proposed deferred recovery mechanism.

b) Hydro One disagrees with the premise of the question. As noted in the above response to part a), ratepayers in the 2023-2027 period will not benefit from the increased CCA deductions.

c) Not confirmed. Please see response to part a) above.

Witness: TRAN Nancy

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O - SOCIETY OF UNITED PROFESSIONALS INTERROGATORY - 023

Reference:

Exhibit O-1-1, Section 1.2, "Inflation Update", Pages 1-4
Exhibit O-1-2, "Inflation Update"
Exhibit E-6-1, Attachment 1.1, "Compensation Benchmarking Forecast"
Interrogatory response to E-6 SUP #10

Interrogatory:

a) In the opinion of Mercer, in light of increased inflation expectations reflected in HONI's amended evidence, do the previous annual forecasts of HONI's standing versus P50 market median for 2023 to 2027 still hold?

b) If the reply to a) is no, please provide a high level estimate update.

c) If the reply to a) is yes, please provide a detailed explanation.

Response:

Response from Mercer:

a) Yes, the findings for the 2023 – 2027 forecast still hold.

b) Not applicable.

c) The basis of the forecast is to see how Hydro One's compensation levels compare with the market across forecast years 2023 to 2027. Specifically, one of the objectives is to compare the impact of anticipated and assumed compensation changes within Hydro One to those that are assumed for the market over the forecast period. When considering the impact high inflation will have on wage adjustments, Mercer assumes Hydro One will be impacted in a similar way as the market. For instance, if one anticipates the market will experience an increase to wage adjustments due to inflation, the same level of increase can reasonably be expected of Hydro One. In addition, Mercer has considered the macroeconomic factors that are expected to put downward pressure on inflationary levels ahead of, or during, the forecast period. Based on these considerations, Mercer concludes that inflationary pressures will likely have little to no material impact on the forecast results.

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O - SOCIETY OF UNITED PROFESSIONALS INTERROGATORY - 024

Reference:

Exhibit E-7-1, "Pension and OPEB Costs", Table 4a "Transmission OPEB Costs Included in Rates", and Table 4b "Distribution OPEB Costs Included in Rates"

Exhibit E-7-1, Attachment 2, "Revised Hydro One Inc. Projected 2021-2027 Benefit Cost Under FASB ASC 715-20-50", prepared by Willis Towers Watson (WTW) , dated 26 February 2021.

Exhibit O-1-2, Attachment 1.1, Page 3, Scotiabank Inflation Forecast dated 2022-03-31

> While the year-over-year [inflation] rate is projected to gradually decelerate (chart 1), this assumes that the Bank of Canada will raise its policy interest rate as aggressively as we forecast. We expect a total of 2.0 percentage points of Bank of Canada rate hikes this year [2022] including the already delivered 0.25% increase followed by another 0.5% in 2023 with the policy rate peaking at 3%. Should policy not tighten accordingly, we would probably raise our inflation forecast for a longer period of time.

Interrogatory:

a) What impact would Scotiabank's referenced Inflation Forecast have on the inflation rates used by WTW in its referenced projection dated the 26th February 2021?

b) What impact would Scotiabank's referenced Inflation Forecast and expected Bank of Canada rate hikes in 2022 and 2023 have on the discount rates used by WTW in its referenced projection dated 26th February 2021?

c)

i. Has HONI requested WTW to revise its referenced projection dated the 26th February 2021 to reflect the items in a) and b) above?
ii. If not, why not? Please provide a detailed explanation.

d) What would the high level estimated impact be on HONI OPEB costs summarized in the referenced Exhibit E-7-1 tables 4a and 4b if they were revised to reflect the factors outlined in a) and b) above?

Response:

a) The inflation assumptions used by WTW in their projections are long-term in nature. As such, WTW has confirmed that the inflation assumptions used in their projections likely would not have been significantly affected by the short-term inflation expectations from Scotiabank's referenced inflation forecast.

b) Please refer to the interrogatory response to O-Staff-385, part b).

c) Please see responses below:
   i. Hydro One has not requested WTW to revise the referenced projection dated February 26, 2021 to reflect the items in parts a) and b) above.
   ii. Please see response to parts a) and b) above.

d) Please see responses to parts a), b) and c) above. Please also refer to interrogatory response to O-Staff-385 part c) for ratepayer protection mechanisms.

O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 143

Reference:

Exhibit O-1-2, Page 9

Interrogatory:

$$Proration\ Factor = \frac{(1 + i_{2021}) \times (1 + i_{2022}) \times (1 + i_{2023})}{(1 + i_{as-filed})^3}$$

Where: i_{2021} is the actual Ontario inflation in 2021 of 3.5%

i_{2022} is the Scotia forecasted Ontario inflation in 2022 of 4.5%

i_{2023} is the Scotia forecasted Ontario inflation in 2023 of 3.3%

$i_{as-filed}$ is the 2% rate used in as-filed plan

$$Proration\ Factor = \frac{(1.035)x(1.045)x(1.033)}{1.02^3} = 1.0525$$

a) It is unclear to us why Hydro One is proposing a "proration factor" as opposed to simply replacing the inflation forecast of the original proposal with an updated forecast. Please explain the reasons for this approach and what material difference there is between this approach a simpler updating of the application for a revised inflation forecast.

Response:

a) As part of the evidence update, inflation assumptions were updated through a de-escalation of all costs by the original inflation of 2.0% per year to the base year of 2020, followed by the application of the revised inflation rates listed in Exhibit O-01-02, Section 2.3. These steps collectively describe Hydro One's approach to update the original inflation assumptions in the investment plan; the delta between the original inflation assumptions and the revised inflation assumptions resulted in a "proration factor" as outlined in Exhibit O-01-02 page 9. The proration factor once calculated was applied to all planned OM&A costs for 2023 and capital costs for 2023-2027. Please refer to the interrogatory response to O-Staff-357 for further discussion in respect of the approach to the inflation update.

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O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 144

Reference:

Exhibit O-1-2, Page 4

Interrogatory:

a) Why was Scotiabank engaged to produce a specific forecast for Hydro One as opposed to the alternative of using a pre-existing forecast, for example the Consensus forecast?

b) What is the current Consensus Forecast for 2022 and 2023 inflation?

c) Does Hydro One carry out any other business with Scotiabank? If yes, please describe that business relationship.

Response:

a) Scotiabank's pre-existing, published Ontario CPI forecast was used by Hydro One. Scotiabank did not create a specific forecast for Hydro One. Please refer to Hydro One's response to O-Staff-359 for further details.

Consensus Forecasts publishes Canada CPI forecasts, however, it does not publish Ontario CPI forecasts. Please refer to Hydro One response to O-LPMA-029 with respect to further Consensus Forecast discussion.

Hydro One's rationale for selecting Ontario CPI for the inflationary adjustment is discussed in Hydro One response to O-Staff-357 part a).

b) Consensus Economics surveys prominent financial and economic forecasters monthly and publishes this information in a report titled Consensus Forecasts. Consensus Economics April 2022 Consensus Forecasts survey for Canada CPI (average % change on previous calendar year) reported the following from eighteen forecasters:

- 2022: a range of between 4.5% and 5.9% and the Consensus (Mean) was 5.2%
- 2023: a range of between 1.8% and 3.5% and the Consensus (Mean) was 2.5%
- Scotiabank was one of the eighteen forecasters included in this survey.
- This document was published on April 14, 2022 and states a survey date of April 11, 2022.

Please refer to O-SEC-244 for the April Consensus Forecasts report.

c) Hydro One employs a number of facilities and programs to provide liquidity and financing. Scotiabank, together with many other major financial institutions, participates as a member in these various facilities and programs.

O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 145

Reference:

Exhibit O-1-2, Page 6-7, Table 2

Interrogatory:

a) Hydro One explains that it is "*is experiencing price escalation for many materials and services, especially for those associated with steel, copper, aluminum, and transportation*". Has the Company undertaken any studies or analysis of its exposure to inflation on the material costs listed in Table 2?

b) What steps has Hydro One taken to limit is exposure to price increases in the contracting for materials?

Response:

a) Hydro One developed an inflation forecast model based on the 2021 Sourceable Spend and calculated inflation for each sourcing category applying the appropriately weighted input indices (examples include Aluminum, Copper, Steel, Nickel, Softwood Lumber, and CPI). Hydro One uses an online platform, Pro Purchaser, to obtain the index data that is applied into the internal calculation.

b) Please refer to Interrogatory O-Staff-363 b) for the steps that Hydro One has taken to minimize the risk of global supply chain issues and market price changes.

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O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 146

Reference:

Exhibit O-1-2, Page 18

Interrogatory:

a) Using Table 6 (TX OM&A) and Table 7 (DX OM&A) as a response format, please provide the proportion of OM&A costs in each cost category that are attributable to internal labour costs (collective agreement and other internal)?

b) Which collective agreements expire prior to the end of 2022, 2023 and 2024?

Response:

a) Hydro One's compensation details (Exhibit E-06-01-2A) aggregates costing and planning data per cost category (e.g., base wages, overtime, performance dollars) for Transmission and Distribution for each employee category. An estimate of the proportion of total OM&A costs that relate to compensation can be found in Hydro One's response to Interrogatory O-Energy Probe-082 and O-SEC-254.

b) Hydro One's agreement with Canadian Union of Skilled Workers (CUSW) expired on April 30, 2022. The agreement with the Power Workers' Union's main bargaining unit (including PWU Hiring Hall) expires on March 31, 2023, as does the agreement with the Society of United Professionals. The agreement with the PWU Customer Service Organization (CSO), expires on September 30th, 2022.

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O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 147

Reference:

Exhibit O-1-2

Interrogatory:

a) Using Tables 8 (TX Capex) and 10 (DX Capex) as a response format, please provide the estimated capital expenditures for materials currently in store (including items already purchased but yet to be delivered) and, separately, those yet to be purchased.

Response:

a) For materials currently in store, Hydro One has approximately $13.6M related to Transmission capital and $6.0 M related to Distribution capital as of year end 2021. Hydro One is not able to present these costs by OEB category, as inventory is purchased centrally and is not tied to any investment category. Hydro One does not have visibility of materials yet to be purchased for 2023-2027.

Please refer to Interrogatory O-Staff-363, part b), for further information on how Hydro One is managing the inventory risks.

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O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 148

Reference:

Exhibit O-1-2, Page 11

Interrogatory:

a) What specific price risk analysis has been undertaken on the significant projects in both distribution and transmission. For example, it is noted that the Pole Sustainment Program requires a large number of poles. Has an analysis been undertaken on the risk of pole price increases and how that might be mitigated (by for example, ordering in advance).

Response:

a) Please refer to Interrogatory O-SEC-261 for an analysis of the inflation experienced in 2021 procurement spend for Hydro One. The pole pricing increases have been accounted in the analysis.

For mitigation plans, please refer to Interrogatory O-Staff-363.

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O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 149

Reference:

Exhibit O-1-2, Page 11-17

Interrogatory:

If the plan is not adjusted for updated inflation assumptions, a range of investments that are not deemed "mandatory" (e.g., driven by regulatory or compliance obligations) would be impacted by deferrals and reductions.

If the cumulative inflation for 2022 and 2023 exceeds 10%, Hydro One will aim to manage its work program to the capped amount through investment reprioritization and redirection and will adjust the outcomes outlined in TSP Section 2.5 and DSP Section 18 3.5 accordingly.

a) It is unclear to us why it would be appropriate for Hydro One to make reductions to its spending if inflation exceeds 10% but not otherwise for a different amount (say 9.5% or some other amount). Please explain the analysis that went into choosing 10% as a point from which no further adjustments would be made to the capital (and presumably OM&A) plans.

b) Given that Hydro One is proposing to make no adjustment to rates for the proposed inflation change provided in this update why would there be any change to budgets irrespective of the actual quantum of inflation during the period?

c) How is Hydro One intending to finance the shortfall that will accumulate in the proposed deferral accounts?

Response:

a) Hydro One voluntarily imposed a cap on its proposed cumulative inflation adjustment to provide the OEB with certainty on the upper limit of any inflation adjustment at the draft rate order stage. In selecting an upper limit, Hydro One considered the fact that since it began the process of updating the application in February 2022, Scotia provided an updated inflation forecast that showed inflation rates in 2022 increasing from 4.5% to 6.3% (Exhibit O-01-01, page 3). The cumulative forecasted inflation as a result of this update was 9.6% (6.3%+3.3%), or 10% rounded.

Recognizing the impracticality of updating evidence further (prior to the DRO process) as the forecast continues to change (and could continue to increase), Hydro One made the decision to set the maximum cumulative inflation amount to the most recent forecast and to accept it as a reasonable maximum inflation amount.

At the time the cap was established, setting it at 10% allowed Hydro One to execute its as-filed workplan given the then current levels of inflation anticipated, thereby mitigating the system risks the investment plans are intended to address, while also providing certainty on the upper limit of the revenue requirement impacts.

b) As discussed in Exhibit O-01-04, Hydro One is proposing that the OEB establish revenue requirements that incorporate the forecast impact of inflation. The approved revenue requirements will determine the applicable capital and OM&A and the resources available to execute Hydro One's work program irrespective of whether inflation-related amounts are deferred as Hydro One proposes.

c) Hydro One would fund the balance in the inflation deferral account through funds from operations and debt. Funds from operations is a measure of a company's operating cash flows.

O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 150

Reference:

Exhibit O-1-2, Attachment Scotiabank

Interrogatory:

"*Scotiabank Economics has a proprietary model based upon expanded work done by our econometricians. It was recently updated to better account for supply side drivers. This econometric approach builds upon a traditional Phillips Curve approach that expresses the relationship between inflation and unemployment. We use a modified approach that takes into account the levels of spare capacity in the economy, as well as labour costs. The resulting model offers a reasonable statistical 'fit' to actual recent inflation*."

a) Please identify the authors of the study.

b) The forecast incorporates the Phillips curve in its macroeconomic models. Do the authors agree that the empirical evidence for a negative relationship between inflation and unemployment is weak at best and currently disputed in the academic community?

c) In any event, the evidence itself identifies changes in aggregate demand as causes to changes in both unemployment and inflation. Do the authors of the study agree that in the current economic environment all forecast with respect to inflation are inherently problematic/unreliable?

d) Please provide the author's December 2021 forecast for 2022 inflation (or the most recent 2021 year-end forecast) that utilized the same or similar econometric model as being used here.

e) Please list the "supply side drivers" incorporated into the econometric model.

f) What judgement inputs are added to the outcome of the econometric model?

g) Please provide (and chart) the actual annual Canadian inflation rates (CPI-trim, CPI-median and CPI-common) for the period 2005 to 2021.

Response:

Response from Scotiabank:

a) The report provided in Exhibit O-01-02 Attachment 1 is authored by Derek Holt. The study referenced in the quote provided in the IR, was authored by René Lalonde and Nikita Perevalov.

b) The negative relationship between the unemployment rate and inflation (or alternatively the positive relationship between the output gap and inflation) called the Phillips Curve has weakened across time. We indeed found that an equation that relies almost exclusively on the notion of a demand-pulled variable like the unemployment rate gap, or the output gap doesn't perform well enough. But if we add to the Phillips curve cost pushed variables like the unit labour cost (wage growth minus productivity growth) and supply chain variables like the PMI supplier deliveries index then the performance of this framework increases substantially. This is our Augmented Phillips Curve Framework. Finally, it is important to note that both the Bank of Canada and the FED still use the Phillips Curve as their main inflation framework.

c) Recent inflation is affected by exogenous events such as the war in Ukraine and Covid related bottlenecks. Under this context it is difficult to forecast inflation. Nevertheless, we found that having a well-built framework that includes a large variety of drivers is very helpful. For instance, Covid related supply chain issues show up in the supplier deliveries index.

d) Our December 2021 forecast for Total CPI (from our published Forecast Tables): 2022: 4.5% 2023:2.9%

e) Our supply side variables are lagged growth of unit labour cost, lagged PMI supplier deliveries index, growth rate of the price of oil (input of production) and growth rate of the real effective exchange rate (imported inputs goods).

f) We added some positive judgment in 2022 to account for the effect of the war in Ukraine on the non energy commodity prices which are not yet explicitly included in our framework.

g) Canadian inflation rates (CPI-trim, CPI-median and CPI-common) for the period 2005 to 2021 can be found the Bank of Canada's website provided in the following link: https://www.bankofcanada.ca/rates/indicators/key-variables/inflation-indicators/

O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 151

Reference:

Exhibit O-1-3, Page 1 and 4
Exhibit O - Updates to:
Exhibit I-24-D-VECC-036 g),
Exhibit I-24-D-VECC-040 a), b) & g)
Exhibit I-24-D-VECC-041 a) & g)
Exhibit JT-VECC-TCQ-06

Preamble:

The Update states (page 1)
"In December 2021, the IESO issued its 2021 APO. The 2021 APO contains materially higher forecasts for CDM in Ontario, averaging a 19% increase in CDM compared to the forecast used in the as-filed evidence over the test period (2023-2027). As a result of the change in the IESO's CDM forecast, from its 2020 APO to its 2021 APO, the CDM assumptions used to establish Hydro One's load forecasts for both transmission and distribution became outdated".

VECC-TCQ-06 (March 2022 Update) states:
"In this evidence update, CDM energy savings for the years 2019-2021 are the same as in APO 2021".

Interrogatory:

a) Please provide a schedule that sets out the historical CDM savings (MWh) for 2020 and earlier years: i) as reported in APO 2020 (per VECC-TCQ-06), ii) as used in HONI's pre-filed evidence, iii) as reported in APO 2021 (per VECC-TCQ-06) and iv) as used for purposes of HONI's updated March 2022 evidence. For items (ii) and (iv), please clarify whether they are consistent with the APO values in their treatment of savings due to codes and standards. If the MWh associated with codes and standards are included in items (ii) and (iv), please separate the impacts of energy efficiency programs vs. codes & standard where possible.

b) The March 2022 Update to VECC-TCQ-06 states - "In this evidence update, CDM energy savings for the years 2019-2021 are the same as in APO 2021". However, the historical CDM

values provided in the March 2022 Update to VECC 40 b) have changed from those in the original response. Please reconcile.

c) It is noted that the development of the Monthly Model (see VECC 40 a)) and the Annual Model (see VECC 41 a)) both used historical CDM (MWh) values for 2019 and previous years. It is also noted that the development of the Monthly Model used 2020 data (see VECC 40 a)). Are the historical CDM (MWh) savings reported in the APO 2021 for 2020 or earlier years different from those used by HONI in its pre-filed evidence (see VECC 40 b)?

d) If the historical CDM values for the years 2020 and earlier provided in the 2021 APO differ from those used by HONI in developing its transmission load forecast model did HONI update its historical CDM values (for 2020 and earlier), re-estimate its Monthly and Annual Models and update its resulting gross energy forecasts for each model?

i. If HONI revised its historic CDM values (for 2020 and earlier) and re-estimated these models, is this the reason for the March 2022 updates provided for VECC 40 b), VECC 40 g), VECC 41 b), VECC 41 f), VECC 41 g) and VECC 43 c).

ii. If HONI did not update its historic CDM values and re-estimate these models, please explain why the forecast growth rates for Monthly and Annual models as set out in the March 2022 Update for VECC 43 c) have changed.

e) Please also provide the revised 2020 gross demand to which the growth rates in March 2022 update of VECC 43 c) would be applied.

Response:

a) The following table provides the schedule that sets out the historical CDM savings (MWh) for 2015-2020.

		2015	2016	2017	2018	2019	2020
i	APO2020	13.97	15.03	17.24	19.34	19.48	-
ii	Pre-evidence	13.93	15.55	17.27	19.31	19.41	19.67
iii	APO2021		15.03	17.24	19.34	20.40	20.90
iv	2022 Update	12.39	15.03	17.24	19.34	20.40	20.90

For item ii, Hydro One used two different sources to estimate the CDM energy savings because the EE and C&S savings for 2020-2021 are not available in the 2020 APO. This is detailed in Hydro One's response to JT VECC-TCQ-06 and VECC 36 g). For item iv, the updated CDM energy savings are consistent with APO 2021.

The CDM energy savings separated into C&S and EE for item ii and item iv are as follows:

Item ii. CDM Energy savings

	2015	2016	2017	2018	2019	2020	Note
C&S	4.20	5.20	6.30	7.10	7.60	7.80	Estimated based on OPO2018 (response to JT VECC-TCQ-06)
EE	9.73	10.35	10.97	12.21	11.81	11.87	Information from the IESO202102 (response to VECC38 Attachment 1)
Total	13.93	15.55	17.27	19.31	19.41	19.67	

Item iv. CDM Energy savings

	2015	2016	2017	2018	2019	2020
C&S	4.22	5.17	6.28	7.07	7.37	7.37
EE	9.75	9.86	10.96	12.27	13.03	13.53
Total	13.97	15.03	17.24	19.34	20.4	20.9

b) CDM figures provided in the updated response to VECC 40 b) are consistent with APO 2021. In the original response to VECC 40 b), the CDM values were raised by losses assuming that they were at end use level, whereas they were already at generation level.

c) Yes, the latest historical CDM figures consistent with APO 2021 were used in updating the monthly forecast.

d) Yes.
   i. Yes.
   ii. Not applicable in view of response to part d-i) above.

e) The 2020 gross demand is 21,927 MW.

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O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 152

Reference:

Exhibit G-1-1, Attachment 3
Exhibit O - Update to Exhibit I-24-D-VECC-040 b)

Interrogatory:

a) Do the revisions to the historical CDM savings impact the calculation of the 2018 and 2019 CDM and Demand Response Variance Account amounts?
    i. If yes please provide an update to Exhibit G. Tab 1, Schedule 1, Attachment 3 and HONI's responses to VECC's related interrogatories.
    ii. If not, why not?

Response:

a) No, the revisions to the historical CDM savings do not impact the calculation of the 2018 and 2019 CDM and Demand Response variance account amounts.
    i. Not applicable.
    ii. There is no change to the CDM peak savings for 2018 and 2019.

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O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 153

Reference:

Exhibit O-1-3, Page 1, 3 and 4
Exhibit O - Update to:
Exhibit I-24-D-VECC-036 g)
Exhibit I-24-D-VECC-040 a) & g)
Exhibit I-24-D-VECC-041 a) & g)

Preamble:

The Update states (page 1)
"In December 2021, the IESO issued its 2021 APO. The 2021 APO contains materially higher forecasts for CDM in Ontario, averaging a 19% increase in CDM compared to the forecast used in the as-filed evidence over the test period (2023-2027). As a result of the change in the IESO's CDM forecast, from its 2020 APO to its 2021 APO, the CDM assumptions used to establish Hydro One's load forecasts for both transmission and distribution became outdated".

The Update states (page 3):
"The updated peak and 12-month average peak CDM figures are presented in Table 2. A two-step process was used to update the CDM figures. First, the 12-month average peak was updated for all years using the latest load profile from the IESO, which distinguishes between leap years and non-leap years. Peak values are not affected by this step. Second, for the years 2019 to 2027, both peak and 12-month average peak values were scaled by the latest forecast of energy savings from CDM in the 2021 APO over the forecast of energy savings from CDM used in the as-filed evidence". (emphasis added)

Interrogatory:

a) Please provide a schedule that sets out the forecast CDM savings (MWh) for 2021 through 2027: i) as reported in APO 2020 (along with references), ii) as assumed in HONI's pre-filed evidence , iii) as reported in APO 2021 (along with references) and iv) as used for purposes of HONI's updated March 2022 evidence. For each of the four sources, please clarify whether

they are consistent in that they all include or all exclude savings due to codes and standards. If the MWh associated with codes and standards are included, for each of the four sources please separate the impacts of energy efficiency programs vs. codes & standard where possible.

b) Please confirm that, for each year, it is the ratio of the CDM forecasts (MWh) provided in parts (iii) and (ii) of the preceding question that was used as the scaling factor in step 2 of the process outlined on page 3. If not confirmed, what was the basis for the scaling factor used?

c) Please provide a schedule that, for the years 2023-2027 sets out the IESO's forecast for Ontario's annual energy demand based on: i) the IESO's 2020 APO and ii) the IESO's 2021 APO. In doing so, please provide comparable forecasts net of CDM and embedded generation. If this is not possible, please provide comparable forecasts based on the two sources and clarify the treatment of CDM and embedded generation in the forecasts.

d) Please provide a schedule that, for the years 2023-2027, sets out the IESO's forecast for Ontario's annual summer peak demand based on: i) the IESO's 2020 APO and ii) the IESO's 2021 APO. In doing so, please provide comparable forecasts net of CDM and embedded generation. If this is not possible, please provide comparable forecasts based on the two sources and clarify the treatment of CDM and embedded generation in the forecasts.

e) Based on the foregoing responses please comment on whether the increased CDM in the 2021 APO relative to the 2020 APO is due to: i) similar levels of CDM penetration in both APOs but a higher gross energy forecast in the 2021 APO or ii) higher levels of CDM penetration in the 2021 APO being applied to a gross energy forecast that is similar to that in the 2020 APO.

Response:

a) The following table provides the schedule that sets out the forecast CDM savings (MWh) for 2021 through 2027.

		2021	2022	2023	2024	2025	2026	2027	Note
i	APO2020		11.82	13.58	15.02	16.11	17.02	18.05	1. 2021 saving not availabe in APO2020; 2. the historical EE program savings for further years are not available in APO2020
ii	Pre-evidence	20.86	22.00	23.33	23.81	24.04	24.11	25.70	savings provided by the IESO in Feb 2021 (responses to JT-VECC-TCQ-06 and VECC 38 attachment 1)
iii	APO2021			26.38	27.54	28.88	30.28	31.49	2021 and 2022 savings are not available in APO2021
iv	2022 Update	22.73	24.55	26.38	27.54	28.88	30.28	31.49	Estimated savings for 2021 and 2022 based on APO2021 savings for 2020 and 2023 using linear growth rate.

The savings for EE and C&S for each schedule are provided below:

i. Savings in APO2020

	2021	2022	2023	2024	2025	2026	2027	Note
C&S	NA	8.07	8.72	9.18	9.63	9.93	10.4	2021 C&S savings is not available; savings from historical EE program for future years are not availabe in APO2020
EE (future program)		3.75	4.86	5.84	6.48	7.09	7.65	
EE (historical program)		Not available						

ii. Savings in pre-filed evidence

	2021	2022	2023	2024	2025	2026	2027	Note
C&S	8	8.07	8.72	9.18	9.63	9.93	10.4	C&S saving in 2021 from OPO2018; C&S savings for 2022-2027 from APO2020
EE	12.86	13.93	14.61	14.63	14.41	14.18	15.30	total savings-savings from C&S
Total Savings	20.86	22.00	23.33	23.81	24.04	24.11	25.70	savings from the IESO in Feb 2021

iii. Savings in APO2021

	2021	2022	2023	2024	2025	2026	2027
C&S	Not available		8.89	9.4	9.89	10.23	10.73
EE			17.49	18.14	18.99	20.05	20.76

iv. Savings in updated evidence March 2022

	2021	2022	2023	2024	2025	2026	2027	Note
C&S	8	8.07	8.89	9.4	9.89	10.23	10.73	C&S savings for 2021 is from OPO2018; savings for 2022 is from APO2020; savings for 2023-2027 is from APO2021
EE	14.73	16.48	17.49	18.14	18.99	20.05	20.76	estimated 2021 and 2022 EE savigs since they are not avilabe in APO2021

b) As noted in the evidence update Exhibit O, Tab 1, Schedule 3, Page 3, the ratio of APO 2021 energy savings to energy savings used in the as-filed forecast was used to update the peak CDM.

c) See response to part a). The savings from APO2020 and APO2021 could not be used directly for the load forecasting for the following reasons:

- APO2020 does not provide savings for 2020 and 2021;
- APO2020 does not provide historical EE program savings for the future years
- APO2021 does not provide savings for 2021 and 2022

Hydro One used the best available information and estimated the CDM savings for the missing years for its load forecasts.

d) APO 2020 and APO 2021 do not provide peak savings information.

e) As noted in O-Staff-363, the CDM savings in the 2021 APO and the 2020 APO are not comparable since the 2021 APO includes categories of savings that were not included in the 2020 APO (e.g. historical program savings for the future years were not included in the 2020 APO).

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Reference:

Exhibit O-1-3, Page 3 and 4
Exhibit D-4-1, Page 5, Table 2
Exhibit I-24-D-VECC-038, Attachment 1

Preamble:

The Update states (page 3)

"The updated peak and 12-month average peak CDM figures are presented in Table 2. A two-step process was used to update the CDM figures. First, the 12-month average peak was updated for all years using the latest load profile from the IESO, which distinguishes between leap years and non-leap years. Peak values are not affected by this step. Second, for the years 2019 to 2027, both peak and 12-month average peak values were scaled by the latest forecast of energy savings from CDM in the 2021 APO over the forecast of energy savings from CDM used in the as-filed evidence. This leaves the load factor intact, as the ratio of average hourly energy savings to maximum hourly energy savings in each year."

VECC 38, Attachment 1 calculates the monthly demand impact for CDM (Cells AB30-AK44) for 2019-2027. These values along with the resulting 12-month averages are set out below:

Row Labels	Max of 2019	Max of 2020	Max of 2021	Max of 2022	Max of 2023	Max of 2024	Max of 2025	Max of 2026	Max of 2027
1	1808.203	1810.963	1934.112	2064.812	2162.947	2153.139	2121.133	2055.916	1931.14
2	1761.945	1761.82	1862.22	1981.292	2097.087	2115.588	2100.844	2036.672	1912.647
3	1655.871	1657.285	1806.124	1949.876	2079.315	2098.393	2083.931	2020.103	1896.295
4	1659.693	1674.8	1846.651	1987.892	2117.458	2135.209	2119.569	2054.334	1928.608
5	1868.508	1865.047	1954.767	2039.035	2100.389	2073.233	2056.946	1991.654	1861.823
6	2114.954	2105.605	2183.984	2264.793	2324.232	2300.969	2258.038	2174.851	2017.567
7	2469.434	2453.506	2510.495	2579.724	2630.281	2617.024	2536.611	2428.207	2234.827
8	2511.479	2492.848	2543.623	2609.263	2682.543	2667.416	2581.175	2469.482	2272.989
9	2062.931	2053.089	2127.45	2203.59	2324.93	2326.67	2281.085	2196.848	2039.157
10	1726.821	1724.866	1817.166	1900.226	2005.709	2028.963	2020.002	1959.816	1839.854
11	1770.654	1769.001	1863.732	1956.676	2055.903	2057.525	2046.963	1985.459	1864.354
12	1767.096	1767.983	1878.691	2004.09	2103.312	2096.785	2072.587	2009.457	1885.814
12-Month Avg.	**1931.46575**	**1928.06775**	**2027.417917**	**2128.439083**	**2223.6755**	**2222.576167**	**2189.907**	**2115.23325**	**1973.75625**

Interrogatory:

a) For a number of the years in the 2019-2027 period the results for peak demand and 12-month average peak demand as calculated in VECC 38, Attachment 1 don't reconcile with the values provided in the pre-filed evidence (Table 2). Please explain why this is the case.

b) How were the CDM peak and 12-month average peak demands used in the pre-filed evidence determined? As part of the response, please explain any adjustments made to the response set out in VECC 38, Attachment 1 in order to derive the resulting derivation of the Peak Demand and 12-Month Average Peak Demand values used in the pre-filed evidence and why they were made.

c) With respect to the first step in the process set out on page 3 of the referenced Updated Evidence, please explain with supporting calculations for each year, how the 12-month average peak impact of CDM was updated using the latest load profile and why this update did not lead to a change in the peak values.

d) Please provide a schedule, equivalent to Table 2, that sets out the results of the first step in process (i.e., updating just for the change in load profile).

e) As compared to the CDM load profiles used in the pre-filed evidence, for a given level of annual CDM energy savings, does the "latest load profile from the IESO" result in higher or lower values for: i) CDM Impact on Peak Demand and ii) CDM Impact on 12-Month Average Peak Demand (page 4, Table 2)?

f) With respect to the second step in the process, please provide the supporting calculations showing the determination of the "scale factor" for each year and the derivation of the revised CDM forecast.

g) Why was a two-step process used as opposed to simply applying the updated load profiles to the IESO's update forecast for CDM energy savings?

Response:

a) The following steps demonstrate how we derive the peak demand and 12-month average peak demand.

Step 1: As explained in the response to I-VECC-38, part b) step 3, the total CDM peak saving for 2019-2027 used in the load forecasting at the generator level is:

	2019	2020	2021	2022	2023	2024	2025	2026	2027
Total	2,511	2,493	2,544	2,609	2,683	2,667	2,691	2,725	2,802

Step 2: Calculate the monthly demand impact for CDM for 2019-2027 based on the information provided by the IESO in Feb 2021.

VECC calculates the monthly demand impact for CDM (Cells AB30-AK44) for 2019-2027 based on Exhibit I-24-D-VECC-038, Attachment 1. Hydro One suggests using the leap year calendar for 2020 and 2024 and the result is provided in the table of Step 4 below.

In providing the response to this interrogatory, it was noticed that in the updated evidence the load profile for leap years was mistakenly applied to all the years. In the table provided in Step 4 below, the revised CDM figures are provided using the correct load profile for each year, which are also shown in rows (1) and (2) of the table in part f) below. This leaves the CDM for both peak and average peak at this step the same as in the as-filed evidence. The impact of this correction on CDM average peak and its implication for the average peak forecast for transmission are not material. Hydro One will update the load forecast to reflect this change at the time of the DRO so that the correct average peak will be used, as shown in response to part f) below.

Step 3: Calculate monthly peak saving profile

	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	72%	73%	76%	79%	81%	81%	82%	83%	85%
2	70%	71%	73%	76%	78%	79%	81%	82%	84%
3	66%	67%	71%	75%	78%	79%	81%	82%	83%
4	66%	70%	73%	76%	79%	80%	82%	83%	85%
5	74%	75%	77%	78%	78%	78%	80%	81%	82%
6	84%	92%	86%	87%	87%	91%	87%	88%	89%
7	98%	98%	99%	99%	98%	98%	98%	98%	98%
8	100%	100%	100%	100%	100%	100%	100%	100%	100%
9	82%	82%	84%	84%	87%	87%	88%	89%	90%
10	69%	69%	71%	73%	75%	76%	78%	79%	81%
11	71%	71%	73%	75%	77%	78%	79%	80%	82%
12	70%	71%	74%	77%	78%	79%	80%	81%	83%

Step 4: Calculate total Ontario monthly peak savings used for the load forecast (# in step 1* monthly profile in step 3).

	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	1,808	1,811	1,934	2,065	2,163	2,153	2,212	2,269	2,381
2	1,762	1,762	1,862	1,981	2,097	2,116	2,191	2,248	2,358
3	1,656	1,671	1,806	1,950	2,079	2,103	2,173	2,229	2,338
4	1,660	1,747	1,847	1,988	2,117	2,135	2,210	2,267	2,378
5	1,869	1,865	1,955	2,039	2,100	2,073	2,145	2,198	2,295
6	2,115	2,302	2,184	2,265	2,324	2,430	2,354	2,400	2,488
7	2,469	2,454	2,510	2,580	2,630	2,617	2,645	2,680	2,755
8	2,511	2,493	2,544	2,609	2,683	2,667	2,691	2,725	2,802
9	2,063	2,053	2,127	2,204	2,325	2,327	2,379	2,425	2,514
10	1,727	1,725	1,817	1,900	2,006	2,029	2,106	2,163	2,268
11	1,771	1,769	1,864	1,957	2,056	2,094	2,134	2,191	2,299
12	1,767	1,768	1,879	2,004	2,103	2,097	2,161	2,218	2,325
12-month Average	1,931	1,952	2,027	2,128	2,224	2,237	2,283	2,334	2,433

b) See response to part a)

c) The latest load profile refers to the hourly CDM savings from the IESO in Feb 2021 which is the same information used for the as-filed evidence. The first step in the process set out on page 3 of the referenced updated evidence should be the same as the peak savings in the pre-filed evidence since the same information was used for these two documents.

d) There is no change to the information provided in Table 2.

e) See response to part a)

f) The requested information is provided below:

	2019	2020	2021	2022	2023	2024	2025	2026	2027
(1) Peak CDM in MW (no change):									
As Presented in Table 2 of Exhibit D-4-1.	2,511	2,493	2,544	2,609	2,683	2,667	2,691	2,725	2,802
(2) 12-Month Average Peak CDM in MW,									
As Presented in Table 2 of Exhibit D-4-1.	1,931	1,952	2,027	2,128	2,224	2,237	2,283	2,334	2,433
(3) Energy CDM Based on APO 2021 (TWh)	20.40	20.90	22.73	24.55	26.38	27.54	28.88	30.28	31.49
(4) Energy CDM As Used in the Original Filing (TWh)	19.41	19.67	20.86	22.00	23.33	23.81	24.04	24.11	25.70
(5) Ratio: (3)/(4)	1.05	1.06	1.09	1.12	1.13	1.16	1.20	1.26	1.23
(6) Updated Peak CDM Savings in MW = (1)*(5)	2,639	2,648	2,772	2,912	3,033	3,085	3,234	3,423	3,434
(7) Updated 12-Month Average Peak CDM in MW= (2)*(5)	2,030	2,073	2,209	2,376	2,514	2,587	2,744	2,932	2,982

g) Considering the increased CDM savings in the 2021 APO compared to the amounts used for the load forecast in the as-filed evidence Hydro One scaled the peak savings by the ratio of the updated CDM energy savings in the 2021 APO to the savings in the as-filed evidence to keep the same load factors.

O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 155

Reference:

Exhibit O-1-3, Page 3 and 4
Exhibit O - Update for Exhibit I-24-D-VECC-43 c)
Exhibit O - Update for Exhibit JT-VECC-TCQ-04

Interrogatory:

a) Please confirm that as well as updating for the revised CDM forecast in the 2021 APO (as describe on pages 3-4), HONI altered the adjustments made to the load forecast for "Other" but maintained the adjustments for EV and Leamington as per the March 2022 updates for VECC-43 c) and VECC-TCQ-04.

b) In its 2021 APO did the IESO revise its assumptions and forecast for EV load relative to that included in the 2020 APO? If yes, what were the revisions for the period up to 2027?

Response:

a) Confirmed.

b) Please see below for the revised EV forecast in the 2021 APO in TWh:

2023	2024	2025	2026	2027
0.60	0.80	1.04	1.26	1.52

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O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 156

Reference:

Exhibit O-1-3, Page 5, Table 3
Exhibit D-4-1, Page 17, Table 3

Interrogatory:

a) What account for the annual variances (2021-2027) in the values for Ontario Demand Load Forecast Before Deducting Impacts of Embedded Generation and CDM as reported in Table 3 in Exhibit O versus Table 3 in Exhibit D?

Response:

a) The annual variances are predominantly driven by the difference in CDM and the small adjustment to the "Other" category as noted in the updated Exhibit JT-VECC-TCQ-04. Any leftover difference is due to updating the forecasting models using the new historical CDM figures consistent with APO 2021. For a discussion of changes to historical CDM, please see response to interrogatory O-VECC-151, part a).

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O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 157

Reference:

Exhibit O-1-3, Page 7-8, Table 7
Exhibit D-5-1, Page 7, Table 4
Exhibit O - Update to:
Exhibit I-24-E-VECC-49 a)
Exhibit I-24-E-VECC-50 a)
Exhibit I-24-E-VECC-52 a) & c)

Preamble:

It is noted that HONI has revised the CDM impact on Distribution Load for both 2019 and 2020 (Application-Table 4 versus Update-Table 7).

It is also noted that HONI's Monthly and Annual Distribution Load Forecast models use 2019 and 2020 CDM impact data (per VECC 49 a) and VECC 50 a)).

Interrogatory:

a) Did HONI use its updated historical distribution CDM values (for 2020 and earlier) to re-estimate its Monthly and Annual Models and update its resulting gross energy forecasts for these models?
   i. If HONI re-estimated these models, does this explain the changes to VECC 52 a) and VECC 52 c).
   ii. If HONI did not update these models for the changed historic CDM values please explain why and also explain the reasons for the changes to VECC 52 a) and VECC 52 c).

b) Please also provide the revised 2020 gross energy to which the growth rates in revised VECC 52 c) would be applied to yield the model based results in revised VECC 52 a).

Response:

a) Yes.
   i. Yes.
   ii. N/A in view of response to part a) i) above.

b) The 2020 gross value is 21,661 GWh.

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O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 158

Reference:

Exhibit JT-VECC-TCQ-13 a)
Exhibit O-1-3, Page 8, Table 7

Preamble:

VECC-TCQ-13 a) outlines how HONI derived the CDM (MWh) distribution savings from the total Ontario CDM savings.

Interrogatory:

a) For each of the years 2019-2027 please provide the details (i.e., the actual calculations) regarding the derivation of the total distribution CDM savings used in the March 2022 Update (i.e., the annual Totals per Table 7). In doing so, please reconcile the total Ontario CDM savings used in each year with the values from the 2021 APO.

Response:

a) Please see below the details related to the derivation of total CDM in Table 7.

Year	Legacy Retail (A)	Acquired (B)	Acquired GS Going to ST (C)	Final Retail * (D)=(A)+(B)-(C)	ST Customers			Final Total * (H)=(D)+(F)+(G)
					Legacy Direct (E)	Finall Direct * (F)=(E)+(C)	Final LDC * (G)	
2019	2464			2464	273	273	1193	3929
2020	2513			2513	286	286	1187	3986
2021	2735			2735	305	305	1292	4332
2022	2950			2950	330	330	1394	4675
2023	3161	207	20	3348	359	379	1493	5220
2024	3302	216	20	3497	376	396	1560	5453
2025	3463	226	21	3668	394	415	1636	5719
2026	3627	237	22	3842	414	436	1713	5991
2027	3769	247	23	3993	434	457	1781	6231

Note. All figures are weather-normal.
* Includes the impact of integrating Acquired Utilities into Hydro One Distribution for the years 2023-2027.

All the individual components in this table are consistent with 2021 APO CDM figures. Consequently, the total (i.e., column H) used in each year is also consistent with the total Ontario CDM from the 2021 APO.

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O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 159

Reference:

Exhibit O-1-3, Page 7-9
Exhibit I-24-D-VECC-52 c)
Exhibit JT-VECC-TCQ-11 b)

Interrogatory:

a) As well as updating for CDM forecast per the 2021APO (as described on pages 37-8), did HONI revise the adjustments made to the load forecast as described in VECC 52 c) and VECC-TCQ-11 b)?
   i. If yes, please provide a revised response to VECC-TCQ-11 b).
   ii. If not, why not given that similar adjustments made to the Transmission Load Forecast were revised as part of the March Update.

Response:

a) No.
   i. N/A in view of response to part a) above.
   ii. In the transmission forecast, there was an item specifically referring to optimism about the future state of the economy at the time the original forecast was made (in early 2021), which no longer would apply at the time of the evidence update as discussed in response to O-CME-23. For the distribution forecast, there was no manual adjustment for such optimism. Consequently, no adjustment was needed in this regard.

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O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 160

Reference:

Exhibit O-1-3, Page 9, Table 8
Exhibit O-1-3, Page 12, Table 12
Exhibit D-5-1, Page 18, Table 5
Exhibit D-5-1, Page 38, Table E.6

Interrogatory:

a) Please provide an explanation of the annual variances (2021-2027) in the values for Total Load Forecast Before Deducting the Impact of CDM as reported in Table 8 in Exhibit O versus Table 5 in Exhibit D.

b) Please provide an explanation of the variances in 2021-2027 between the total forecast GWh in Table 12 of Exhibit O and the totals in Table E.6 of Exhibit D and, in particular, how much is due to factors other than the changes in CDM.

Response:

a) The forecast for direct customers was increased in line with the latest information that Hydro One had through industry monitoring and analysis, pointing to a higher potential load growth for these customers in the future compared to the original forecast. Any leftover variance is due to updating forecasting models for the latest historical CDM consistent with APO 2021.

b) As detailed in response to part a) above, apart from the variance due to CDM, other variances are due to the increase in the forecast of direct customers (included in the ST rate class) and updating forecasting models for the latest CDM historical figures, as presented in the following table.

	2021	2022	2023	2024	2025	2026	2027
Total Change (GWh)	-123	-215	-307	-443	-643	-867	-869
Change in CDM (GWh)	-611	-708	-826	-963	-1176	-1420	-1368
Other Changes (GWh)	488	493	518	520	532	553	499

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O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 161

Reference:

Exhibit O-1-3, Page 9, Table 8
Exhibit O-1-3, Page 14, Table 15
Exhibit I-24-D-VECC-53, Attachment 1

Interrogatory:

a) Is the reason for the total CDM values for 2021-2027 being different in Tables 8 and 15 due to the fact the former is measured at the wholesale level while the later measured at the end-use level? If not, please explain the reason for the differences.

b) Please provide an updated response to VECC-53 (including Attachment 1) consistent with the updated distribution load forecast.

c) For the pre-filed evidence and the March Update, was the retail load by customer class determined by: i) subtracting the forecast CDM from the forecast total gross distribution load and then allocating the resulting net load forecast to customer classes as described in VECC 53, Attachment 1 or ii) by allocating the forecast gross distribution load to customer classes, allocating the total forecast distribution CDM to customer classes and then, for each class, subtracting the allocated CDM from the class's gross load forecast.
   - If the approach used was that set out in item (i), please explain how the CDM Impacts by Rate Class were determined for purposes of Table 15.
   - If the approach used was that set out in item (ii), please reconcile with the response to VECC 53, Attachment 1 which appears to allocate the total net load to customer classes.

Response:

a) Yes.

b) First, the forecast of total retail load is disaggregated into different rate classes based on historical patterns. Next, the impact of customer reclassification is considered. Please see the Excel attachment to this response for further details.

c) Approach i) was used.
   - The sales figures net of CDM were used to determine CDM by rate class.
   - N/A in view of the response provided above.

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CALCULATIONS – DISAGGREGATION OF FORECAST TOTAL RETAIL LOAD INTO RATE CLASSES

This exhibit has been filed separately in MS Excel format.

O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 162

Reference:

Exhibit O-1-3, Page 3 and 12, Table 12
Exhibit O-1-3, Page 14, Table 15
Exhibit D-5-1, Page 38, Table E.6
Exhibit D-5-1, Page 40, Table E.8

Interrogatory:

a) At page 3 of the March 2022 Update HONI indicates that the CDM values were updated for the years 2019-2027. However, in Table 15 of the Updated Evidence the total CDM values for the years 2015-2018 have also been revised from those set out in the pre-filed evidence (Table E.8). Please explain the basis for the changes to the 2015-2018 CDM values in the Update.

b) It is noted that in the update the CDM values assigned to the acquired customer classes in the years 2021-2027 have changed from those in the pre-filed evidence (Table 15 vs Table E.8). However, the resulting forecast GWhs for the various acquired customers classes are unchanged (Table 12 vs. Table E.6). Please explain why this is the case.

Response:

a) Hydro One should have indicated that the CDM values were updated for the years 2015-2027 consistent with the 2021 APO. Please see response to O-VECC-151 a) for discussion of changes to historical CDM.

b) Due to lack of sufficient historical information, the forecast for embedded LDC is derived by linking net sales to economic factors so that it does not depend on CDM. Consequently, the forecast remained intact.

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O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 163

Reference:

Exhibit O-1-3, Page 3, Table 1
Exhibit O-1-3, Page 15, Table 16
Exhibit H-10-1, Page 2, Table 2

Interrogatory:

a) Please confirm that for each of five years (2023-2027) the percentage change in the transmission charge determinants is the same for all three determinants (i.e., Network, Line Connection and Transformation Connection).

b) Please provide an updated version of Table 2 (Exhibit H, Tab 10, Schedule 1) assuming the transmission revenue requirement is the same as in the pre-filed evidence but the transmission billing determinants are per the March 2022 Update.

c) Please provide an update version of Table 2 (Exhibit H, Tab 10, Schedule 1) assuming the transmission revenue requirement and transmission billing determinants per the March 2022 Update.

Response:

a) Confirmed.

b) An updated version of Table 2 (Exhibit H, Tab 10, Schedule 1) with the pre-filed transmission revenue requirement and updated transmission billing determinants is provided below. Please note that the table has been updated with latest available information and is therefore not on exactly the same basis as the pre-filed evidence. Details can be found in the footnotes to the table.

Average Bill Impacts on Transmission and Distribution-connected Customers With Updated Load Forecast

	2022	2023	2024	2025	2026	2027
Revenue Requirement ($ Millions)	1,816.2	1,823.2	1,937.8	2,027.5	2,140.3	2,219.0
Adjustments to Revenue Requirement ($ Millions) (Note 1)	67.3	-43.9	-54.7	-54.4	-53.1	-53.5
Rates Revenue Requirement ($ millions) (Note 1)	1,883.5	1,779.3	1,883.1	1,973.1	2,087.2	2,165.5
% Increase in Rates Revenue Requirement over prior year		-5.5%	5.8%	4.8%	5.8%	3.8%
% Impact of load forecast change		2.0%	0.0%	0.6%	0.6%	-0.2%
Net Impact on Average Transmission Rates (Note 2)		-3.2%	5.3%	4.9%	5.8%	3.2%
Transmission as a % of Tx-connected customer's Total Bill		7.6%	7.6%	7.6%	7.6%	7.6%
Estimated Average Bill Impact		-0.2%	0.4%	0.4%	0.4%	0.2%
Transmission as a % of Dx-connected customer's Total Bill		6.2%	6.2%	6.2%	6.2%	6.2%
Estimated Average Bill Impact		-0.2%	0.3%	0.3%	0.4%	0.2%

Note 1: Adjustments include non-rate revenues, export revenues, disposition of regulatory accounts and low voltage switchgear credit. For purpose of estimating rate impacts, adjustments also include historical misallocated Future Tax Savings amounts being recovered in 2022 (+$87.1) and 2023 (+$43.5) per the OEB Decision in proceeding EB-2020-0194. The 2022 rates revenue requirement of $1,883.5 million was approved in EB-2021-0185 on December 16, 2021.

Note 2: The calculation of net impact on transmission rates accounts for Hydro One's revenue disbursement allocation factor of 91.4% as approved for 2022 UTR Revenue Requirement (EB-2022-0084 issued April 7, 2022).

Note 3: The Adjustments to Revenue Requirement reflects the $27.5M credit for External Revenue Variances in 2023.

Note 4: The Impact of load forecast change includes a 1.2% impact in 2023 due to the correction to approved 2022 load forecast charge determinants as per the OEB Decision in proceeding EB-2019-0082, dated April 23, 2020.

c) Please see response to Interrogatory O-SEC-252.

O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 164

Reference:

Exhibit O-1-3, Page 16, Table 17
Exhibit O-1-3, Attachment 1
Exhibit L-6-1, Page 3, Table 1

Interrogatory:

a) Please confirm that if the update distribution load forecast was adopted for purposes of setting rates, then the allocation of the distribution revenue requirement to customer classes would need to be updated as would the rate design for each customer class.

b) Please confirm that such updates would likely result in different 2023 revenues for each customer class than those set out in Attachment 1 (based on the updated load forecast).

c) Please update Table 1 (Exhibit L, Tab 6, Schedule 1) assuming the distribution revenue requirement is the same as in the pre-filed evidence and the rates (fixed and variable) for each customer class are increased by the same percentage in order to recover the revenue shortfall for the class as set out in Attachment 1.

Response:

a) Confirmed. At the Draft Rate Order stage, Hydro One plans to follow the below process to derive 2023 distribution rates.
    1. Use updated load forecast and total revenue requirement (with updated inflation adjustment) to run the Cost Allocation Model (CAM). This CAM is provided in response to O-SEC-252 (b).
    2. Follow the rate design process, including revenue-to-cost ratio adjustments, using the updated charge determinants and revenue requirement allocation to rate classes from the above-noted CAM.
    3. Deduct the deferred revenues related to the inflation update and load forecast shortfall (as shown in O-1-4, Tables 2 and 4 and updated at the time of the DRO) from the total revenue requirement mentioned in Step 1 and allocate this revised revenue requirement to rate classes using the same % share as derived in Step 2 above.

b) See response to part a).

c) Distribution rates and customer bill impacts reflecting the latest load forecast (but excluding the update related to the inflation adjustment) are provided in response to O-Staff-392, parts a) and b).

O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 165

Reference:

Exhibit O-1-1, Page 6
Exhibit O-1-4

Interrogatory:

"*As a result, relative to the Application as filed, there will be no material change to the proposed transmission or distribution rates for the 2023 to 2027 period due to the proposed inflation and load forecast updates*."

a) The new proposal creates intergenerational rate shifts to ratepayers. What is Hydro One's proposal to mitigate or minimize the risk to the 2022-2027 cohort of ratepayers and those risks of the 2028 and beyond cohort?

b) Please provide the annual number of Hydro One distribution account changes (close, open, name change) for each year 2017 to 2021.

c) In order to mitigate these risks why it is not preferrable for Hydro One to set rates on a permanent basis for the years 2022 and 2023 and then re-apply for 2024 rates -presumably when there is less inflation uncertainty?

Response:

a) Please refer to the response in interrogatory O-Staff-384 for a discussion on the intergenerational considerations of the deferred revenue proposal. At the time of the DRO, if based on the updated inflation forecast/actuals, the cumulative inflation in 2022 and 2023 exceeds 10% (calculated in the manner described in Section 2.5.2 Confirmation and Adjustment of Inflation Forecast, Exhibit O-01-02), Hydro One would commit to managing its work program through investment reprioritization and redirections, to protect customers from further exposure to inflationary pressures and will adjust the outcomes outlined in TSP Section 2.5 and DSP Section 3.5 accordingly. The protections included in the confirmation and adjustment process are expected to mitigate the costs to be passed along to the 2028 and beyond cohort of ratepayers.

b) Please refer to the response in interrogatory G-VECC-094 part a) for residential account changes between 2017 and 2021, which reflect the vast majority of Hydro One's customer base. As noted in response to G-VECC-094, customer account changes is not an appropriate metric to assess customer turnover due to the way Hydro One tracks these accounts in the system.

c) Hydro One notes that final rates have already been established for 2022 for each of Transmission and Distribution.

Hydro One's joint rate application for a 5-year Custom IR Framework for 2023-2027 rates was made pursuant to the OEB's direction.[1] As the OEB expected Hydro One to file a single application for distribution rates and transmission revenue requirement for the period 2023 to 2027, it would not be consistent with the OEB's direction for Hydro One to file on a single-year basis for 2023 as suggested by VECC in this interrogatory and to then re-apply for approval of rates for the 2024-2028 period.

Furthermore, the approach suggested by VECC in this interrogatory would not be efficient from a regulatory standpoint. In addition to requiring duplication of the extensive effort that has gone into the preparation and review of the current Application by Hydro One, the OEB and all parties, Hydro One notes that the evidentiary updates were most impacted by changes in forecast inflation levels for 2021 through 2023, which impact revenue requirement in all years of this application

Additionally, the approach suggested by VECC would not be practical from a scheduling standpoint. The 2024-2028 joint rate application, and the single year 2023 joint rate application would both need to proceed in parallel before the OEB. Not only would the scheduling of the applications be impractical and perhaps not achievable, but there would be no greater certainty on inflation by the time such amended applications would need to be filed.

Lastly, without approval of a 5-year rate plan it will be difficult for Hydro One to move forward with execution of multi-year capital investments that are currently part of its plan.

[1] See the March 16, 2018 OEB Correspondence Letter (OEB_letter re HONI Dx and Tx_20180316) for the OEB's expectations regarding future applications for Hydro One distribution rates and transmission revenue requirement

O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 166

Reference:

Exhibit O-1-1, Page 6
Exhibit O-1-4

Interrogatory:

a) What carrying costs do the proposed new deferral accounts attract?

Response:

a) As indicated in the Draft Accounting Orders filed in Exhibit O-1-4, Attachments 1 and 2, Hydro One would record interest on the proposed deferral accounts using the simple interest rates set by the OEB (i.e. quarterly OEB approved prescribed interest rates) applicable to deferral and variance accounts.

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O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 167

Reference:

Exhibit O-1-4, Page 9

Interrogatory:

a) What is the annual rate impact (residential) of the deferred distribution revenue requirement shown in Table 2?

Response:

a) Bill impacts reflecting the deferred distribution revenue requirement and updated load forecast are provided in response to O-SEC-252.

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O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 168

Reference:

Exhibit O-1-4, Page 8

Interrogatory:

a) What is the annual increase to the UTR of he deferred revenue requirement shown in Table 1?

b) For the 2015 to 2022 period please provide the total UTR revenue to Hydro One transmission and the Board approved amount for those years

Response:

a) The annual UTRs including the deferred transmission revenue requirement and updated load forecast are provided in the response to O-SEC-252.

b) The total UTR revenue to Hydro One transmission and the Board approved amounts for 2015 to 2022 are provided in the table below.

Year	Actual UTR Revenue	Approved UTR Revenue	Reference (See Notes)
2015	$ 1,463,942,915	$ 1,477,025,634	EB-2014-0140, dated December 2, 2014
2016	$ 1,468,437,260	$ 1,480,470,830	EB-2014-0140, dated December 4, 2014 and 2016 order issued January 14, 2016
2017	$ 1,392,595,878	$ 1,437,455,729	EB-2016-0160, dated September 28, 2017 and November 9, 2017
2018	$ 1,535,006,132	$ 1,510,709,683	EB-2016-0160 dated December 20, 2017 (includes 2017 Foregone)
2019	$ 1,506,906,462	$ 1,568,848,577	EB-2018-0130 dated June 13, 2019
2020	$ 1,553,947,003	$ 1,589,937,152	EB-2019-0082 dated December 10, 2019
2021	$ 1,770,951,274	$ 1,775,551,158	EB-2020-0194, dated May 27, 2021
2022	N/A	$ 1,883,469,327	EB-2021-0185, dated December 16, 2021

Note 1: The 2020 UTR revenue requirement is consistent with the interim UTRs that were applied from January to December 2020. The final 2020 revenue requirement ($1,585,751,902) was approved on April 23, 2020 as a part of EB-2019-0082, but was not implemented due to the COVID-19 pandemic. The 2020 foregone revenue was included in the approved 2021 UTR, and reflected in the approved 2021 UTR revenue requirement.

Note 2: The 2021 UTR revenue requirement includes the 2021 portion of the misallocation of the Future Tax Savings, which was added to the 2021 revenue requirement that was approved on December 17, 2020 (EB-2020-0202) and the Hydro One Networks Foregone Revenue Letter, dated November 20, 2020.

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O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 169

Reference:

Exhibit O-1-4, Page 3 and 7
Exhibit O-1-2, Page 16-17
Exhibit A-4-1, Page 1-3

Preamble:

Exhibit A states (page 3):
"The industry-specific weightings and pro-forma Inflation Factors for the Transmission and Distribution businesses are set out in Exhibits A-04-02 and A-04-03, respectively. The Inflation Factor will be updated annually to reflect the latest values issued by the OEB".

Exhibit O, Tab 1, Schedule 4 states (page 3):
"Based on a comparison between the updated and approved base revenue requirements (as confirmed and adjusted, if necessary, at the time of the DRO review) and the revenue requirements based on as-filed 2% inflation assumptions for Transmission and Distribution, the incremental revenue requirements associated with the inflation update, as presented in Table 1 and Table 2 (based on the current inflation assumptions, to be updated at DRO), will be recorded in the proposed Inflation Updates Sub-accounts of the Transmission Approved Revenue Requirement Deferral Account and the Distribution Approved Revenue Requirement Deferral Account, as applicable, for recovery commencing in 2028. For greater certainty, the confirmation and adjustment for inflation at the time of the DRO review will be subject to a proposed inflation cap that is further described in Section 2.5.2 of Exhibit O-01-02".

Exhibit O, Tab 1, Schedule 4 states (page 7):
"Table 1 for Transmission and Table 2 for Distribution, below, summarize the incremental revenue requirements that Hydro One is proposing to record for each of the 2023 to 2027 test years in the Inflation Updates Sub-accounts, within each of the

Transmission Approved Revenue Requirement Deferral Account and the Distribution Approved Revenue Requirement Deferral Account, as applicable."

Interrogatory:

a) Please clarify, for the years after 2023, how the revenue requirements for transmission and distribution that will be used to determine rates will be established (e.g., will they be derived by escalating the previous year's revenue requirement used for rate setting by the RCI formula (Exhibit A, Tab 4, Schedule 1, page 1), where the inflation value used will be the inflation factor approved by the OEB for that year).

b) Please clarify how the amounts to be recorded in the Inflation Updates Sub-accounts will be calculated for the years after 2023. In doing, please explain whether the "DRO" referred in the Schedule 4 (page 3) quote above is: i) the DRO for the 2023 rates such that for the years after 2023 the amounts to be recorded in the Inflation Updates Sub-accounts of the Transmission Approved Revenue Requirement Deferral Account and the Distribution Approved Revenue Requirement Deferral Account will be as determined in the 2023 DRO regardless of the inflation factors ultimately approved by the OEB for use in those years (as suggested by the reference from page 7) or ii) the DRO that will be generated for each of the subsequent years based on the OEB's approved inflation factors for the year concerned. To help in the explanation please provide a simplified example of the calculation for Transmission where the inflation factors approved by the OEB for 2024-2027 are different from those forecast at the time of the 2023 DRO.

c) If the proposed approach is as described in part (i) of the preceding question, please explain why this is appropriate.

Response:

a) Hydro One confirms that the revenue requirements for 2024-2027 will be established in accordance with the Custom IR proposal as outlined in Exhibits A-04-01, A-04-02 and A-04-03 including the RCI formula and inflation factors which will be established by the OEB annually.

b) Hydro One confirms that the DRO reference is as outlined in part i) of the IR. The intent of inflationary update is to ensure that the rebasing year, 2023, includes appropriate baseline cost forecasts reflecting more realistic inflation assumptions for 2021-2023, when factoring in the evolving economic and geopolitical environment. As a result of a higher 2023 starting point, the cost forecasts in 2024-2027 have also increased. Please see the response to O-Staff-

390 for a numerical example where the inflation factors approved in a future year is different than those forecasted at the time of the 2023 DRO.

c) Hydro One believes this is appropriate as it represents a customer centric approach that preserves our ability to deliver on our commitments to customers without impacting the proposed transmission and distribution rates during the 2023 to 2027 period. The proposal is in line with the OEB's filing requirements and above materiality thresholds in each of Transmission and Distribution.

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O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 170

Reference:

Exhibit O-1-4, Page 3 and 9
Exhibit O-1-3, Attachment 1

Preamble:

Exhibit O, Tab 1, Schedule 4, page 3 states:

"The final approved rates revenue requirements to be confirmed at the time of the DRO will be inclusive of the impact from all applicable deferral and variance accounts, and any other updates as determined to be necessary in the ordinary course of the DRO process. The revenue requirement shortfalls due to the load updates will be captured on an annual basis in the Load Shortfalls Sub-accounts of the Transmission Approved Revenue Requirement Deferral Account and the Distribution Approved Revenue Requirement Deferral Account for recovery commencing in 2028". (emphasis added)

Exhibit O, Tab 1, Schedule 4 (page 9) states:

"Table 3 for Transmission and Table 4 for Distribution, below, summarize the deferred revenue requirements that Hydro One is proposing to record for each of the 2023 to 2027 test years in the Load Shortfalls Sub-accounts, within each of the Transmission Approved Revenue Requirement Deferral Account and the Distribution Approved Revenue Requirement Deferral Account, as applicable".

Interrogatory:

a) With respect to the reference from Exhibit O, Tab 1, Schedule 4, page 3, please clarify the role of deferral and variance accounts in determining the amounts to be recorded in the Load Shortfalls Sub-accounts of the Transmission Approved Revenue Requirement Deferral Account and the Distribution Approved Revenue Requirement Deferral Account.

b) Please confirm that the amounts set out in at Schedule 4, page 9, Tables 3 and 4 (and calculated in Schedule 3, Attachment 1) do not include any shortfalls in the refund/recovery of deferral and variance accounts due to the lower billing determinants?

c) With respect to Attachment 1, please confirm that (for both Transmission and Distribution) the revenue requirement that will be used to set the rates for 2024-2027 will not be known at the time the 2023 DRO is prepared and will only be known after the OEB has approved the inflation factor for the year in question.
   i. If not confirmed, please explain why.
   ii. If confirmed, please also confirm that for the years 2025-2027 the approved rates for the "previous year" will not be known at the time the 2023 DRO is prepared.

d) The reference from page 9 suggests that Hydro One is proposing that the amounts determine the amounts to be recorded in the Load Shortfalls Sub-accounts for 2024-2027 as part of the 2023 DRO. Please clarify whether or not this is the case. If yes, please explain why this is appropriate given the responses to the previous questions.

Response:

a) Please see Exhibit O-01-04, Attachments 1 and 2 for details on what the proposed revenue requirement deferral accounts will record in each of the sub-accounts for inflation updates and load shortfalls. See response to part b) below for a description of how deferral and variance accounts are considered in determining amounts to be recorded in the Load Shortfall Sub-accounts.

b) **Transmission:** The amounts set out in Exhibit O-01-04, page 9, Table 3 include the shortfall for the refund/recovery of deferral and variance accounts due to the lower billing determinants. Consistent with how the revenue requirement is calculated for determination of the Uniform Transmission Rates, the deferral is calculated from the rates revenue requirement which includes the offsets for DVA.

Distribution: It is confirmed that the amounts set out in Exhibit O-01-04, page 9, Table 4 do not include any shortfalls in the refund/recovery of deferral and variance accounts due to the lower billing determinants. In contrast to transmission rates, recovery of deferral and variance accounts for distributors is done through separate charges/rate riders. The rate riders for disposition of deferral and variance account balances have been recalculated to reflect the updated load forecast and are provided in Tables 1-3 below.

Table 1 - Rate Riders for Group 1 Deferral/Variance Accounts

Rate Class	Unit	Group 1 Volumetric Rate Rider ($/kWh or $/kW)	Group 1 Volumetric Rate Rider - Applicable to Non-WMP Customers Only ($/kWh or $/kW)	Volumetric Rate Rider for Global Adjustment Sub-Account - Applicable to Non-RPP, Non-LDC, Non-MWP, Class B Customers ($/kWh)
UR	kWh	-0.0004		-0.0007
R1	kWh	-0.0004		-0.0007
R2	kWh	-0.0004		-0.0007
GSe	kWh	-0.0004		-0.0007
UGe	kWh	-0.0004		-0.0007
GSd	kW	-0.0519	-0.0726	-0.0007
UGd	kW	-0.0641	-0.0897	-0.0007
St Lgt	kWh	-0.0004		-0.0007
Sen Lgt	kWh	-0.0004		-0.0007
USL	kWh	-0.0004		-0.0007
DGen	kW	-0.0239	-0.0344	-0.0007
ST	kW	-0.0814	-0.1144	-0.0007
AUR	kWh	-0.0004		-0.0007
AUGe	kWh	-0.0004		-0.0007
AUGd	kW	-0.0590	-0.0821	-0.0007
AR	kWh	-0.0004		-0.0007
AGSe	kWh	-0.0004		-0.0007
AGSd	kW	-0.0595	-0.0829	-0.0007

Table 2 - Rate Riders for Disposition of Group 2 Deferral/Variance Accounts

Rate Class	Unit	Group 2 Fixed Rate Rider ($/month)	Group 2 Volumetric Rate Rider Applicable to Non-WMP Only ($/kWh or $/kW)
UR	kWh	-0.08	
R1	kWh	-0.14	
R2	kWh	-0.29	
GSe	kWh		-0.0002
UGe	kWh		-0.0001
GSd	kW		-0.0475
UGd	kW		-0.0282
St Lgt	kWh		-0.0003
Sen Lgt	kWh		-0.0003
USL	kWh		-0.0002
DGen	kW		-0.0610
ST	kW		-0.0048

Table 3 - Base Rate Adjustments for Past Tax Amounts

Rate Class	Unit	Fixed ($/month)	Volumetric ($/KWh or $/kW)
UR	kWh	0.80	
R1	kWh	1.44	
R2	kWh	4.00	
GSe	kWh	1.10	0.0023
UGe	kWh	0.82	0.0011
GSd	kW	4.43	0.8249
UGd	kW	4.01	0.4717
St Lgt	kWh	0.11	0.0042
Sen Lgt	kWh	0.16	0.0091
USL	kWh	0.87	0.0006
DGen	kW	1.77	0.0928
ST	kW	32.54	0.0504

c) Hydro One confirms that the final total revenue requirements for 2024-2027 will not be known at the time of the draft rate order process of this Application. However, the amount of the inflation update to Hydro One's cost forecast outlined in Exhibit O-01-02 will be known and not subject to change in future years. Any differences in the 2024-2027 total revenue requirements will be driven by changes to the Inflation Factors underpinning the Custom IR framework and will flow through to rates consistent with what would have occurred absent Hydro One's revenue deferral proposal.

d) Hydro One is proposing that the amounts recorded in the Load Shortfalls sub-accounts for disposition will be approved and finalized at the time of the draft rate order process of this application. At the time of the draft rate order, the OEB will approve a set of 2023-2027 charge determinants for Hydro One's distribution and transmissions businesses which will not be subject to change in future years. As noted above, the changes to the total revenue requirement in future years will be solely driven by changes to the Inflation Factors underpinning the Custom IR framework. Hydro One does not expect annual changes to Inflation Factors would have a material impact on the calculated revenue deficiency in future years. Hydro One's proposed approach represents a reasonable approximation of an amount that largely mitigates the impact of the revenue deficiency associated with the load forecast update while balancing simplicity of implementation.

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O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 171

Reference:

Exhibit O-1-4, Page 3 and 8
Exhibit O-1-4, Attachment 1, Page 2
Exhibit O-1-4, Attachment 2, Page 2

Preamble:

Exhibit O, Tab 1, Schedule 4, page 3 states:
"the incremental revenue requirements associated with the inflation update, as presented in Table 1 and Table 2 (based on the current inflation assumptions, to be updated at DRO), will be recorded in the proposed Inflation Updates Sub-accounts of the Transmission Approved Revenue Requirement Deferral Account and the Distribution Approved Revenue Requirement Deferral Account, as applicable, for recovery commencing in 2028".

And

"The revenue requirement shortfalls due to the load updates will be captured on an annual basis in the Load Shortfalls Sub-accounts of the Transmission Approved Revenue Requirement Deferral Account and the Distribution Approved Revenue Requirement Deferral Account for recovery commencing in 2028". (emphasis added)

Exhibit O, Tab 1, Schedule 4 page 8 states:
"As further outlined in Section 2.5.2 of Exhibit O-01-02, Hydro One proposes that at the time of the DRO it will update the revenue requirements for which it seeks approval, for each of Transmission and Distribution, based on the actual or most recent inflation forecast for 2022 and 2023, which would then be applied to the final approved Capital and OM&A plans. At that time, the incremental revenue requirement arising from the difference in inflation assumptions (i.e. the final inflation rate confirmed at the DRO process and the 2.0% original inflation rate used in the plan per year) will be recorded in the Inflation

Updates Sub-accounts, within the Transmission Approved Revenue Requirement Deferral Account or the Distribution Approved Revenue Requirement Deferral Account, as applicable".

Attachment 1, page 2 states that for the "Transmission Approved Revenue Requirement Deferral Account", Sub-Account "Inflation Updates":
"Initial entry to record the incremental approved revenue requirement, including taxes, in an amount equal to the difference between the as-filed base revenue requirement and approved base revenue requirement arising from the inflation update for the 2023-2027 rate application term".

Attachment 1, page 2 states that for the "Transmission Approved Revenue Requirement Deferral Account", Sub-Account "Load Shortfalls":
"Initial entry to record the portion of approved rates revenue requirement, including taxes, equal to the revenue deficiency attributed to the change in forecast billing determinants for the 2023-2027 rate application term".

Attachment 2, page 2 states that for the "":
"Initial entry to record the incremental approved revenue requirement, including taxes, in an amount equal to the difference between the as-filed base revenue requirement and approved base revenue requirement arising from the inflation update for the 2023-2027 rate application term".

Attachment 2, page 2 states that for the "Distribution Approved Revenue Requirement Deferral Account", Sub-Account "Load Shortfalls":
"Initial entry to record the portion of approved rates revenue requirement, including taxes, equal to the revenue deficiency attributed to the change in forecast billing determinants for the 2023-2027 rate application term".

Interrogatory:

a) With respect to the Transmission Approved Revenue Requirement Deferral Account, Sub-Account Inflation Updates and the Distribution Approved Revenue Requirement Deferral Account, Sub-Account Inflation Updates, the above references indicate that the full amount of the deferred transmission and distribution revenues for the 2023-2027 period will be recorded in the respective accounts as of January 1, 2023. Please clarify whether or not this is HONI's proposal.
   i. If it is HONI's proposal, please explain why this is appropriate when interest is proposed to be calculated based on the opening monthly balance.
   ii. If not, when does HONI's proposed that the shortfall for each year will be recorded in the respective accounts?

b) For the Load Shortfalls Sub-accounts of the Transmission Approved Revenue Requirement Deferral Account and the Distribution Approved Revenue Requirement Deferral Account, please clarify whether HONI is proposing that the amounts be recorded annually (per Exhibit O, Tab 1, Schedule 4, page 3) or all recorded as of January 1, 2023 (as suggested in Attachments 1 and 2).
   i. If it is HONI's proposal to record the total amount for 2023-2027 as of January 1, 2023, please explain why this is appropriate when interest is proposed to be calculated based on the opening monthly balance.
   ii. If it is HONI's proposal to record the annual revenue shortfalls at the start of each year, please explain why this is appropriate when interest is proposed to be calculated based on the opening monthly balance.

Response:

a) With respect to the Transmission Approved Revenue Requirement Deferral Account, Sub-Account Inflation Updates and the Distribution Approved Revenue Requirement Deferral Account, Sub-Account Inflation Updates,
   i. Hydro One clarifies that its proposal is to record the approved amounts in the deferral accounts on a monthly basis as they accrue, such that the balance would be reflective of proportionate revenue amounts deferred to that point in time and not the full amount of the balances deferred. As a result, interest is accrued on a monthly basis based on the preceding month's ending principal balance.
   ii. Not applicable.

b) With respect to the Load Shortfalls Sub-accounts of the Transmission Approved Revenue Requirement Deferral Account and the Distribution Approved Revenue Requirement Deferral Account,

i. Please see response in part a) i. above, as the same methodology for accruing interest applies to this sub-account.

ii. Not applicable.

O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 172

Reference:

Exhibit O-1-4, Page 3

Preamble:

Exhibit O, Tab 1, Schedule 4, page 3 states:

"the incremental revenue requirements associated with the inflation update, as presented in Table 1 and Table 2 (based on the current inflation assumptions, to be updated at DRO), will be recorded in the proposed Inflation Updates Sub-accounts of the Transmission Approved Revenue Requirement Deferral Account and the Distribution Approved Revenue Requirement Deferral Account, as applicable, for recovery commencing in 2028". (emphasis added)

And

"The revenue requirement shortfalls due to the load updates will be captured on an annual basis in the Load Shortfalls Sub-accounts of the Transmission Approved Revenue Requirement Deferral Account and the Distribution Approved Revenue Requirement Deferral Account for recovery commencing in 2028". (emphasis added)

Interrogatory:

a) With respect to the Inflation Updates Sub-account of the Transmission Approved Revenue Requirement Deferral Account, how does HONI anticipate the balance will be recovered from Transmission customers (i.e., how will the balance to be recovered be allocated to Networks versus Transmission Connection vs. Line Connection)?

b) With respect to the Inflation Updates Sub-account of the Distribution Approved Revenue Requirement Deferral Account, how does HONI anticipate the balance will be allocated to the distribution rate classes and what billing determinant will be used to recover the amount allocated to each rate class.

c) With respect to the Load Shortfalls Sub-accounts of the Transmission Approved Revenue Requirement Deferral Account, how does HONI anticipate the balance will be recovered from Transmission customers (i.e., how will the balance to be recovered be allocated to Networks versus Transmission Connection versus. Line Connection)?

d) With respect to the Load Shortfalls Sub-accounts of the Distribution Approved Revenue Requirement Deferral Account, how does HONI anticipate the balance will be allocated to the distribution rate classes and what billing determinant will be used to recover the amount allocated to each rate class?

Response:

a) Hydro One will bring forward specific proposals for disposition of the Transmission and Distribution Approved Revenue Requirement Deferral Accounts, including the proposed disposition period and allocator(s), in its next rebasing application.

b) See response to part a).

c) See response to part a).

d) See response to part a).

O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 173

Reference:

Exhibit O-1-5, Page 1

Preamble:

The Update states:

"As noted above, Hydro One performed an internal review and identified that the External Station Maintenance, E&CS and Other External Revenues variance account balances from 2013 to 2020 were understated by $25.8 M as noted in Table 1As noted above, Hydro One performed an internal review and identified that the External Station Maintenance, E&CS and Other External Revenues variance account balances from 2013 to 2020 were understated by $25.8 M as noted in Table 1".

Interrogatory:

a) Please provide a schedule that sets out for the years 2013-2020 the adjustments made to the actual values for each of External Station Maintenance, E&CS and Other External Revenues variance accounts.

b) Please provide a continuity schedule that sets out the annual adjustments required to the External Station Maintenance, E&CS and Other External Revenues variance account balances, including interest through to December 31, 2022, that results in the $27.5 M adjustment.

Response:

a) Please see the schedule below that sets out the 2013-2020 adjustments made to actual Transmission External Revenues as was recorded in the External Station Maintenance, E&CS and Other External Revenues Variance account:

Year	Total Principal Adjustment ($M)	Annual Interest Adjustment ($M)	Total Adjustment ($M)
2013	(2.8)	-	(2.8)
2014	(1.6)	(0.1)	(1.7)
2015	(1.6)	(0.1)	(1.7)
2016	(5.4)	(0.1)	(5.5)
2017	-	(0.1)	(0.1)
2018	(5.3)	(0.3)	(5.6)
2019	(4.9)	(0.4)	(5.3)
2020	(4.2)	(0.3)	(4.5)
TOTAL	**(25.8)**	**(1.4)**	**(27.2)**
Projected interest amounts to Dec. 31, 2022		**(0.3)**	**(27.5)**

Of the $27.5M credit adjustment proposed to be returned to customers in 2023, Hydro One confirms that the most significant aspects of the correcting adjustment relate to Other External Revenues as described in the evidence update.

b) Please see Exhibit O-01-05, Attachment 1 (Transmission DVA Schedule) that sets out the total credit adjustment of $27.5M applied to the External Station Maintenance, E&CS and Other External Revenues variance account, which reflects the correcting entry in 2021.

Please note that the quarterly OEB approved prescribed interest rates for deferral and variance accounts applicable to 2013 through 2020 were used to determine accrued interest.

O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 174

Reference:

Exhibit O-1-5, Page 3
Exhibit D-2-1, Page 1 and 6

Preamble:

The Updates states:

> *"Hydro One confirms that the findings from its review have no impact on the 2023 to 2027 revenue requirement, as the Transmission external revenue test year forecasts remain accurate."*

Historical and forecast Transmission external revenues per the original Application (page 1) were as follows:

Table 1 - Transmission External Revenues ($M)

	Historical				Bridge	Forecast				
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
	Actual	Actual	Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Secondary Land Use	25.6	27.7	29.1	46.5	28.8	28.0	24.3	24.6	24.9	25.1
Station Maintenance	4.6	4.0	3.5	3.4	3.4	3.4	3.4	3.4	3.2	3.2
Engineering & Construction	0.1	0.1	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Other External Revenues	9.1	8.1	5.2	8.7	7.2	8.4	8.2	8.1	7.8	8.6
Total	**39.4**	**39.9**	**38.0**	**59.0**	**39.8**	**40.1**	**36.2**	**36.5**	**36.2**	**37.3**

The following explanation was included in the original Application (page 6) regarding the forecast Other External Revenue:

> *"The Other category of external revenues is forecasted to be $8.4M in 2023 Test Year which is higher than the prior five-year average (2018-2022: $7.7M) and in line with the 2024-2027 forecast period average ($8.2M).*

In the update, the historical and forecast values for Transmission External Revenues are now:

Table 2 - Updated Transmission External Revenues ($M)*

	2018 Actual	2019 Actual	2020 Actual	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	2027 Forecast
Secondary Land Use	25.6	26.9	28.4	46.5	28.8	28.0	24.3	24.6	24.9	25.1
Station Maintenance	4.6	4.0	4.2	3.4	3.4	3.4	3.4	3.4	3.2	3.2
Engineering & Construction	0.1	0.1	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Other External Revenues	10.0	9.5	11.4	8.7	7.2	8.4	8.2	8.1	7.8	8.6
Total	**40.3**	**40.5**	**44.2**	**59.0**	**39.8**	**40.1**	**36.2**	**36.5**	**36.2**	**37.3**

Exhibit Reference: D-02-01, Table 1

Interrogatory:

a) The forecast Other External Revenues for the years 2021 and after are now less than those in any of the previous three years. Please explain why the forecast values are less than those experienced historically.

Response:

a) The 2021-2027 forecast Other External Revenues are lower than the previous three years of Actuals (2018-2020) because Hydro One anticipates receiving less external revenues from B2M LP and idle Transmission lines. Particularly, in 2020, B2M LP incurred higher than normal spending that is anticipated in future years. The 2021 actual Transmission External Revenue is provided in Interrogatory O-LPMA-045 part d) and reflects revenues in-line with the forecast. Please also refer to Interrogatory O-VECC-175 part a) on the reclassification performed between categories of external revenues, which contributed to the higher historical actuals when compared to the forecast values.

Hydro One notes that the determination of forecast Other External Revenues in years 2021 and beyond is not affected by the correcting entry as described in Exhibit O-01-05, and any potential variance between the actual and forecast Other External Revenues in any given year will be captured in the Transmission External Revenues variance account.

O - VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORY - 175

Reference:

Exhibit O-1-5, Page 3
Exhibit D-2-1, Page 1

Preamble:

The Updates states:

"There were also minor corrections made to the Secondary Land Use and Stations Maintenance categories as an outcome of reviewing the groupings/classifications and completeness of the revenues".

Interrogatory:

a) For 2020 the correction appears to be an increase in Station Maintenance of $0.7 M with an offsetting decrease of $0.7 M to Secondary Land Use. Please confirm that this was case, such that the "minor correction" did not change the total Transmission External Revenues for 2020.

b) For 2019 the correction appears to be a reduction of $0.8 M in Secondary Land Use revenues with no offsetting increase elsewhere. Please confirm that this is the case and explain the basis for the correction.

Response:

a) Not confirmed. There was a reclassification of $0.7M from the "Secondary Land Use" category to the "Other" category. The increase of $0.7M in Station Maintenance was identified from conducting a completeness check of total Transmission External Revenues, which contributed to the increase in the total Transmission External Revenues for 2020.

b) Not confirmed. There was a reclassification of $0.8M from the "Secondary Land Use" category to the "Other" category due to a review of the nature of the revenues performed.

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O- ONTARIO SUSTAINABLE ENERGY ASSOCIATION INTERROGATORY - 007

Reference:

Exhibit B-3-1, Section 3.0
Exhibit ISD D-SS-01

Preamble:

Hydro One intends to spend $478.2 million on system upgrades driven by load growth. OSEA is interested in understanding the update to the capital expenditures in D-SS-01 based on the updated information and changes to Hydro One's business case for alternative solutions including CDM.

Interrogatory:

a) Please provide an update to the table on page 1 of 24 under D-SS-01.

b) Please provide an update to the table in Appendix A starting on page 17 of 24 for Description of Investments.

c) If no update to the table in Appendix A is available please explain why an update was not necessary, with supporting references to Hydro One's updated evidence (e.g., overall spending adjustments).

d) For each project listed in Appendix A, please provide an update to potential alternative solutions that could address the supply needs based on the broader changes justified by the updated evidence. Specifically, OSEA is interested in the potential for non-wires alternatives such as CDM to cost-effectively meet these supply needs.

Response:

a) & b) Please refer to I-01-O-Staff-393, part c). The tables requested are provided below and reflect the changes due to the inflation update.

1.0 APPENDIX A – DESCRIPTION OF INVESTMENTS

Project Name	Project ID	Project Description	Net Capital Investment ($ Millions)				
			2023	2024	2025	2026	2027
City of Owen Sound Tie-Line Reinforcement	SS-01.1	Construct 1.0km of new 4.16kV tie-lines and install new tie switches between 24th St West DS and 2nd Ave West DS, and between 6th Street East DS, and 2nd Ave East DS to improve load transfer capability between these stations due to load growth.	**0.0**	**0.3**	**2.4**	**0.0**	**0.0**
Bradford North DS	SS-01.2	Construction of a new 44kV:27.6kV DS, as well as associated feeders, to support area growth and relieve existing 27.6kV feeders.	**0.0**	**0.5**	**4.7**	**0.0**	**0.0**
Colpoys Bay DS F2 Feeder Upgrade	SS-01.3	Upgrade 4.5km of 12.5kV line on Colpoys Bay DS F2 feeder from 1phase to 3phase.	**0.1**	**1.2**	**0.0**	**0.0**	**0.0**
Lively DS F2 Upgrade - Black Lake Rd	SS-01.4	Upgrade 2.5km of 12.47kV line from Lively DS F2 feeder from 1-phase to 3-phase.	**0.0**	**0.0**	**0.1**	**1.5**	**0.1**
Mar DS	SS-01.5	Construction of new 44kV:8.32kV Mar DS to relieve loading on Colpoys Bay DS and facilitate residential and summer tourism load growth	**0.0**	**0.6**	**4.5**	**0.0**	**0.0**
Town of Shelburne voltage conversion	SS-01.6	Construction of a new 44kV:8.32kV DS to replace Shelburne DS, and increase station capacity, to support load growth in the area	**3.0**	**0.0**	**0.0**	**0.0**	**0.0**
New Old School DS and feeders	SS-01.7	Construction of a new 44kV:27.6kV DS, and 4 new 27.6kV feeders, to relieve existing 27.6kV feeders out of Snelgrove DS and to accommodate future load growth	**2.0**	**0.0**	**0.0**	**0.0**	**0.0**
King City DS - New Station & Feeders	SS-01.8	Construction of a new 44kV:13.8kV DS. Build feeder ties and transfer load with existing 13.8kV feeders from Eversley DS, to balance load between feeders / stations.	**0.0**	**0.0**	**0.0**	**0.5**	**3.1**
Caledonia TS New Feeders	SS-01.9	Construction of 20 circuit-km of 27.6kV feeder to relieve capacity constraints on Caledonia TS M5 feeder, and supply existing and new load from Caledonia TS M6 feeder.	**1.1**	**5.6**	**0.0**	**0.0**	**0.0**
Brockville 44kV Load Growth	SS-01.10	Construction of Phase 1 of a new overbuild double circuit 44kV line out of Brockville TS toward the Prescott area, to provide load relief and facilitate future load growth. 7km out of the total 18.5km.	**9.0**	**0.0**	**0.0**	**0.0**	**0.0**
Dresden Area Load Relief	SS-01.11	Build 17km of double circuit 27.6kV feeder from Wallaceburg TS to intersection of Cedar Line and Kent Bridge Rd, to accommodate for load growth in the area.	**0.1**	**1.4**	**5.3**	**4.9**	**0.0**

Project Name	Project ID	Project Description	Net Capital Investment ($ Millions)				
			2023	2024	2025	2026	2027
Ancaster Area Load Relief	SS-01.12	Construction of 25 circuit-km of 27.6kV line to relieve capacity constraints on Dundas TS M4, M6, and Nebo TS M6, M7, M8 feeders. Existing and forecast load transferred to Dundas TS #2 M15 and M16 feeders.	**0.0**	**0.0**	**0.0**	**1.9**	**6.4**
Dover Center Load Relief	SS-01.13	Extend Wallaceburg TS M3 by overbuilding 13.3km of 27.6kV feeder along Dover Center DS F2 to accommodate future load growth.	**0.0**	**0.9**	**4.8**	**0.0**	**0.0**
Hawthorne TS M1 Load Growth	SS-01.14	Installation of a new 115kV:27.6kV 15MVA transformer in the existing Manotick DS yard, and construction of two new 27.6kV feeders to support load growth in the area.	**0.9**	**4.4**	**0.0**	**0.0**	**0.0**
Almonte TS M28 Load Growth	SS-01.15	Construction of 2km of 44kV line from Townline Rd East to relieve Almonte TS M26 feeder	**0.0**	**0.0**	**0.3**	**3.3**	**0.0**
Elginburg DS F2 and Station Load Growth	SS-01.16	Transfer sections of Elginburg DS F2 to Cataraqui DS F2, and install line voltage regulator to support load transfer.	**1.5**	**0.0**	**0.0**	**0.0**	**0.0**
Harrowsmith DS F3 F5 Load Growth	SS-01.17	Construction of 8km of new 12.5kV feeder to offload both F3 and F5, and redistribute loads	**0.0**	**2.6**	**1.3**	**0.0**	**0.0**
Pembroke TS Load Growth	SS-01.18	Construction of 8km of new 44kV feeder up to Greenwood DS to relieve Pembroke TS M2 feeder	**0.0**	**0.0**	**0.0**	**1.1**	**10.0**
Calabogie DS F1 Load Growth	SS-01.19	Construction of a new 7km 12.5kV feeder out of Calabogie DS to Barret Chute Road to relieve loading on F1 feeder	**0.0**	**0.1**	**2.3**	**0.0**	**0.0**
Manotick DS Add F3 Feeder Load Growth	SS-01.20	Construction of a new 8.32kV feeder out of Manotick DS to relieve loading on F1 and F2 feeder	**2.6**	**0.0**	**0.0**	**0.0**	**0.0**
Stewartville TS Load Growth	SS-01.21	Construction of 2km of 44kV overbuild line to transfer load from Stewartville TS to Arnprior TS	**0.0**	**0.0**	**0.0**	**0.1**	**1.3**
Kemptville 8kV Load Growth	SS-01.22	Construction of a new 44kV:8.32kV padmount DS to relieve loading on Kemptville West and Acton Corners DS	**1.6**	**0.0**	**0.0**	**0.0**	**0.0**
Chesterville TS Load Growth	SS-01.23	Construction of a new 27.6kV:8.32kV padmount DS to offload Chesterville TS M4 via Newington DS F2. Install new switches to offload Chesterville M2 onto Morrisburg M26.	**0.0**	**0.0**	**0.1**	**1.2**	**0.0**
Listowel Load Relief - Load Growth	SS-01.24	Construction of 3 km of double circuit 44kV line and install a 44kV:4.16kV pad mount transformer to relieve Listowel Elma, Bright and Davidson DS's.	**1.5**	**0.0**	**0.0**	**0.0**	**0.0**
Ferndale DS F2 Feeder Upgrade - Load Growth	SS-01.25	Upgrade 8.4km of 12.5kV line on Ferndale DS F2 from 1phase to 3phase.	**0.2**	**2.5**	**0.0**	**0.0**	**0.0**

Project Name	Project ID	Project Description	Net Capital Investment ($ Millions)				
			2023	2024	2025	2026	2027
Saugeen Shores DS and Port Elgin Load Growth	SS-01.26	Construction of a new 44kV:8.32kV Saugeen Shores DS to relieve loading on Port Elgin DS and facilitate residential and commercial subdivision growth	**2.9**	**1.9**	**0.0**	**0.0**	**0.0**
Commanda DS Load Growth	SS-01.27	Construction of a new 44kV:12.47kV Commanda PDS to relieve loading on Commanda DS and facilitate load growth.	**1.3**	**0.0**	**0.0**	**0.0**	**0.0**
Kirkland Lake Voltage Conversion - Stage 2	SS-01.28	Voltage convert all feeders at Woods DS from 4.16kV to 12.47kV to relieve Woods DS F5, F6, F7.	**2.6**	**0.0**	**0.0**	**0.0**	**0.0**
Kirkland Lake Voltage Conversion - Part 3	SS-01.29	Voltage convert all feeders at Kirland Lake DS #1 from 4.16kV to 12.47kV to relieve Kirland Lake DS #1 F1, F2, F3.	**3.1**	**0.0**	**0.0**	**0.0**	**0.0**
Manitoulin TS - Add Third Feeder - Load Growth	SS-01.30	Construction of 1.5km of 44kV line from Manitoulin TS to relieve Manitoulin TS M26 feeder	**0.0**	**0.3**	**5.3**	**0.0**	**0.0**
Wikwemikong Supply - Station & Line Work	SS-01.31	Construction of 15km of 12.47kV line from Manitowaning DS to relieve Manitowaning DS F1 feeder	**2.3**	**0.0**	**0.0**	**0.0**	**0.0**
Crilly DS Upgrade	SS-01.32	Construction of a new 115kV:25kV Crilly DS to relieve loading on the existing Crilly DS and facilitate First Nation load growth	**0.0**	**0.2**	**0.2**	**7.9**	**0.0**
Elmhurst Beach DS	SS-01.33	Construction of a new 44kV:27.6kV DS to relieve loading on Elmhurst Beach DS and facilitate subdivision growth.	**0.0**	**0.0**	**5.7**	**0.0**	**0.0**
Kleinburg TS M26 Extension	SS-01.34	Construction of 11km of 44kV line to the Mayfield West region, to relieve Pleasant TS M21 and support future load growth in the area	**0.0**	**0.0**	**0.0**	**0.2**	**2.3**
Mount Albert DS	SS-01.35	Construction of a new 44:8.32kV DS to relieve loading on Mount Albert DS and facilitate subdivision growth.	**0.2**	**1.7**	**0.0**	**0.0**	**0.0**
Midhurst Wilson DS F2 Extend to Doran Rd Load Grow	SS-01.36	Overbuild 6.5km of existing 8.32kV line with a new 27.6kV feeder from Wilson Road to Doran Rd	**2.6**	**0.0**	**0.0**	**0.0**	**0.0**
Midhurst Wilson DS Feeder Development to Carson Rd	SS-01.37	Construction of 2km of 27.6kV line from Snow Valley DS to facilitate subdivision growth	**0.0**	**1.1**	**0.0**	**0.0**	**0.0**
Carlisle DS Offloading	SS-01.38	Construction of 5 circuit-km of 27.6kV feeder, and installation of 2 x 2.5MVA 27.6kV:8.32kV pad-mount transformers, to relieve capacity constraints on Carlisle DS	**0.0**	**2.5**	**0.8**	**0.0**	**0.0**

Project Name	Project ID	Project Description	Net Capital Investment ($ Millions)				
			2023	2024	2025	2026	2027
Solina DS Upgrade and Feeder Expansion	SS-01.39	Installation of a second 44kV:27.6kV 10MVA transformer in the existing Solina DS yard, and construction of 2 new 27.6kV feeders to support load growth in the area.	**0.0**	**0.5**	**4.8**	**0.0**	**0.0**
Bondhead Area Load Relief	SS-01.40	Construction of 9km of 44kV line from Kleinburg TS M24 to relieve Holland TS M4, to support load growth in the Bondhead Area along Highway 400	**0.0**	**0.2**	**4.7**	**0.0**	**0.0**
South Middle Road TS DESN1 Feeder Development	SS-01.41	Build 12 new 27.6kV feeders from South Middle Road TS DESN1 (approximately 100 circuit-km of overhead circuits and 50 circuit-km of underground circuits), and reconfigure the existing system to balance loading while supporting load growth.	**14.9**	**1.2**	**0.8**	**0.0**	**0.0**
Norfolk TS new feeder build	SS-01.42	Build 25 circuit-km of 27.6kV feeder to relieve capacity constraints on Norfolk TS M3, M5 and M6 feeders, and supply existing and new load from Jarvis TS M1 and M4 feeders.	**0.0**	**0.0**	**0.0**	**0.5**	**8.4**
Edgeware TS new feeder build	SS-01.43	Build 8 circuit-km of 27.6kV feeder to relieve capacity constraints on Edgeware TS M2 feeder, and supply existing and new load from Edgeware TS M3 feeder.	**0.0**	**0.0**	**0.0**	**0.4**	**1.8**
Bloomsburg HVDS new feeder build	SS-01.44	Build 15 circuit-km of 27.6kV feeder to relieve capacity constraints on Bloomsburg HVDS M1 and M2 feeders, and supply existing and new load from new Bloomsburg HVDS M4 and M5 feeders.	**0.0**	**0.2**	**2.6**	**2.5**	**0.0**
South Middle Road TS DESN2 Feeder Development	SS-01.45	Build 12 new 27.6kV feeders from South Middle Road TS DESN 2 (approximately 84 circuit-km of 27.6kV overhead circuits, and 50 circuit-km of 27.6kV underground circuits), and reconfigure the existing system to balance loading while supporting load growth.	**14.7**	**16.6**	**41.5**	**0.0**	**0.0**
Rockland West Load Growth	SS-01.46	Installation of a second 115kV:8.32kV 7.5MVA transformer in the existing Rockland DS yard, and construction of 3 new 8.32kV feeders to support load growth in the area.	**0.1**	**1.0**	**1.8**	**0.0**	**0.0**
Brockville 8kV Load Growth	SS-01.47	Installation of two 44kV:8.32kV pad mount transformers for the Brockville 8.32kV system to support load growth and provide back up in the area	**2.9**	**0.0**	**0.0**	**0.0**	**0.0**
Frontenac TS Load Growth	SS-01.48	Construction of 8km of 44kV overbuild line to transfer load from Frontenac TS to Gardiner TS	**0.0**	**0.0**	**0.0**	**0.7**	**2.2**
Napanee TS M3 Load Growth	SS-01.49	Construction of 7km of new 44kV line from Napanee TS M4 to relieve the overloaded Napanee TS M3 feeder	**0.0**	**0.0**	**0.0**	**0.3**	**2.0**

Project Name	Project ID	Project Description	Net Capital Investment ($ Millions)				
			2023	2024	2025	2026	2027
Curve Inn DS New Feeder	SS-01.50	Construction of a new 27.6kV feeder, and 7km of line, from Curve Inn DS to relieve Park Road DS F1 and supply future load growth in the area.	**2.7**	**0.0**	**0.0**	**0.0**	**0.0**
Belle River Load Growth	SS-01.51	Construction of a new feeder position and approximately 11 km of new distribution line to relieve existing feeders and bring additional capacity to the western part of Town of Lakeshore	**0.0**	**0.0**	**0.6**	**2.6**	**2.7**
Manning Road and Hwy 2 Load Growth	SS-01.52	Construction of approximately 12 km of new distribution line to relieve existing feeders and bring additional capacity to the western part of Town of Lakeshore	**0.0**	**0.5**	**2.1**	**2.2**	**0.0**
Holland DS F1 to Doane DS F2 Feeder Tie	SS-01.53	Construction of 7km of new 27.6kV line to transfer a portion of Doane DS F2 to Holland DS F1 to provide load relief and alleviate PQ issues.	**0.0**	**0.6**	**1.7**	**0.0**	**0.0**
Corbetton Area Load Growth	SS-01.54	Installation of 2x3MVA padmounted transformers to relieve Corbetton DS F3 and support subdivision growth in the town of Dundalk	**0.0**	**0.0**	**0.0**	**0.3**	**1.5**
Kleinburg TS M28 Expansion - Load Growth	SS-01.55	Construction of 10km of new 44kV line out of Kleinburg TS to support industrial load growth in the Bolton area	**0.0**	**0.0**	**0.3**	**5.8**	**2.9**
Tillsonburg TS M1 Load Relief	SS-01.56	Construction of 28km of new 27.6kV feeder from Commerce Way TS to relieve loading on Tillsonburg TS M1 Feeder.	**0.0**	**0.0**	**0.3**	**3.7**	**8.1**
Strathroy Carroll St. Loop	SS-01.57	Extend Strathroy TS M3 feeder by 5 km to create a tie with Longwood TS M24 feeder to meet forecasted load growth	**1.5**	**0.0**	**0.0**	**0.0**	**0.0**
Strathroy TS Load Relief	SS-01.58	Construction of 14km of new 27.6kV feeder out of Longwood TS to relive loading on Strathroy TS M1 Feeder.	**0.0**	**0.0**	**0.2**	**1.8**	**0.6**
Wolverton HVDS Feeder Load Relief	SS-01.59	Construction of 3.5km of new 27.6kV line, and a new feeder position at Wolverton HVDS. Existing feeders will be reconfigured to improve reliability and accommodate load growth	**0.0**	**0.0**	**0.2**	**1.3**	**0.4**
Meaford TS M2 Conductor Refurbishment Load Growth	SS-01.60	Upgrade 3.5km of 44kV line by increasing conductor ampacity, in order to supply residential subdivision load growth and maintain voltage performance.	**0.0**	**0.0**	**0.0**	**0.2**	**1.4**

Project Name	Project ID	Project Description	Net Capital Investment ($ Millions)				
			2023	2024	2025	2026	2027
Owen Sound TS M26 Conductor Refurb Load Growth	SS-01.61	Upgrade 6.0km of 44kV line by increasing conductor ampacity, in order to supply residential and industrial load growth, and to maintain voltage performance.	**0.0**	**0.0**	**0.1**	**1.7**	**0.8**
Meaford TS M2 Padmounts Lora Bay Oxmead DS F3	SS-01.62	Construction of new 44kV:8.32kV Padmount DS to relieve loading on Oxmead DS and facilitate subdivision growth	**2.9**	**0.0**	**0.0**	**0.0**	**0.0**
Palmerston TS – M2 Load relief - New feeder	SS-01.63	Construction of 8.5km of new 44kV line from Palmerston TS to relieve the M2 feeder	**0.0**	**0.0**	**0.4**	**4.0**	**1.9**
Plainfield DS F3 Enhancement	SS-01.64	Upgrade 8.5km of 8.32kV line on Plainfield DS F3 from 1phase to 3phase	**1.7**	**0.0**	**0.0**	**0.0**	**0.0**
Dartford DS F3 Enhancement	SS-01.65	Upgrade 6km of 8.32kV line on Dartford DS F3 from 1phase to 3phase	**0.7**	**2.0**	**0.4**	**0.0**	**0.0**
Jarvis TS New Feeder Build	SS-01.66	Extend Jarvis TS M8 3.3km in order to supply new customers, and to transfer a portion of Jarvis TS M1 to address feeder capacity concerns.	**0.4**	**3.2**	**0.0**	**0.0**	**0.0**
Shabaqua DS F1 upgrade	SS-01.67	Voltage convert 20 km of line from 12.5kV to 25kV to address power quality concerns resulting from load growth.	**0.0**	**0.0**	**0.0**	**0.3**	**5.0**
Sunnidale Corners DS Load Growth	SS-01.68	Upgrade 1.5km of 4.8kV (1-phase) line to 8.32kV (3-phase) on Sunnidale Corners DS F2 to support load growth.	**0.0**	**0.0**	**0.0**	**0.0**	**2.1**
Marionville DS Load Growth	SS-01.69	Installation of a second 115kV:27.6kV 15MVA transformer in the existing Marionville DS yard, and construction of 2 new 27.6kV feeders to support load growth in the area.	**0.0**	**0.0**	**0.0**	**0.3**	**5.6**
Kemptville East 8kV Load Growth	SS-01.70	Construction of two new 44kV:8.32kV padmount DS to relieve loading on South Gower DS	**0.0**	**0.3**	**2.6**	**1.3**	**0.0**
Brockville 44kV Load Growth Part 2	SS-01.71	Construction of Phase 2 of a new overbuild double circuit 44kV line out of Brockville TS toward the Prescott area, to provide load relief and facilitate future load growth. 11.5km out of the total 18.5km.	**3.9**	**1.9**	**0.0**	**0.0**	**0.0**
Newport PDS Load Relief	SS-01.72	Offload a portion of Newport PDS onto Jarvis TS M3 and Caledonia TS M6 feeders, through approximately 12kms of 8.32kV:27.6kV voltage conversion, and 5 x 16kV:4.8kV pole-top step transformers.	**0.4**	**5.1**	**0.0**	**0.0**	**0.0**

Project Name	Project ID	Project Description	Net Capital Investment ($ Millions)				
			2023	2024	2025	2026	2027
Lambton TS M7 M8 Feeder Build	SS-01.73	Build 16 circuit-km of 27.6kV feeder to relieve capacity constraints on Lambton TS M1, M3 and M5 feeders, and supply existing and new load using the new Lambton TS M7 and M8 feeder positions.	**5.8**	**0.0**	**0.0**	**0.0**	**0.0**
Burleigh DS F2 1ph to 3ph Coversion - Part 2	SS-01.74	Upgrade 5.4 km of 12.5 kV line go upgrade Burleigh DS F2 feeder from 1ph to 3ph	**0.0**	**1.6**	**0.0**	**0.0**	**0.0**
Leamington Area DESN5 Feeder Development	SS-01.75	Build 12 new 27.6kV feeders from Leamington Area DESN 5 (approximately 50 circuit-km of overhead circuits), and reconfigure the existing system to balance loading while supporting load growth.	**1.0**	**12.3**	**25.1**	**12.8**	**0.0**
Leamington Area DESN6 Feeder Development	SS-01.76	Build 12 new 27.6kV feeders from Leamington Area DESN 6 (approximately 50 circuit-km of overhead circuits), and reconfigure the existing system to balance loading while supporting load growth.	**0.0**	**0.0**	**1.0**	**12.8**	**26.1**
Forest Jura DS Fan Monitoring	SS-01.77	Install fan monitoring and SCADA telemetry at Forest Jura HVDS to provide additional capacity for future load growth.	**0.2**	**1.4**	**0.0**	**0.0**	**0.0**
Dunnville DS F1 Load Relief	SS-01.78	Offload portion of Dunnville DS F1 onto Dunnville TS M1 through 2.25km of 8.32kV: 27.6kV voltage conversion, and 6 x 16kV:4.8kV pole-top step transformers.	**1.3**	**0.0**	**0.0**	**0.0**	**0.0**
Other Projects (<$1M)			**9.7**	**4.1**	**4.8**	**2.4**	**8.6**
Total			**103.3**	**80.3**	**134.2**	**80.1**	**105.4**

Note: As part of Hydro One's response for I-08-B3-Energy Probe-039, it was clarified that four additional projects were not shown in the ISD filed. These projects had been incorrectly listed under D-SR-04 "other projects <$1M". As a result of these changes, following are the updated investment tables for each respective ISD. These changes will be reflected at the DRO stage:

SR-04: Table 2 - Total Investment Cost

($M)	2023	2024	2025	2026	2027	Total
Gross Investment Cost	51.0	48.5	32.3	36.6	36.3	204.7
Less Removals	5.2	6.4	3.9	3.2	3.6	22.3
Capital and Minor Fixed Assets	45.8	42.1	28.4	33.4	32.7	182.4
Less Capital Contributions	0.0	0.0	0.0	0.0	0.0	0.0
Net Investment Cost	45.8	42.1	28.4	33.4	32.7	182.4

SS-01: Table 2 - Total Investment Cost

($M)	2023	2024	2025	2026	2027	Total
Gross Investment Cost	114.6	88.6	146.8	89.6	118.5	558.1
Less Removals	9.9	6.7	11.0	8.9	12.0	48.5
Capital and Minor Fixed Assets	104.7	81.9	135.8	80.7	106.5	509.6
Less Capital Contributions	0.0	0.0	0.0	0.0	0.0	0.0
Net Investment Cost	104.7	81.9	135.8	80.7	106.5	509.6

c) not applicable.

d) In Procedural Order Number 5 (PO5), the Commission stated: "The OEB is providing for written interrogatories on Hydro One's application update. Parties are to only file interrogatories pertaining to the evidence filed by Hydro One on March 31, 2022 and April 8, 2022. Such interrogatories are not to be used as an opportunity for further exploration and questioning of evidence previously filed in this proceeding." This interrogatory is related to Hydro One's original evidence, does not seek clarification or information on Hydro One's updated evidence and is outside the scope of interrogatories permitted by PO5. Hydro One respectfully declines to respond to this interrogatory.

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O- ONTARIO SUSTAINABLE ENERGY ASSOCIATION INTERROGATORY - 008

Reference:

Exhibit B-3-1, Section 3.0
Exhibit B-3-1, DSP Section 3.11, D-SS-04

Preamble:

Hydro One intends to spend $177.3 million on energy storage solutions, and specifically, implementing battery storage solutions. OSEA is interested in the projected economic impacts of inflationary pressures and supply chain disruptions.

Interrogatory:

a) Please provide an update to the table on page 1 of 10 under D-SS-04.

b) Please provide an update to table 2 – total investment costs on page 8 of 10 under D-SS-04.

c) If no update is available please explain why an update was not necessary, with supporting references to Hydro One's updated evidence (e.g., overall spending adjustments).

Response:

a) & b) Please see table below

Table 1 - Total Investment Cost

($M)		2023	2024	2025	2026	2027	Total
Gross Investment Cost	Grid Scale Storage	23.4	23.8	24.3	24.7	25.2	121.4
	Residential Storage	12.8	13.0	13.2	13.5	12.7	65.2
Less Removals		0.0	0.0	0.0	0.0	0.0	0.0
Capital and Minor Fixed Assets		**36.1**	**36.8**	**37.5**	**38.2**	**37.9**	**186.6**
Less Capital Contributions		0.0	0.0	0.0	0.0	0.0	0.0
Net Investment Cost		**36.1**	**36.8**	**37.5**	**38.2**	**37.9**	**186.6**

c) Not applicable.

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O- ONTARIO SUSTAINABLE ENERGY ASSOCIATION INTERROGATORY - 009

Reference:

Exhibit D-3-1
Exhibit D-4-1
Exhibit D-5-1

Preamble:

The inflationary pressures Hydro One has used to justify the updated evidence will have an impact on economic growth and load forecast. OSEA is interested on the impact to load forecast and CDM activities.

Interrogatory:

a) Please provide an update to the consensus forecast provided in Appendix A of D-3-1 (page 4 of 4).

b) Please provide an update to the load forecast provided in Table 1: Hydro One's 2023-2027 Load Forecast from the inflationary pressures used to justify additional evidence.

c) Please provide an update for Table 3 on page 17 of 50 for Load Forecast Before and After Embedded Generation and CDM.

d) Please provide an update to Table 4: One Standard Deviation Uncertainty Bands for Hydro One Transmission's Charge Determinants on page 19 of 50.

e) Please provide an update for Table 4 of CDM Impact on Hydro One Distribution Load in D-5-1 page 7 of 40.

f) Please provide an update for Table 5 of Hydro One Load Forecast Before and After Deducting CDM Impact on in D-5-1 page 18 of 40.

g) Please provide an update for Table 6: One Standard Deviation Uncertainty Bands for Hydro One Distribution Load in D-5-1 page 19 of 40.

h) Please explain in detail with examples how the inflationary pressures would impact the methodology outlined Appendix B: Annual Econometric Model of D-4-1.

i) Please explain in detail and with examples how the inflationary pressures would impact the methodology outlined Appendix C: End-Use Model of D-4-1.

j) Please explain in detail and with examples how the inflationary pressures would impact the methodology outlined Appendix B: Monthly Econometric Model of D-5-1.

k) Please explain in detail and with examples how the inflationary pressures would impact the methodology outlined Appendix B: Annual Econometric Model of D-5-1.

l) Please explain in detail and with examples how the inflationary pressures would impact the methodology outlined Appendix C: End-Use Model of D-5-1.

m) If no update is available for a), b) and c) above, please explain why an update was not necessary and why the load forecast is not impacted by changes in inflation for Hydro One customers and potential future customers. Please provide commentary including supporting references to Hydro One's updated evidence and Hydro One's load forecast methodology.

n) Please provide a description of how the updated evidence impacts CDM activities and investments.

Response:

a) Please see response to O-LPMA-041, part c.

b) No update is needed as explained in response to parts e) and h) to m).

c) No update is needed as explained in response to parts e) and h) to m).

d) No update is needed as explained in response to parts e) and h) to m).

e) CDM impact used in the updated evidence is consistent with the latest (2021) APO, for which the forecast is already updated in Exhibit O-01-03. Consistent with the approach approved in Hydro One's prior transmission and distribution rate applications before the OEB, Hydro One's load forecast methodology relies upon CDM levels forecasted by the IESO.

f) No update is needed as explained in response to parts e) and h) to m).

g) No update is needed as explained in response to parts e) and h) to m).

h) The methodology for the annual econometric model of Exhibit D-4-1 does not depend on inflation for the following reason. Inflation is included in this model in two ways. First, it is used to deflate disposable income. Consequently, only increasing inflation reduces the real value of disposable income and, thereby, the load forecast, and thus leads to a higher rate, because the coefficient linking disposable income to load is positive. But this is not fair to our customers, nor it can be justified by economic theory. The reason is that, with higher inflation, the disposable income does not remain constant. Disposable income would increase along with inflation as wages and other source of income increase in line with expected rate of inflation so that the real value of disposable income would remain the same and thus the load forecast would not be impacted. Second, it is used to deflate energy prices. Again, we cannot expect energy prices to remain the same when inflation increases. If we adjusted for the value of disposable income and energy prices along with inflation, the real disposable income and real energy prices would remain the same and thus the load forecast is not impacted.

i) For the same reasons indicated in response to part h) above, the End-Use forecast is not sensitive to inflation as it is based on real (i.e. constant price) values.

j) The methodology for monthly model does not depend on inflation for the following reasons. In this model, value of building permits is deflated by inflation. Consequently, only increasing inflation reduces the real value of building permits and, thereby, the load forecast, and thus leads to a higher rate, because the coefficient linking building permits to load is positive. But this is not fair to our customers, nor it can be justified by economic theory. The reason is that, as inflation increases, the value of building permits would not stay constant but, rather, it would increase along with inflation. If we adjusted for the value of building permits along with inflation, the real value would remain the same and thus the load is not impacted.

k) The methodology for annual econometric model of Exhibit D-5-1, does not depend on inflation for the same reasons indicated in response to part h) above.

l) Similarly, for the same reasons indicated in response to part h) above, End-Use forecast is not sensitive to inflation as it is based on real (i.e., constant price) values.

m) For the reasons indicated in parts h) to l), no forecast update is needed apart the one already provided in the updated evidence.

n) The updated forecast has no impact on CDM activities. Also, CDM is set by the IESO. There is also no impact on investment as noted in response to I-01-O-Staff-393, part a).

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