EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-10

Capital Projects
Ref: Chapter 2 Appendix 2-AA

Question(s):

a) Please confirm whether the capital contributions are netted in the total capital spend in the amounts in Appendix 2-AA.

Response

a) No, capital contributions are not included in Appendix 2-AA.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-11</u>

Capital Expenditures
Ref: Chapter 2 Appendices

Preamble:

In response to error check question #1, Kingston Hydro stated that the total expenditures shown in Appendix 2-AB are the annual capital additions. Although OEB staff notes that usually Appendix 2-AB reflect capital expenditures and not capital additions.

Question(s):

a) Please explain why the fixed asset continuity tables beyond 2023 were included in Appendix 2-BA.
b) Please explain why the capital additions for some of the years in Appendix 2-BA do not match the capital additions in Appendix 2-AB.
c) As required, please update Appendix 2-AB, Appendix 2-BA, Appendix 2-C (depreciation), Account 1592 sub-account CCA changes balances, the applicable tabs in the PILs model, the PILs smoothing adjustment, Account 1508, Sub- account Revenue Requirement Differential Variance Account related to Capital Additions, and any other applicable items (including the support, as applicable).

Response

a) We did not include data beyond 2023 in Appendix 2-BA Fixed Asset Continuity schedules.

b) The total capital additions reported in App2-BA Fixed Asset Continuity schedules contain the correct data from our annual financial audit statements. The annual "Net Capital Expenditures" reported in the App2-AB Summary by OEB Category should match the total annual capital additions reported in App2-BA Fixed Asset Continuity schedules however, we noted that 2016, 2018 and 2021 values do not match and we offer the following explanation:

- 2016 – the total capital additions reported in Appendix 2-BA continuity schedule include an additional $2,881,880 for ICM additions.
- 2018 – the System Access and General Plant expenditures of App2-AB are incorrect and should be $339,114 and $556,467 respectively.
- 2021 – The OEB ordered us to refund $16,626 to a customer for a capital contribution that we collected in a previous year. We should have reported the System Access, Capital Contributions and Net Capital Expenditure amounts of App 2-AB as $700,261, $133,256 and $4,605,955 respectively.

c) The corrections to 2018 and 2021 Actual Expenditures of Appendix 2-AB are noted in our response to part b) above. Appendix 2-AB of the OEB EXCEL template has also been updated and submitted as a separate attachment with our interrogatory responses.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-12</u>

Change in Depreciation Rate for Specifics - Smart Meters
Ref: Exhibit 2, Tab 2, Schedule 3, page 3

Preamble:

Kingston Hydro revised the depreciation rate for 1860 Smart Meters that were purchased in 2009-2010 to have a useful life of 18 years. Useful life for wholesale meters per the Kinetrics Report is 5-15 years. Kingston Hydro has been using a useful life of 15 years to be consistent with expected useful life of Smart Meters.

The change in depreciation that occurred in 2019 was to extend the estimated useful life of smart meters that were purchased in 2009-2010 to 18 years vs 15 years. Future additions of Smart Meters will still start with the estimated useful life of 15 years, because they begin with a 10-year seal, which can only be extended through the same process of sampling and testing.

Appendix 2-BB Service Life for new smart meters will remain at 15 years until more data is collected to accurately predict their estimated useful life. Not all smart meters have moved to an EUL of 18 years and Kingston Hydro will continue evaluate their life cycle throughout this IRM.

Question(s):

a) Please clarify if Kingston Hydro is seeking to change the depreciation from 15 years to 18 years in this application.

b) Please explain what evaluation will take place during the IRM cycle and how this impact will be reported.

<u>Response</u>

a) No Kingston Hydro is not seeking to change the depreciation of smart meters from 15 to 18 years in this application.

b) Only one cohort of smart meters, those purchased in 2009-2010 for initial implementation, have passed the sampling and testing of their 10-year seal allowing their seal to be extended to 18 total years. If more cohorts continue to pass and have their seal extended Kingston Hydro will seek to extend their EUL in a future application. Currently only one cohort has passed the sampling and testing of their 10-year seal which does not guarantee future smart meter cohorts will. This is a relatively new asset and as its EUL continues to be determined we will adjust and update accordingly.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-13</u>

Distribution Plan Introduction
Ref 1: Exhibit 2, Tab 4, Attachment 2.4.1.1 page 11
Ref 2: Exhibit 1, Tab 3, Attachment 1 page 3

Preamble:

Kingston Hydro states that it owns the electric assets in the core area of the city. Kingston Hydro also states that Utilities Kingston, an affiliate, manages, operates, and maintains the electrical distribution assets in the core area of the City of Kingston. The existing agreement between Kingston Hydro and Utilities Kingston expires September 16, 2022.

Question(s):

a) Was this DSP prepared by Kingston Hydro resources or Utilities Kingston resources?
b) What was the role of Kingston Hydro in the preparation of this DSP?
c) What role did Utilities Kingston have in the preparation of this DSP?
d) Has Kingston Hydro confirmed that Utilities Kingston is in complete agreement with the contents of this DSP?
e) Are there to be any changes to the terms of service provided by Utilities Kingston to Kingston Hydro after September 16, 2022 when the current agreement expires?

f) What contingency plans does Kingston Hydro have in place to manage, operate and maintain the distribution system in the event of agreement breach that results in termination of the service agreement with Utilities Kingston?

Response

a) Kingston Hydro is a virtual utility and has no employees. The DSP was prepared by Utilities Kingston employees.

b) The Kingston Hydro Board of Directors approved the DSP.

c) Utilities Kingston prepared the DSP and recommended the DSP to Kingston Hydro Board.

d) Since Utilities Kingston staff prepared and presented the DSP to the Kingston Hydro Board, yes Utilities Kingston is in agreement with the contents of this DSP.

e) No changes are proposed to the terms of service provided by Utilities Kingston to Kingston Hydro after September 16, 2022 when the current agreement expires.

f) No contingency plans are required as the agreement is to be renewed.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-14

Key Investment Elements of the DSP
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1 pages 21, 92

Preamble:

Kingston Hydro states that they use a real-time GIS dashboard. Real-time information is updated as annual inspection work is completed and comes directly from operational staff that observe, use, inspect, maintain, and operate Kingston Hydro assets.

Question(s):

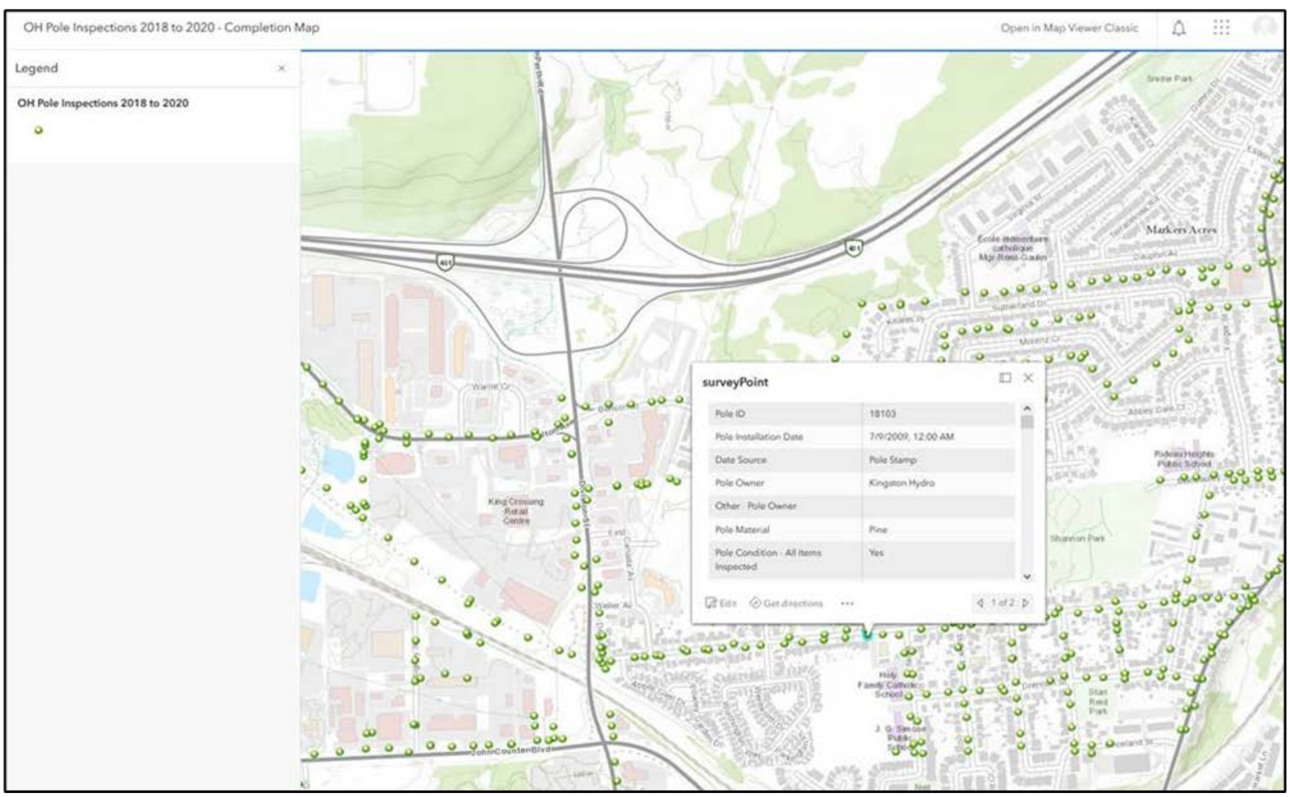
a) Please provide an example of real-time dashboard information as accessed by staff from the GIS.

Response

a) Our Power Line Technicians and Substation Electricians act as inspectors to collect information during their infrastructure inspections via the ArcGIS Collector app and ArcGIS Survey123 app. Depending on the type of inspection (pole, manhole, transformer vault, substation) the app has predetermined parameters to choose from, some of which have a grading system (where applicable). For example, does the pole have shell rot (yes or no)? If yes, what is the severity of shell rot (Minor, Major, Critical)? There are many data points that are collected by the inspector using a tablet with cellular data communications that allows all Hydro Operations staff to view the results in real-time through the corporate ArcGIS viewer.

This information is constantly reviewed by staff to identify projects and to prioritize projects due to their condition assessment. For example, a group of inspected poles have been deemed critical condition along the same pole line. This will be looked at closer by the engineering technologists to make this grouping of poles into a pole replacement project.

Example of pole inspection data collected:



Example of vault transformer, pad mount transformer and hand hole/manhole data collected:

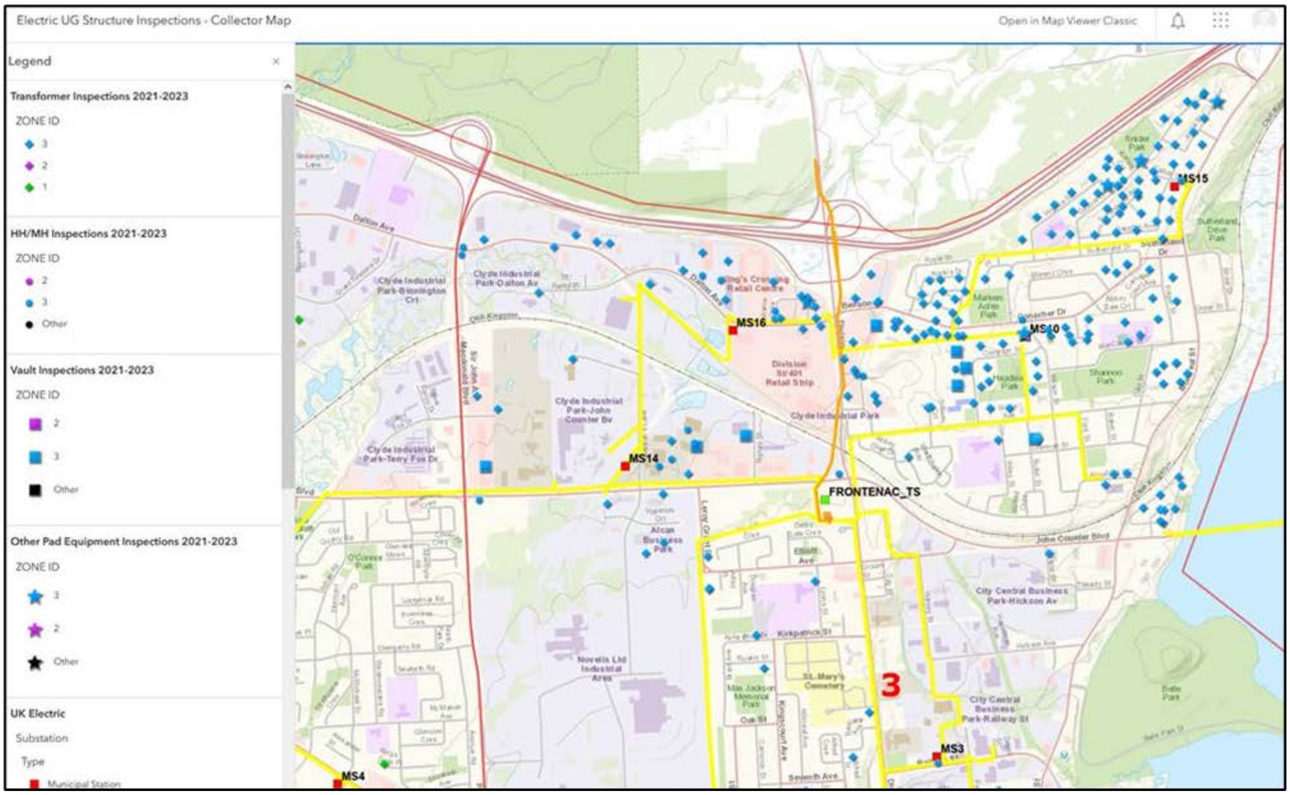


EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-15

Future Influences on DSP
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1 pages 27, 226, 228

Preamble:

Kingston Hydro states that a significant number of smart meter seals are scheduled to expire within the next 5-7 years which will result in lumpy rather than levelized/paced capital expenditures.

Question(s):

a) How many meters will require reverification in each of the forecast years?
b) How many meters will require replacement in each of the forecast years?
c) Has Kingston Hydro confirmed that meter seal expiry will result in new meters being required versus seal updates of existing meters?
d) Please provide annual forecast meter replacement costs for the 2023 – 2027 period.

Response

a) Kingston Hydro does not intend to obtain reverification of existing meters. We do however intend to seek seal extensions by sampling meters so as to manage the annual replacement of smart meters.

b) Kingston Hydro is planning and forecasting the replacement of the following number of meters:

2023 – 485 meters
2024 – 527 meters
2025 – 474 meters
2026 – 900 meters
2027 – 940 meters

c) As meter sampling is occurring in the forecast years and we do not know the results of that work, we cannot offer an answer to the question. We do know that if the meters fail the sampling test, they will need to be replaced.

d) 2023 – $375,000

Forecast estimates:
2024 - $380,000
2025 - $465,000
2026 - $600,000
2027 - $625,000

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-16</u>

Coordinated Planning with Third Parties
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1 pages 33, 34, 228

Preamble:

Kingston Hydro states that it plans to initiate the pre-design of a new Municipal Transformer Station in 2024-2025 as one of the outcomes of the Regional Planning process. Kingston Hydro is currently supplied from Hydro One transformer stations connected to the transmission grid.

Question(s):

a) Did Kingston Hydro perform a business case to determine that ownership of a Municipal Transformer Station was preferable to supply from a new Hydro One owned transformer station?
b) Why is the pre-design work for the station in System Access instead of System Service?

<u>Response</u>

a) A formal business case has not been completed. It is expected that a formal business case would be part of any formal filings seeking approval (regulatory and Kingston Hydro Board) for a new station. Preliminary consideration of Kingston

Hydro undertaking this work did identify savings to our customers in areas of distribution versus transmission connections, feeder construction and overall cost to construct. Proposed funding in 2024 –2025 will assist in scoping and identifying these factors more clearly.

b) The pre-design work for an MTS is considered System Access because the new customer service requests including new customer connections, modifications to existing customer connections and expansions for customer connections will be ultimately supplied from new 44kV feeders.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-17</u>

Performance Measurement for Continuous Improvement
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1 page 43

Preamble:

Kingston Hydro states that, for Customer Hours of Interruption (CHI) statistics, Severe Weather Days are defined as days with Maximum Wind Gust of 50km/h or higher lasting more than 2 hours.

Question(s):

a) What is the reference standard or document for this threshold definition?

<u>Response</u>

a) Section 6.2.1 of the Metsco Report (submitted as attachment in response to 1-Staff-3 a) describes this metric and Section 5.3 of the Metsco Report shows analysis used to arrive at the 50km/h threshold definition for Kingston Hydro.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-18

Performance Measurement for Continuous Improvement
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1 page 46

Preamble:
Kingston Hydro utilizes a Warehouse Inventory Turnover metric.

Question(s):

a) Does the value of the inventory used in this metric include equipment and material retained for spare purposes as well as new build purposes? Please explain your response.

Response

a) Yes, this metric includes equipment and material retained for spare purposes as well as new build purposes. Our business requirements require us to stock spare equipment for emergencies and purchase minimum order quantities in order to complete certain projects. This periodically leaves us with leftover stock that is used as the need arises. Example of this would be a minimum order of 3000 meters on a power cable when only 1500m might be necessary for a particular project. The remainder would be kept in stock for emergencies and future projects. Spare major equipment is necessary to have on hand for emergencies. Those two instances primarily account for our low inventory turns.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-19</u>

Performance Measurement for Continuous Improvement
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1 page 54, 80

Preamble:

Kingston Hydro uses a metric to track Average CHI for Defective Equipment Outages. The metric tracks defective equipment as a single category. Table 5.2-29 summarizes defective equipment cause breakdown from 2015 to 2021. Tables 5.2-10 through 5.2-11 provide annual SAIFI equipment failure statistics over the historical period for cables, transformers and poles.

Question(s):

a) Please break out information in Table 5.2-29 on an annual basis over the historical period.

<u>Response</u>

a) Tables 5.2-29a, 5.2-29b and 5.2-29c below break out the information in DSP Table 5.2-9 (DSP page 55) on an annual basis over the historical period 2015-2021.

1

Year	2015	2016	2017	2018	2019	2020	2021	Total
Cable	4820	4372	2796	3949	998	3791	2726	23452
OH Wires & Lead	146	181	1048	285	32	138	3	1833
Hot Spot	117	0	86	0	0	23	0	226
Distribution Switch	4694	244	92	146	374	53	375	5978
Fuse	44	18	91	22	185	857	168	1385
Distribution Transformer	39	80	14	154	49	11	132	479
Elbow	1166	0	0	0	0	0	0	1166
Lightning Arrester	245	0	0	273	0	67	0	585
Spaced Aerial	0	142	0	0	0	0	0	142
Pole	0	8283	0	0	0	0	0	8283
5kV Switchgear	0	0	0	9488	0	0	0	9488
Others	437	357	1474	194	1702	13314	3293	20771

Table 5.2-29a – Total Customer-hours of Interruption Caused by Defective Equipment

Year	2015	2016	2017	2018	2019	2020	2021	Total
Cable	3183	2512	2023	1927	452	1544	5958	17599
OH Wires & Lead	70	155	877	103	21	87	7	1320
Hot Spot	577	0	82	0	0	58	0	717
Distribution Switch	6789	178	25	229	797	1211	125	9354
Fuse	52	24	10	25	71	1152	80	1414
Distribution Transformer	7	19	18	41	14	18	67	184
Elbow	597	0	0	0	0	0	0	597
Lightning Arrester	2100	0	0	143	0	30	0	2273
Spaced Aerial	0	386	0	0	0	0	0	386
Pole	0	2630	0	0	0	0	0	2630
5kV Switchgear	0	0	0	2065	0	0	0	2065
Others	40	925	1658	286	1322	4000	1823	10054

Table 5.2-29b – Total Customer of Interruption Caused by Defective Equipment

1

Year	2015	2016	2017	2018	2019	2020	2021	Total
Cable	6	5	4	7	3	5	5	35
OH Wires & Lead	5	8	3	3	1	4	1	25
Hot Spot	10	0	5	0	0	3	0	18
Distribution Switch	5	4	1	3	6	3	2	24
Fuse	3	3	2	2	2	4	3	19
Distribution Transformer	1	2	2	3	1	1	3	13
Elbow	3	0	0	0	0	0	0	3
Lightning Arrester	1	0	0	1	0	1	0	3
Spaced Aerial	0	1	0	0	0	0	0	1
Pole	0	1	0	0	0	0	0	1
5kV Switchgear	0	0	0	1	0	0	0	1
Others	3	10	7	4	5	7	4	40

Table 5.2-29c – Number of Events Caused by Defective Equipment

Note: Data has been corrected.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-20

Performance Measurement for Continuous Improvement
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1 page 58

Preamble:

Kingston Hydro states that PILC cable faults occurred two times per year on average in the past ten years and has established a systematic plan to replace PILC cable risers at substations.

Question(s):

a) Does this mean that the majority of faults have been related to risers versus underground mains?
b) Are the failures primarily in the cable or the splice between cable sections?
c) What type of cables are being used to replace the PILC cables, and why?

Response

a) Yes.

b) Failures are typically in the termination of the cable riser.

c) We have standardized on tree-retardant cross-link poly-ethylene cable with jacketed concentric neutral (TR-XLPE JCN) because it is an industry standard cable type that is widely available and has lower environmental impacts (no lead or oil impregnated paper insulation).

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-21</u>

Performance Measurement for Continuous Improvement
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1 page 55

Preamble:

Kingston Hydro uses a metric to track SAIFI of defective equipment outages deemed to be in a particularly poor condition.

Question(s):

a) Does the "poor" condition correspond to the Health Index classifications (poor, very poor) in the Kinectrics ACA study? If not, how is the condition determined?
b) Does Kingston Hydro have SAIFI data for defective equipment outages for equipment deemed to be in fair or better condition based on the Health Index of the equipment?

<u>Response</u>

a) Defective equipment that fails is automatically assigned a poor ranking by the outage criteria. However, a single failure of an asset does not necessarily infer that the asset health index or asset condition assessment is poor, so Kinetric's work is independent of the equipement failure ranking. Multiple failures of the same equipment would however suggest an issue with that equipment, that might then trigger a “poor” rating in the asset condition results.

b) No, we do not have SAIFI data for defective equipment outages for equipment deemed to be in the Fair, Good or Very Good health index classifications of the Kinectrics ACA study.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-22

Performance Measurement for Continuous Improvement
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1 pages 22-23, 67 – 71, 227

Preamble:

Kingston Hydro states that customer engagement activities identified support for improved reliability. Current reliability performance indicates higher SAIDI and SAIFI target values in the forecast years compared to the historical period. Kingston Hydro states that with the decreased investment plan to upgrade assets compared to the historical period, it expects the SAIDI and SAIFI contributions due to Scheduled Outage for asset upgrades will decrease.

Period	*SAIFI Target*	*SAIDI Target*
2015 - 2021	*0.95*	*1.03*
2022 - 2027	*1.11*	*1.35*

Question(s):

a) How do the forecast SAIFI and SAIDI targets support customer engagement outcomes?
b) What were the results of the Large Customer engagement activities?

c) Is it expected that the decreased asset investment plan will result in SAIDI and SAIFI performance that will be within the proposed targets for the 2022 – 2027 period?

d) What additional investments would be required to have future SAIDI and SAIFI performance that will be within the targets for the 2015 – 2021 period?

e) Did Kingston Hydro consider maintaining the same 2015 – 2021 reliability targets for the forecast period?

Response

a) Kingston Hydro follows the regulatory requirements of Section 5.2.3 of the Chapter 5 filing requirements. The Kingston Hydro DSP supports a reasonable balance between rates and reliability. The proposed investments in System Renewal as described continue to address system reliability concerns of our customers in areas such as transformer renewals, switch replacement etc.

b) In 2019, large customers were invited to provide input into several factors, including reliability. We received feedback from representatives at Limestone District School Board, Queen's University, Kingston Health Science Centres, Providence Care, Department of National Defence (CFB Kingston) and Weston Foods.

Customer feedback specifically relating to reliability was as follows:

- "Reliability and power outage communications extremely important for parents and students. There is a good relationships with Utilities Kingston. Power reliability is good for the schools." (Limestone District School Board)
- "Very satisfied from an electric perspective. Very robust." (Hospitals)

- At the meetings, the following reliability questions were asked and answered:
  - Improvements of substations – will that affect reliability? (Yes, breakers are obsolete, etc., so reliability will improve with the substation upgrades)
  - Historical power quality during switching – will that we addressed? Are others seeing the issue with loads around retail hours? Do others have power quality issues? (Utilities Kingston clarified we can work with large customers to determine the problem: we want to know about power quality issues – please tell us the date, time, recording.)
- Other comments related to power quality:
  - CFB Kingston indicated no power quality issues – their issues are more related to equipment and design at the army base and the age of the systems.
  - Customers have seen more power quality issues in areas outside of the Kingston Hydro distribution area.
- Large users commended Kingston Hydro that the “message has been more enlightened in the last 15 years”, meaning we are more receptive to customer feedback today.
- Indicated that forced outage notifications are working well. Kingston Hydro is easy to work with.

c) Yes, we expect that SAIDI and SAIFI performance will be within the proposed targets for the 2022 – 2027 period due to the significant investments and upgrades to the Kingston Hydro distribution system over the past 10 years. The Kingston Hydro DSP supports a reasonable balance between rates and reliability. We don’t expect the decrease in the asset investment plan over the next 5 years will significantly impact the SAIDI and SAIFI performance.

d) Please refer to response to part c) above. We don't expect the decrease in the asset investment plan over the next 5 years will significantly impact the SAIDI and SAIFI performance.

e) No, Kingston Hydro followed the regulatory requirements of Section 5.2.3 of the Chapter 5 filing requirements.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-23</u>

Performance Measurement for Continuous Improvement
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1 pages 70

Preamble:

Kingston Hydro states that a 44kV cable termination that failed at a customer-owned substation in 2021 resulted in contributions of 0.38 in SAIFI and 0.50 in SAIDI. This single event contributed 35.5% of the annual SAIDI result and 18.1% of the annual SAIFI result in 2021. This failure was deemed as foreign interference as opposed to defective equipment.

Question(s):

a) Please confirm that the termination was a customer-owned, installed and maintained asset and not a Kingston Hydro termination.

<u>Response</u>

a) Yes, the termination was customer owned, installed and maintained asset.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-24</u>

Performance Measurement - Asset Management
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1 page 59

Preamble:

Kingston Hydro states that it will continue to pace the replacement of obsolete and legacy 5kV oil switches in transformer vaults with the goal of eventually eliminating these legacy assets to improve system operability and worker safety. Kingston Hydro states it has replaced three 5kV oil switches in the previous planning horizon (2015-2020). Kingston Hydro states it will continue this oil switch replacement program over the 2022-2027 timeframe.

Question(s):

a) How many 5kV oil switches remain to be replaced?
b) How many 5kV oil switches are planned to be replaced annually in the 2022 – 2027 timeframe?

<u>Response</u>

a) Nine 5kV oil switches (45 ways) remain to be replaced.

b) The 2022-2023 plan includes two 5kV oil switches (10 ways); two in 2022 and zero in 2023. The 2024-2027 forecast includes five 5kV oil switches but these projects have not been finalized or approved by the Kingston Hydro board yet.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-25</u>

Asset Management Process
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1 pages 91

Preamble:

Kingston Hydro states that fleet assets are required to remain in good working condition. Replacement is recommended when the vehicle reaches a prescribed odometer reading, hours of service, or age combined with an upward trend of unscheduled maintenance costs over the previous 2-3 years.

Question(s):

a) What are the prescribed odometer reading, hours of service, age and maintenance cost criteria for each fleet vehicle class?

<u>Response</u>

a) The following info is taken into consideration for vehicle replacements.

1. Model year
2. Engine hours
3. Condition of truck and mounted equipment
4. Engineering structure report

5. Preventative maintenance reports
6. Unscheduled Maintenance reports
7. Parts availability
8. Reliability from the last 2-3 years
9. Health and safety concerns
10. Hydro staff review the above info with the mechanics to get an opinion on the estimated future reliability for forecast years of the budget.

We wish to clarify our process for evaluating fleet assets outlined in the DSP. We do not use fixed prescribed performance targets or weightings/percentages to assess vehicle condition. We compare the performance of similar type/class of vehicles in the fleet when we assess vehicle condition and place varying levels of importance/weighting on the info mentioned above with consideration of the type/class of vehicle and other subjective factors.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-26

Asset Management Process
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1 pages 93

Preamble:

Kingston Hydro states that it has updates for its 44kv and 5kV Master Plans.

Question(s):

a) Please provide the 2019 and 2020 memo updates to the Master Plans.

Response

a) The following memos are included as attachments to these interrogatory responses and contain updates to the Master Plans:

- Memo dated November 7, 2019 on the subject “Final 2019-2040 44kV Master Plan and Regional Load Forecast”
- Memo dated November 7, 2019 on the subject “2009-2019 Electric System Loading Trends”
- Memo dated June 3, 2020 on the subject “5kV Electric Master Plan – Update”

Response to Ontario Energy Board (OEB)

Interrogatory #1-Staff-26 (a)

Attachment 1 of 3

(Memo: Final 2019-2040 44kV Master Plan and Regional Load Forecast)

Memorandum

To: File (K00_07_18 - 2017 Master Plan Update)

From: Tom Brackenbury, P.Eng., Utilities Engineer

Date: November 7, 2019

Subject: Final 2019-2040 44kV Master Plan and Regional Load Forecast

Cc: Chris Phippen, P.Eng., Manager, Utilities Engineering

Jim Miller, Director, Utilities Engineering

Purpose

The purpose of this memo is to update and finalize the 2019-2040 forecast for the 44kV Master Plan based on new information received from DND in March 2019.

The 44kV Master Plan also serves as the basis for developing the Regional Plan and Distribution System Plan. The following table summarizes the timing of revisions to these documents 5 years:

Report	First Issue	Revision Cycle	Next Update Timeframe
44kV Master Plan	2012-2013	Every 5 years	2017-2019
Regional Plan	2014-2015	Every 5 years	2019-2020
Distribution System Plan	2014-2015	Every 5 years	2019-2020

Executive Summary

The loading on Frontenac TS and Gardiner TS is approaching the Emergency Summer Capacity of these two stations. (e.g. emergency operating contingency with one transformer out-of-service). There appears to be sufficient capacity for the next 6 years (2020-2025) to satisfy Kingston Hydro's Medium incremental load forecast. The next Regional Plan review is scheduled to commence this month and will consider both the near term (2019-2025) and the long term (2026-2040). The Regional Plan is required to be updated at least every 5 years. The subsequent Regional Plan update may need to be initiated as early as 2021 especially if the actual load growth in 2020-2021 is greater than the Medium forecast.

The finalized spatial load forecast suggests that the total incremental system demand for Medium to High growth scenarios over 2019-2040 timeframe is expected to be between 16.4 and 45.75 MW respectively. This memo includes a comparison of the incremental demand and available capacity of the following upstream Hydro One feeders and stations that supply Kingston Hydro:

Subject: Final 2019-2040 44kV Master Plan and Regional Load Forecast

Hydro One Station	Settlement Type	Hydro One Feeders
Frontenac	Transmission	M2, M4, M5
Gardiner	Distribution	M7, M9, M12
Frontenac	Distribution	M3

Spatial Load Forecast

The 44kV master plan is based on a spatial load forecast of new incremental load that was developed from a review of pending development applications, vacant lands and customer surveys. The new incremental load was then aggregated by Hydro One Feeder and Settlement Point based on the existing catchment areas of the 44kV distribution system. We also estimated the connection timeframe for new incremental load and tallied it according to Near Term (2018-2022), Medium Term (2023-2037) and Long Term (2038 or later).

A preliminary update to the 44kV master plan was undertaken in 2017-2018 (refer to Memo Dated April 4, 2018). UK staff requested a load forecast from DND in 2017/2018 but did not receive a load forecast from DND until March 2019. The DND forecast has now been incorporated into the finalized forecast presented in this memo.

As a final note, three growth scenarios (Low, Medium, and High) were developed to account for uncertainties in load profiles and timelines of new development. The results are shown in Figure 3a through 3c below.

1. The Medium Growth Scenario for the Frontenac and Gardiner Settlement points shown in Figure 3a through 3c below is summarized in the following table:

Medium Growth (MW)

	Frontenac DX	Frontenac TX	Gardiner DX	Total
2018-2022	0.15	3.83	3.40	7.38
2023-2037	0.18	1.72	2.86	4.76
2038 or later	0.21	1.79	2.25	4.26
Total	0.55	7.34	8.51	16.40
Annual Inc. Load Growth 2019-2040	0.03	0.35	0.41	0.78

2. The High Growth Scenario for the Frontenac and Gardiner Settlement points shown in Figure 3a through 3c below is summarized in the following table:

High Growth (MW)

	Frontenac DX	Frontenac TX	Gardiner DX	Total
2018-2022	0.16	6.29	5.59	12.04
2023-2037	0.30	6.50	9.87	16.67
2038 or later	0.86	7.17	9.01	17.04
Total	1.31	19.97	24.47	45.75
Annual Inc. Load Growth 2019-2040	0.06	0.95	1.17	2.18

3. The following charts summarize the incremental load growth for Low, Medium and High growth scenarios.

Fig. 3a Incremental Load Growth (kW)

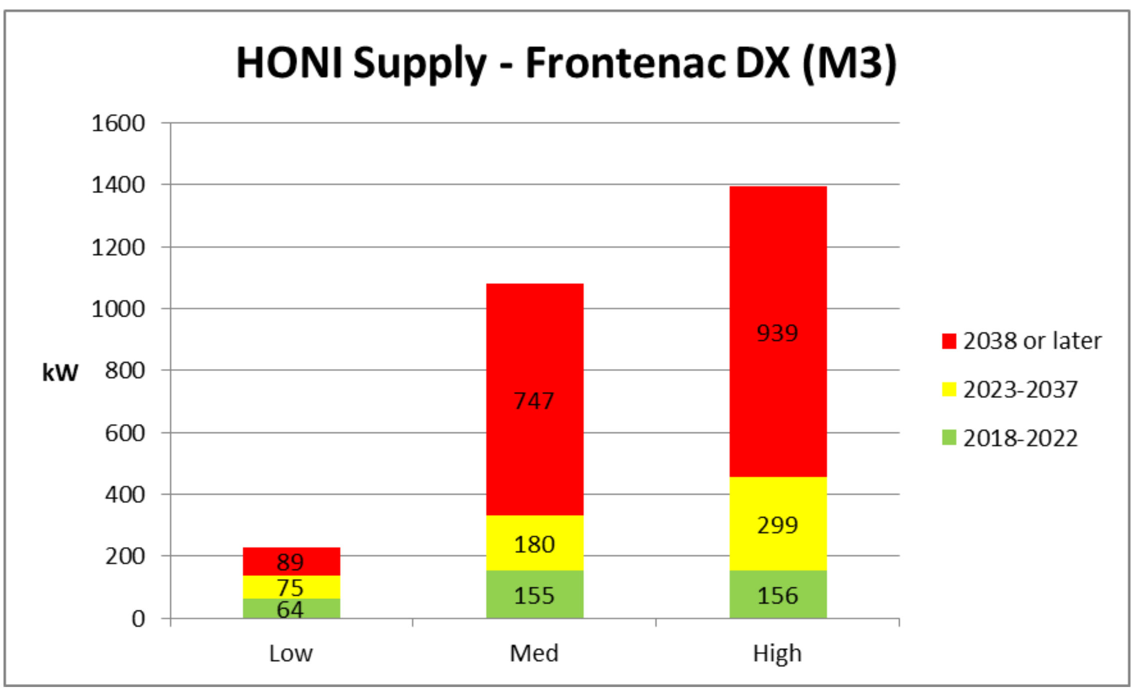


Fig. 3b Incremental Load Growth (kW)

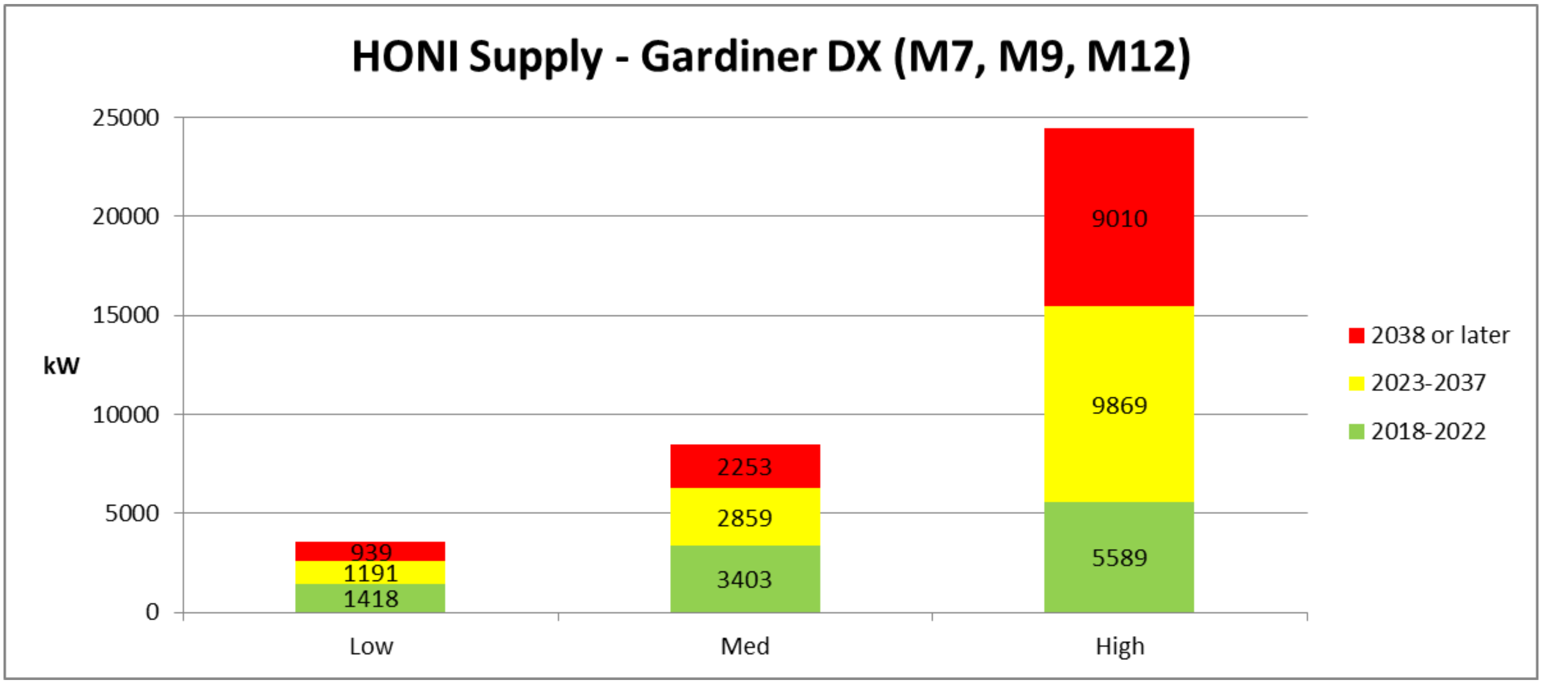
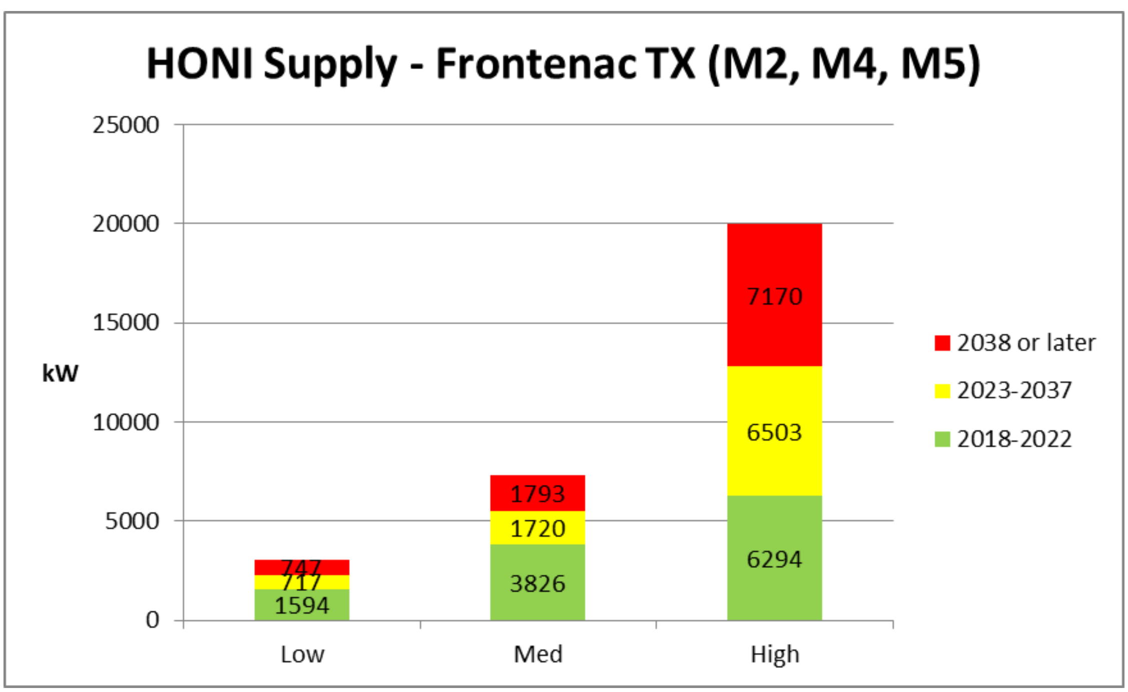


Fig. 3c Incremental Load Growth (kW)



2019-2040 Regional Load Forecast

For the preliminary 2019-2040 Regional Forecast, Kingston Hydro will assume the following:

- 2019 Summer peak demand of 115.3MW (2016-2019 historic average)
- 2019 Winter peak demand of 124.1MW (2016-2019 historic average)
- The following annual incremental load increase (MW/year) starting in 2020:

	Frontenac DX	Frontenac TX	Gardiner DX	Total
Annual Inc. Load Growth 2020-2040	0.047*	0.35	0.41	0.81*

*NOTE: The annual incremental demand for Frontenac DX was increased slightly from the calculated value of 0.031MW/year to 0.047MW/year

Comparison of Spatial Load Forecast and Regional Forecast

The Spatial Load Forecast is developed from predicted connection dates when incremental load will be connected to the electric distribution system whereas the Regional Load Forecast assumes an average annual incremental load increase over the entire study period (2019-2040). As a result, the spatial load forecast for Medium growth is predicting a “front loaded forecast” with significant growth in the 2018-2022 timeframe whereas the regional load forecast is predicting a “smoothed” or gradual increase over the 2019-2040 timeframe.

Capacity Assessment

Station capacity may be allocated using one of the following methods provided it is mutually agreed upon by the parties involved:

1. Allocate capacity through a CCRA
2. Allocate station LTR capacity based on ratio of total # dedicated feeders serving Kingston Hydro to total # of feeder positions.
3. Allocation based on historic loading percentage of total station load

The capacity of Gardiner DESN1 has been allocated to Kingston Hydro using method 1; a CCRA with Hydro One executed in 2007 allocates 58.1MW of the Gardiner DESN1 capacity to Kingston Hydro (this appears to be the annual peak demand capacity allocated for Summer or Winter).

The station losses and capacity of Frontenac TS have been historically allocated using Method 2 which has resulted in a 50/50 allocation between Kingston Hydro and Hydro One. Below is a summary of the allocated capacity using Method 2.

	Station Rating					Allocated Capacity		
Station	Winter 10-Day LTR MVA	Summer 10-Day LTR MVA	# of dedicated breakers	Total # of breakers	% allocation	PF	Winter Allocated MW	Summer Allocated MW
Frontenac TS	129.8	117.7	3	6	50%	90%	58.4	53.0
Gardiner TS	171.9	151.8	3	9	33%	90%	51.6	45.5
					Total		110.0	98.5

The shared Frontenac M3 feeder is managed by Hydro One and Kingston Hydro does not know the full load or capacity of the Frontenac M3 feeder. To date, discussions between Hydro One and Kingston Hydro have focused on the Capacity and Loading of the Frontenac TX and Gardiner DX supply and the associated dedicated 44kV feeders.

The Kingston Hydro system load has declined slightly over the past decade due to several factors including CDM and GA. Over the same period, the Hydro One load on Gardiner and Frontenac TS may have increased slightly due to growth in the suburbs of Kingston. As a result, the capacity allocated to Kingston Hydro in 2019 may be less than the capacity previously allocated to Kingston Hydro in 2009. This will be an important discussion point for the Regional Plan as the loading at both Frontenac TS and Gardiner DESN1 appears to be approaching the rated capacity. For example, the Kingston Hydro peak winter demand increased from 130MW in 2002 to 134MW in 2006 whereas, the Kingston Hydro peak winter demand decreased steadily from 2016-2019.

Hydro One has advised Kingston Hydro in recent years that the Frontenac TS and 115kV transmission system have reached capacity. Hydro One has also advised Kingston Hydro in recent years that the Gardiner DESN2 station still has 50MW of remaining capacity, therefore, Hydro One will not likely build a new station until Gardiner DESN2 is loaded up. With that in mind, Kingston Hydro should initiate negotiations with Hydro One for a new feeder from Gardiner DESN2. A new feeder from Gardiner DESN2 would increase both the feeder capacity and station capacity available to Kingston Hydro. Simply extending a new feeder from Gardiner DESN2 and establishing a tie with an existing Gardiner DESN1 feeder near the city limits would improve the available capacity to Kingston Hydro under an emergency condition (e.g. one transformer out-of-service) and could be done cost-effectively without the need to extend the feeder all the way into Kingston Hydro territory. This is demonstrated in the attached capacity charts.

Suggested Discussion Points with IESO/Hydro One for the Upcoming Regional Plan

In addition to the above information, the following points should be discussed at the upcoming Regional Planning meetings:

1. Frontenac & Gardiner TS peak loading data:
    a. What are the historic dates/times of the annual summer and winter peaks for the Gardiner and Frontenac TS facility?
    b. What is the coincident load of each Kingston Hydro supply point at the date/time of the annual facility peaks?
    c. Did any abnormal operating conditions occur (e.g. load transfers between Frontenac and Gardiner TS) at the time of the annual facility peak?
2. How much remaining capacity exists at Frontenac TS and Gardiner TS? How much is allocated to Kingston Hydro? We have assumed allocation of capacity based on number of breaker positions. For Frontenac TS we have 3 of 6 breakers. For Gardiner we have 3 of 9 breakers which results in less capacity allocation even though feeders at Frontenac and Gardiner have same ratings. Discuss with Hydro one.
3. Does the Regional forecast predict any loading concerns for Frontenac TS in the near future? If yes, does Kingston Hydro need to consider any future operating restrictions (e.g. deferral of load transfers to off-peak dates/times)?
4. The forecast info above does not take into account the potential for additional load growth over the next 20 years due to electrification of transportation and heating (aka decarbonization). Should the Regional Plan include a forecast for low and high rates of decarbonization over the next 20 years?
5. Kingston Hydro is currently a winter peaking utility. Many customers do not currently have air conditioning. Institutional and Commercial customers may install/upgrade air conditioning systems over the next 20 years due to a combination of climate change, occupant comfort and economic factors.
6. Historically, Kingston Hydro’s demand has declined slightly over the past 11 years at both the System and Facility level due to economic, CDM, DR and GA factors. What is the historical trend of Hydro One load over the past 11 years for the Kingston Area?
7. Moving forward, the Kingston Hydro System and Facility demand is expected to increase for two reasons, there are no new or significant CDM/DR programs expected in the near term and the local economy is expected to experience modest growth due to new housing projects to address the current housing shortage and expansions/upgrades to institutional facilities. What is the forecast trend of Hydro One load for the Kingston Area?

8. The 15MW Queen's Cogen Facility consists of two 7.5MW cogen units. This facility has the potential to reduce the loading at Frontenac TS and/or Gardiner TS. Currently, Kingston Hydro collects a standby charge from Queen's Cogen and does an annual Gross Load Billing settlement to compensate Hydro One for lost transmission revenue associated with maintaining capacity at Frontenac TS. Also, Kingston Hydro does not have a Power Purchase Agreement with Queen's Cogen. Based on these two factors, we don't understand why the IESO includes embedded DG in the TX/DX facility forecasts? Shouldn't we be planning for the worst case scenario in the event that the embedded DG is not available? Should Queen's Cogen be given some compensation if the Regional plan relies on them to offset some of the Facility demand?

Technical Background

Future Evolution of Load Forecasting

In the future, load forecast strategies may need to consider the following market disrupters:

- Advancements in appliance energy efficiency (e.g. induction stoves)
- Regulated targets for Conservation Demand Management (CDM) (e.g. OEB/IESO retrofit programs)
- Distributed Energy Resources (DERs)
  - maturing technology
  - competitive pricing (e.g. grid parity, transactive markets)
  - incentives (e.g. IESO FIT program, IESO Energy storage pilot, etc.)
- Potential for future electric load increases due to:
  - Incentives and regulations that encourage switching transportation fuels to meet carbon reduction targets (e.g. Electric Vehicles, Buses, Ferries, Trains, Scooters, etc.)
  - Increasing economic prosperity and marketing of luxury products(e.g. Hot Tubs)
  - Incentives and regulations that encourage switching heating fuels to meet carbon reduction targets. The City, Queen's and CFB Kingston are considering the goal of "net-zero by 2040" and switching heating systems from a hydro carbon fuel source to electric (e.g. Electric heat vs. Natural Gas Heat) appears to be the quickest way for these customers to achieve this target.
  - Increasing adoption of air conditioning due to climate change
  - Increasing use of power hungry Computer Servers and Data Centres to support data hungry services such as crypto currency technology (block chain) and smart consumer products that leverage the Internet of Things (IoT)

Unfortunately, it is difficult to forecast the long term impact of the above trends/targets/programs at this time as many of these technologies and policies are in the early deployment/adoption stage and/or their feasibility depends on evolving subsidization and financing models. In the case of CDM, the OEB/IESO program info has been used to estimate the system energy (kWh) reduction but there is limited data available to estimate the associated demand (kW) reduction which can vary with each CDM program.

Spatial Load Forecast Methodology

The incremental load was estimated through a spatial forecast involving the following steps:

1. Took a “snapshot” of pending development applications, vacant land and economic activity as of Fall 2017. Received an updated forecast from DND in March 2019.

2. Estimated the “connected load” or distribution transformer size in kVA needed to service new development based on expected occupancy type (commercial, residential, institutional, etc.), zoning by-laws and the Ontario Electrical Safety Code (OESC).

3. Estimated the new “actual incremental load” for various scenarios by multiplying the connected load by the estimated “diversity factor %” (DF%). Based on previous experience, three scenarios of diversity factor were considered: Low = 25%, Med = 40% and High = 60%*.

4. Assigned a “confidence factor %” (CF%) between 0% to 100% to estimate the likelihood of each development (0% represents “not likely at all”, 100% represents “definite”). The confidence factor assignment is subjective and based on a combination of customer feedback and historic customer patterns.

5. Calculated the Low, Medium and High growth scenario for each development as follows:

    a. Low Growth = connected load x 25% x CF%

    b. Med Growth = connected load x 60% x CF%

    c. High Growth = connected load x 60%

6. Tally the Low, Medium and High Growth development scenarios to estimate the new incremental load for each Hydro One feeder and Hydro One settlement point.

*NOTE: The diversity factor for a feeder is calculated as the percentage ratio of actual load to total connected load. Previous studies for Williamsville and MS17 have calculated a percentage diversity factor of 60% and 25% respectively.

Rationale for Load Growth Scenarios

The low, medium and high load forecasts are intended to show the potential range and uncertainty of future load growth.

By considering a range of diversity factors (DF%) we account for uncertainty of the actual coincident peak load due to new development.

By factoring in the confidence factor (CF%) we account for the probability of new development for a given timeframe.

By tallying the low, medium and high growth development scenarios by Hydro One feeder and settlement point, we are attempting to predict how feeders and settlement points may be impacted by development.

Despite all of the above considerations, it is important to understand that other factors beyond our control (e.g. economic) could cause actual development to occur differently than predicted.

Capacity Assumptions for Updated 44kV Master Plan

Similar to the 2012 Master Plan, the updated Master Plan will be based on the following capacity planning assumptions:

- The Hydro One supply must have sufficient Capacity to meet gross system peak load (summer or winter) in the event that there is no embedded generation. In other words, Kingston Hydro has no power purchase agreements with embedded DERs that would guarantee the availability and price of electric power for distribution and financial planning purposes.
- The backup supply for Frontenac M3 shared feeder should be treated differently from the backup supply for the other dedicated feeders from Gardiner and Frontenac TS since the Frontenac M3 supply is a radial feed that has limited back-up capabilities.
- The Hydro One supply to dedicated feeders from Gardiner and Frontenac TS should have sufficient capacity to meet gross system peak load (summer or winter) with one 44kV feeder out of service*
- The Hydro One supply to dedicated feeders from Gardiner and Frontenac TS should have sufficient capacity to meet gross system load (summer or winter) with 1 Hydro One transformer out of service (e.g. Frontenac T1, Frontenac T2, Gardiner T1, Gardiner T2).

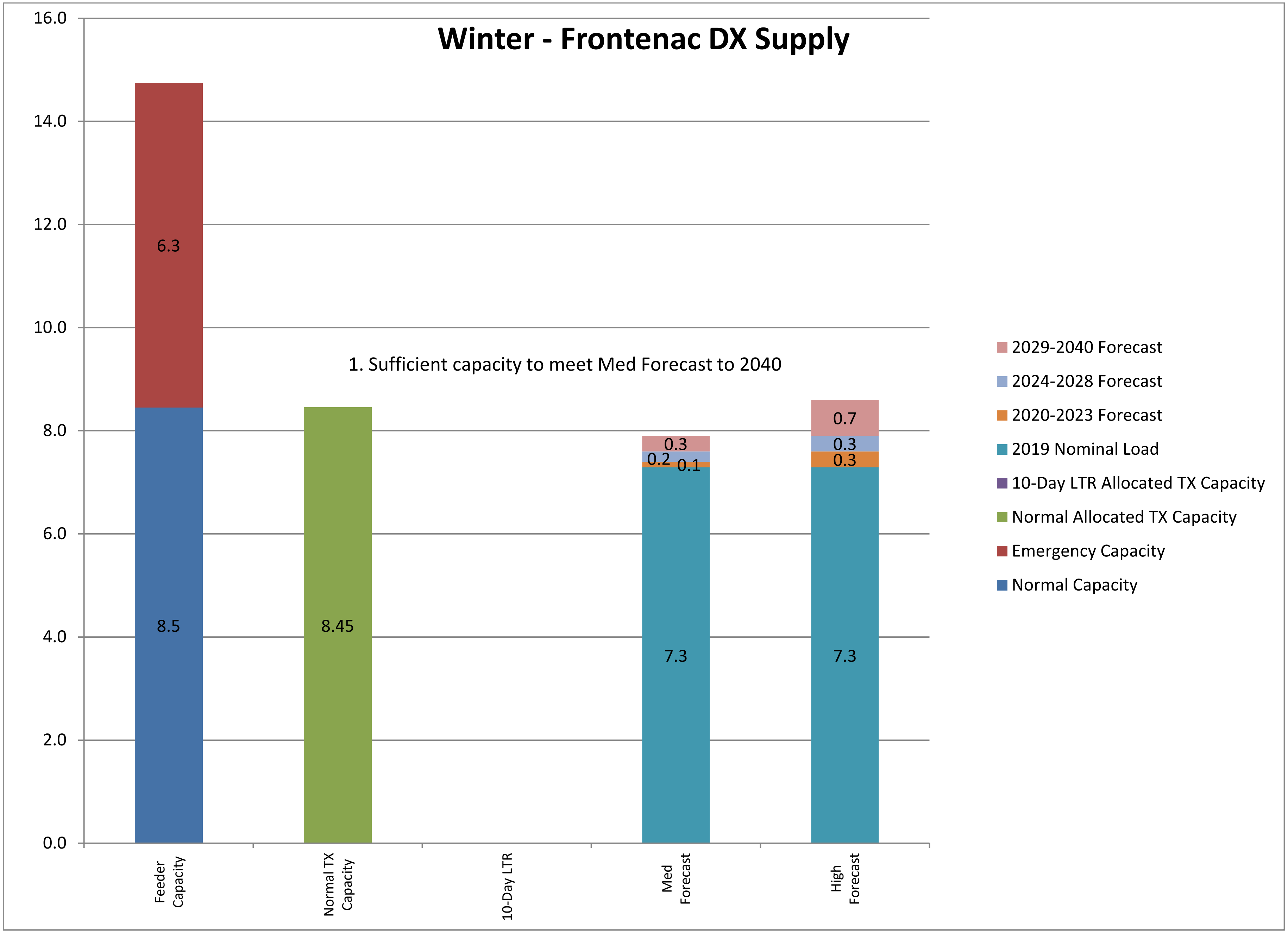
References:

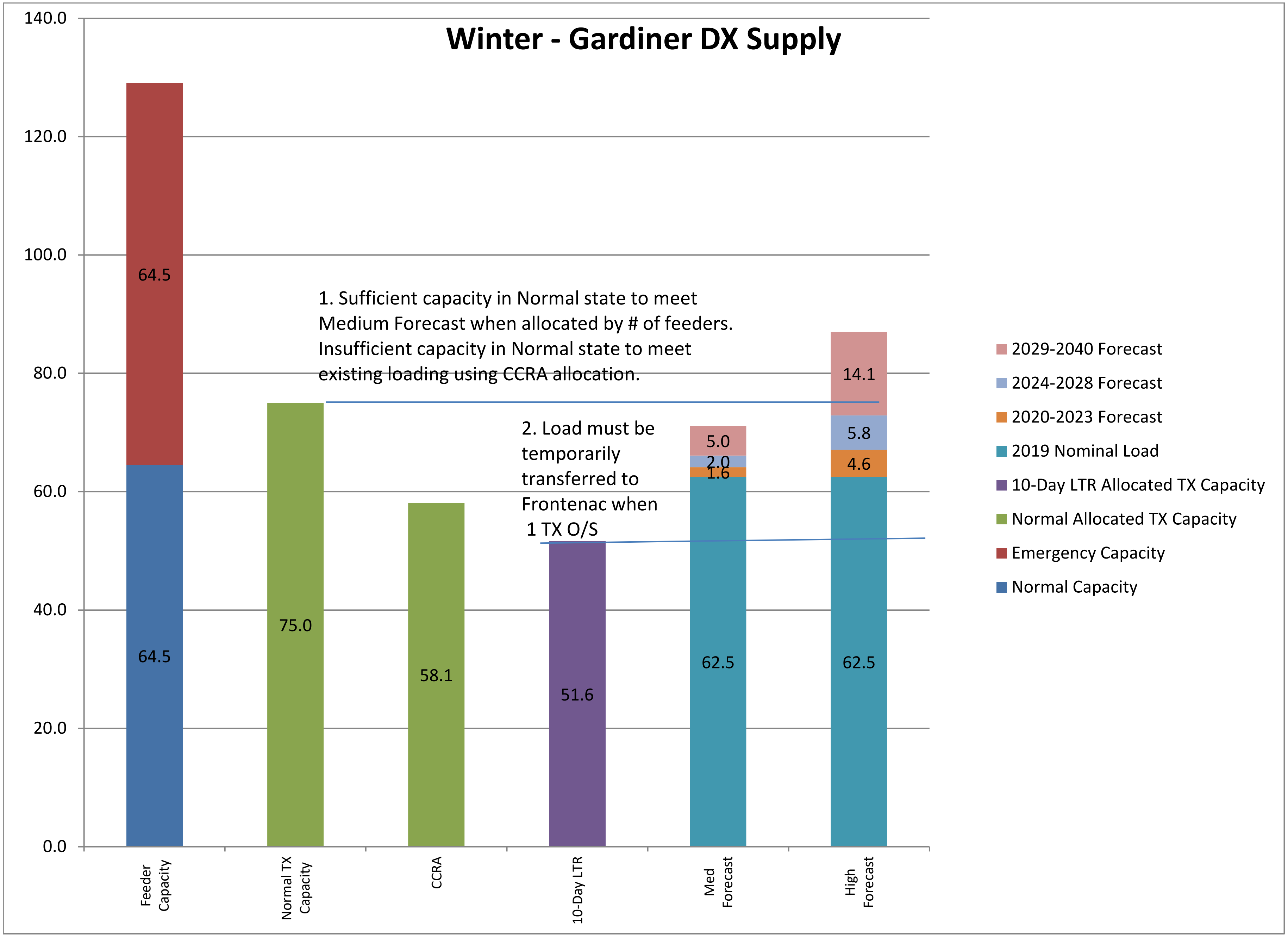
1. **File: 20171004 worst case growth rev 20191030.xlsx**
   Folder: N:\K_Electric\K00_General\K00_07 Planning\K00_07_18 2017 44kV Master Plan Update\working files
2. **File: P to K Load Forecast_KH-IESO-Gen_60min_TB_Summer.xls**
   Folder: X:\Kingston Hydro 2021 Custom IR\Ch5 DSP\Regional Plan\1_Prelim Load Forecast
3. **File: P to K Load Forecast_KH-IESO-Gen_60min_TB_Winter.xls**
   Folder: X:\Kingston Hydro 2021 Custom IR\Ch5 DSP\Regional Plan\1_Prelim Load Forecast

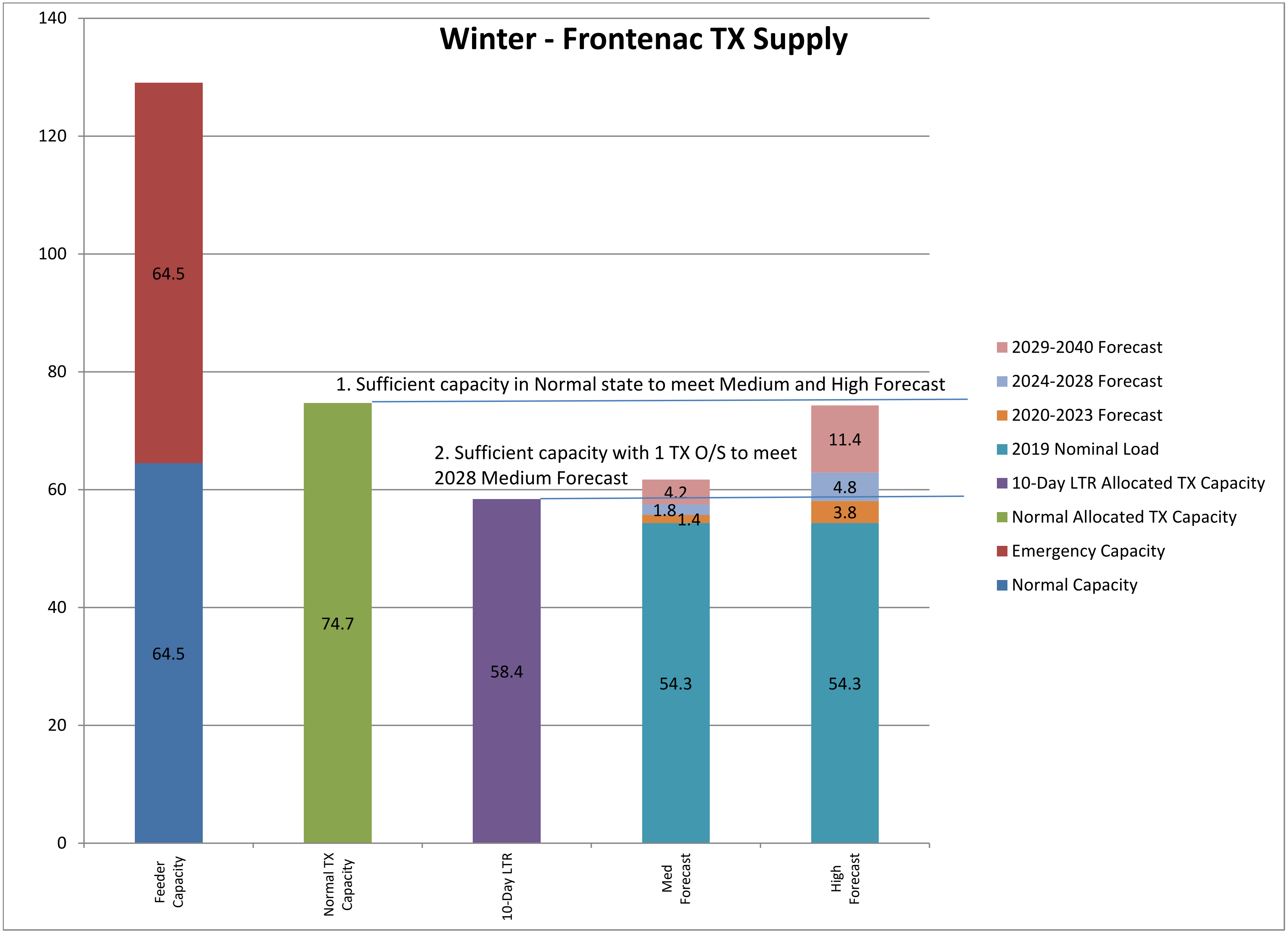
/attached

The following charts are attached and summarize the system capacity and availability to accommodate the Winter and Summer forecasts:

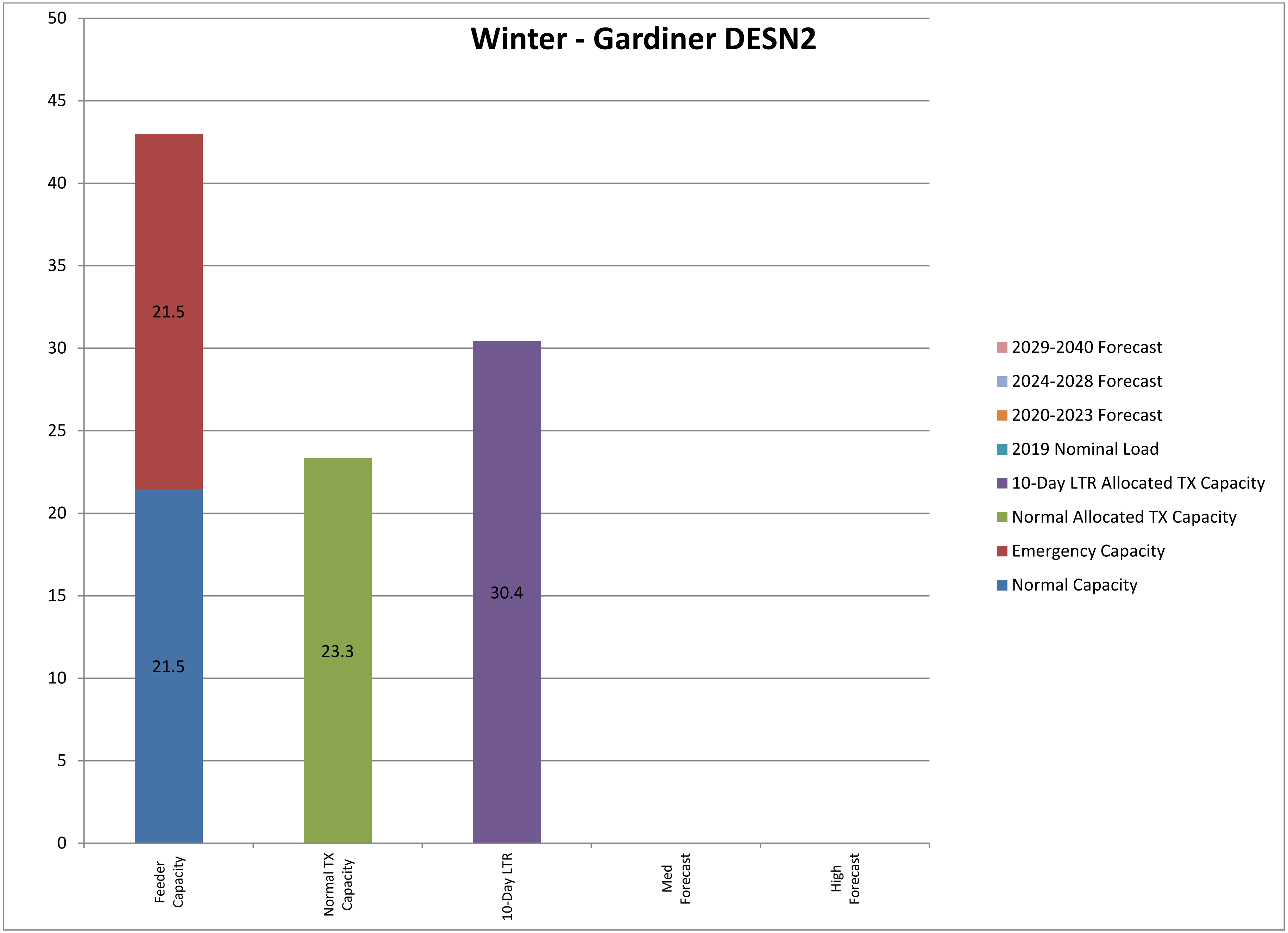
- Winter Frontenac DX Supply
- Winter Gardiner DX Supply
- Winter Frontenac TX Supply
- Winter Gardiner DESN2
- Winter Frontenac TX & Gardiner DX Combined
- Winter Frontenac TX & Gardiner DX & Future Gardiner DESN2
- Summer Frontenac DX Supply
- Summer Gardiner DX Supply
- Summer Frontenac TX Supply
- Summer Gardiner DESN2
- Summer Frontenac TX & Gardiner DX Combined
- Summer Frontenac TX & Gardiner DX & Future Gardiner DESN2

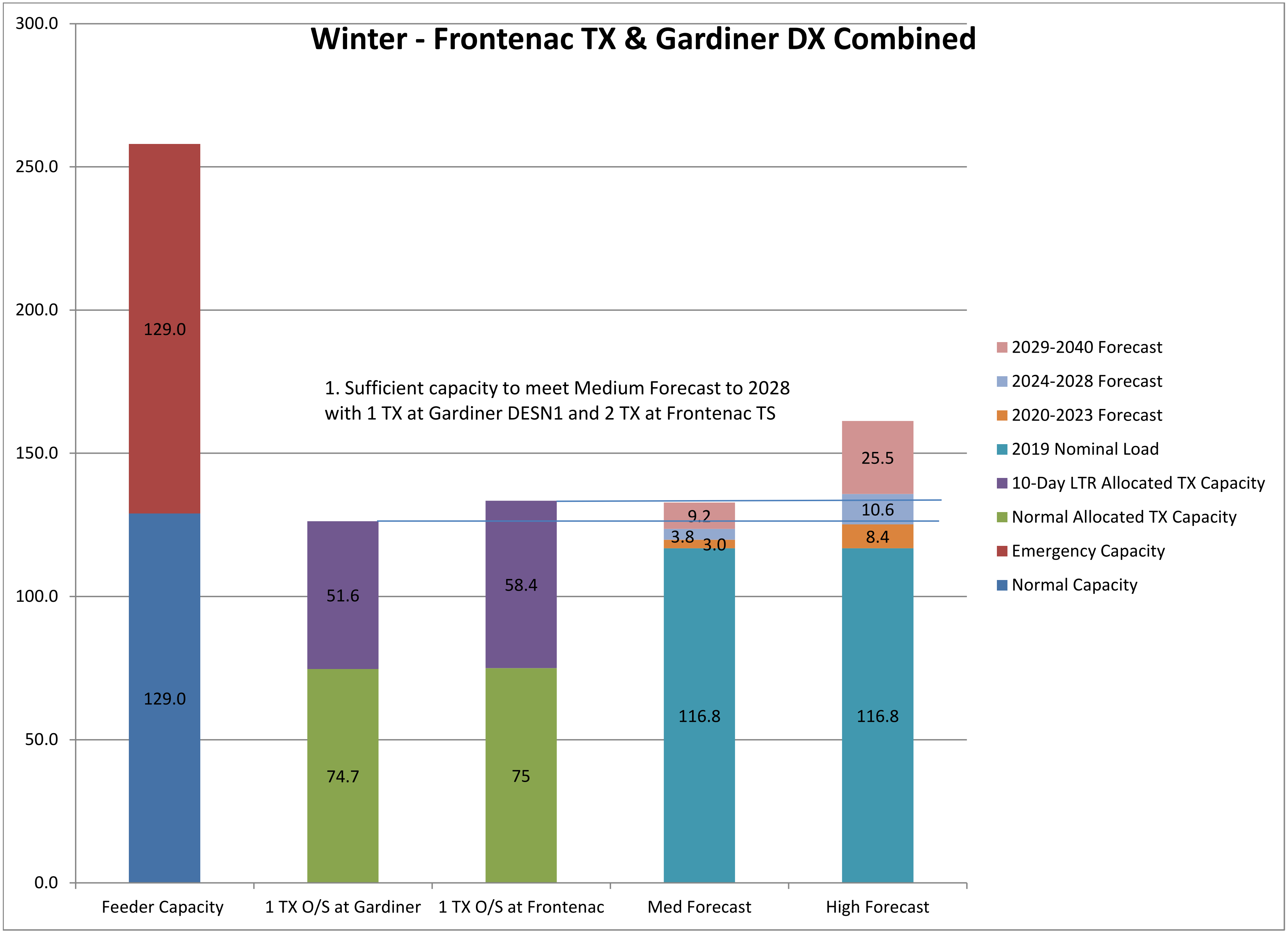

Winter - Frontenac DX Supply
1. Sufficient capacity to meet Med Forecast to 2040
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
6.3
8.5
8.45
0.3
0.2
0.1
7.3
0.7
0.3
0.3
7.3
Feeder Capacity
Normal TX Capacity
10-Day LTR
Med Forecast
High Forecast
2029-2040 Forecast
2024-2028 Forecast
2020-2023 Forecast
2019 Nominal Load
10-Day LTR Allocated TX Capacity
Normal Allocated TX Capacity
Emergency Capacity
Normal Capacity

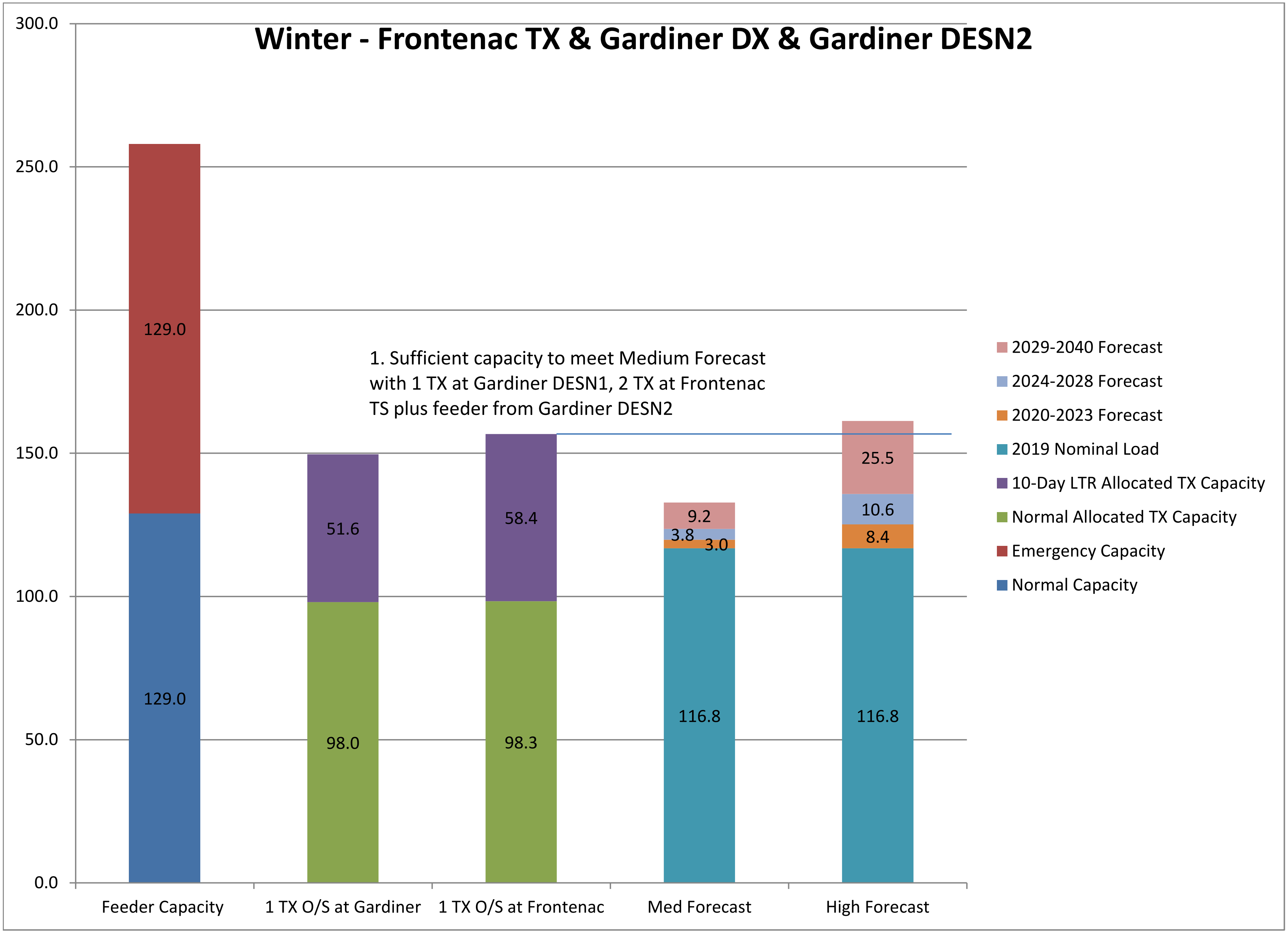

Winter - Gardiner DX Supply
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
64.5
64.5
75.0
58.1
51.6
62.5
1.6
2.0
5.0
62.5
4.6
5.8
14.1
1. Sufficient capacity in Normal state to meet Medium Forecast when allocated by # of feeders. Insufficient capacity in Normal state to meet existing loading using CCRA allocation.
2. Load must be temporarily transferred to Frontenac when 1 TX O/S
Feeder Capacity
Normal TX Capacity
CCRA
10-Day LTR
Med Forecast
High Forecast
2029-2040 Forecast
2024-2028 Forecast
2020-2023 Forecast
2019 Nominal Load
10-Day LTR Allocated TX Capacity
Normal Allocated TX Capacity
Emergency Capacity
Normal Capacity



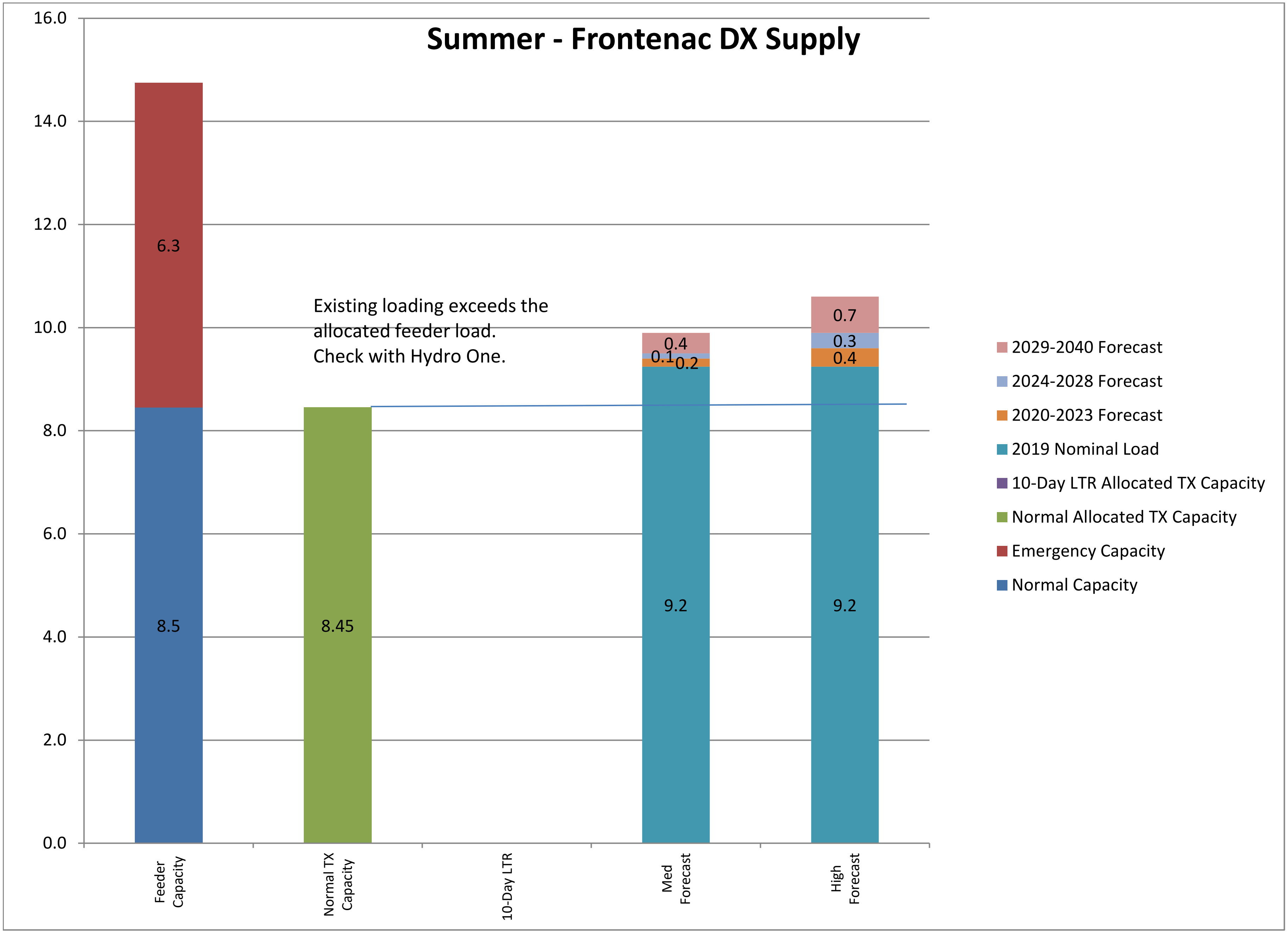
Winter - Frontenac TX Supply
140
120
100
80
60
40
20
0
64.5
64.5
74.7
58.4
54.3
1.4
1.8
4.2
54.3
3.8
4.8
11.4
1. Sufficient capacity in Normal state to meet Medium and High Forecast
2. Sufficient capacity with 1 TX O/S to meet 2028 Medium Forecast
Feeder Capacity
Normal TX Capacity
10-Day LTR
Med Forecast
High Forecast
2029-2040 Forecast
2024-2028 Forecast
2020-2023 Forecast
2019 Nominal Load
10-Day LTR Allocated TX Capacity
Normal Allocated TX Capacity
Emergency Capacity
Normal Capacity


Winter - Gardiner DESN2
50
45
40
35
30
25
20
15
10
5
0
21.5
21.5
23.3
30.4
Feeder Capacity
Normal TX Capacity
10-Day LTR
Med Forecast
High Forecast
2029-2040 Forecast
2024-2028 Forecast
2020-2023 Forecast
2019 Nominal Load
10-Day LTR Allocated TX Capacity
Normal Allocated TX Capacity
Emergency Capacity
Normal Capacity

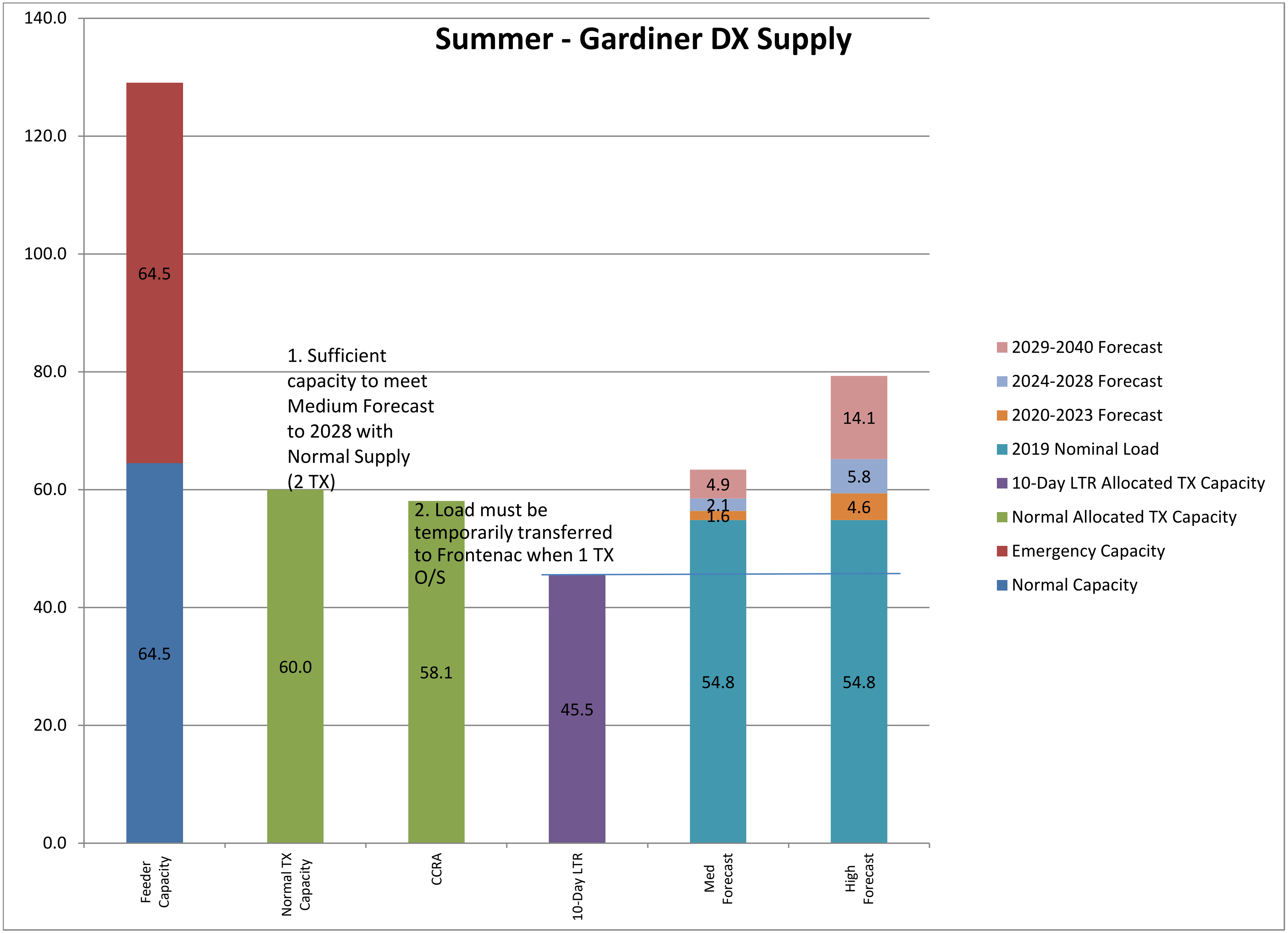

Winter - Frontenac TX & Gardiner DX Combined
300.0
250.0
200.0
150.0
100.0
50.0
0.0
129.0
129.0
1. Sufficient capacity to meet Medium Forecast to 2028
with 1 TX at Gardiner DESN1 and 2 TX at Frontenac TS
51.6
74.7
58.4
75
9.2
3.8
3.0
116.8
25.5
10.6
8.4
116.8
Feeder Capacity
1 TX O/S at Gardiner
1 TX O/S at Frontenac
Med Forecast
High Forecast
2029-2040 Forecast
2024-2028 Forecast
2020-2023 Forecast
2019 Nominal Load
10-Day LTR Allocated TX Capacity
Normal Allocated TX Capacity
Emergency Capacity
Normal Capacity

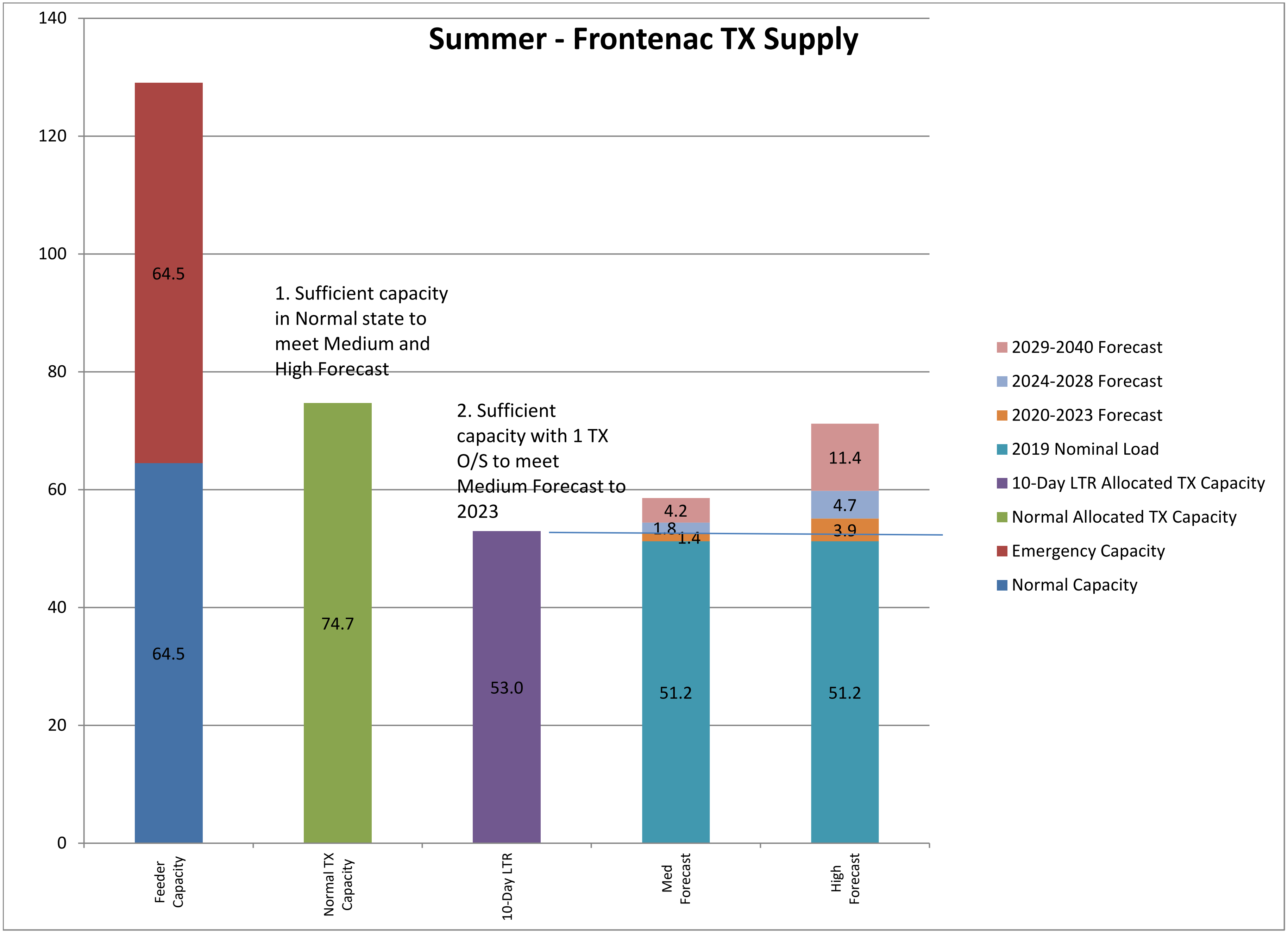


Winter - Frontenac TX & Gardiner DX & Gardiner DESN2
300.0
250.0
200.0
150.0
100.0
50.0
0.0
129.0
129.0
51.6
98.0
58.4
98.3
9.2
3.8
3.0
116.8
25.5
10.6
8.4
116.8
1. Sufficient capacity to meet Medium Forecast with 1 TX at Gardiner DESN1, 2 TX at Frontenac TS plus feeder from Gardiner DESN2
Feeder Capacity
1 TX O/S at Gardiner
1 TX O/S at Frontenac
Med Forecast
High Forecast
2029-2040 Forecast
2024-2028 Forecast
2020-2023 Forecast
2019 Nominal Load
10-Day LTR Allocated TX Capacity
Normal Allocated TX Capacity
Emergency Capacity
Normal Capacity

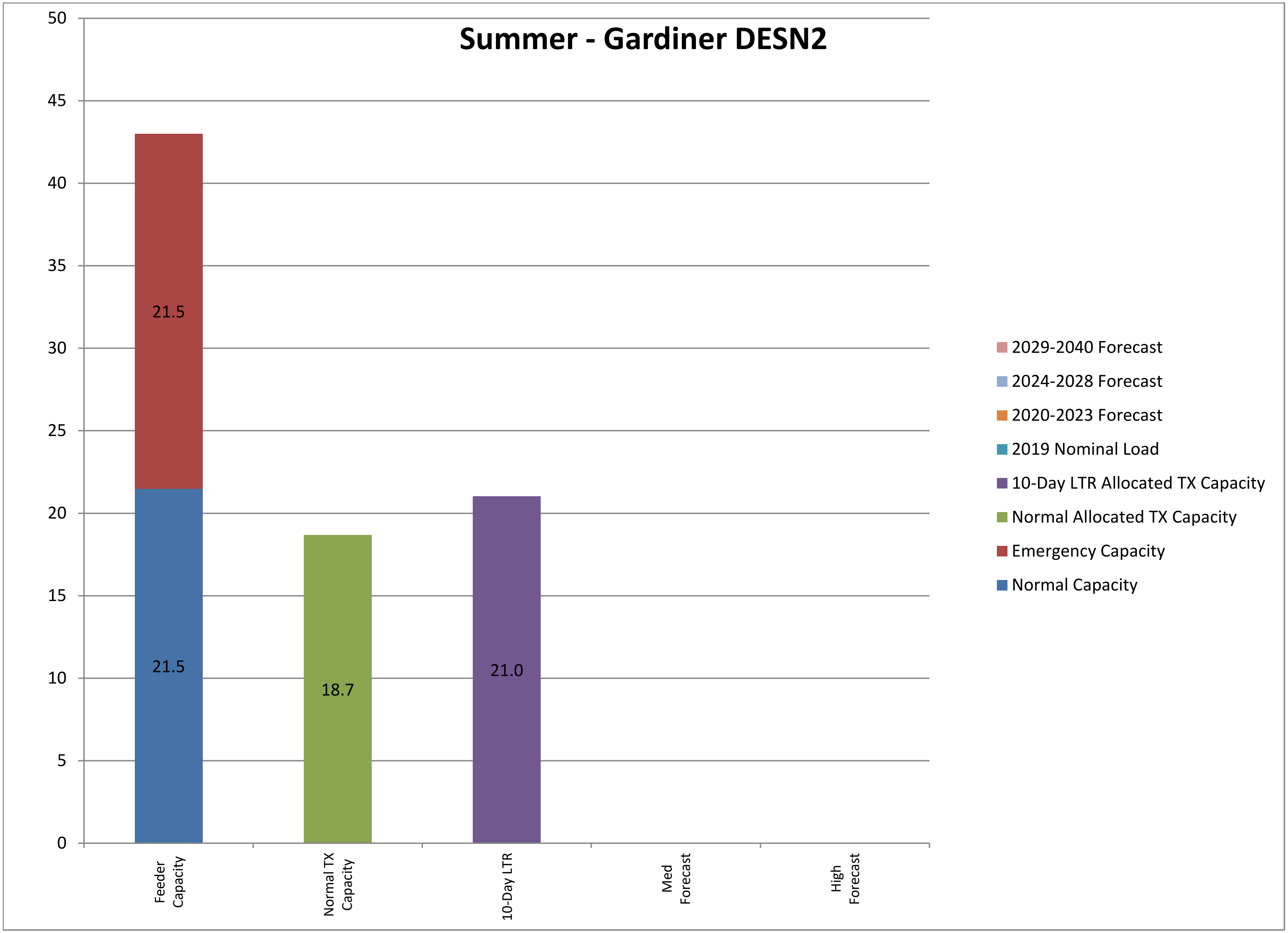


Summer - Frontenac DX Supply
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
6.3
8.5
8.45
Existing loading exceeds the
allocated feeder load.
Check with Hydro One.
0.4
0.1
0.2
9.2
0.7
0.3
0.4
9.2
Feeder Capacity
Normal TX Capacity
10-Day LTR
Med Forecast
High Forecast
2029-2040 Forecast
2024-2028 Forecast
2020-2023 Forecast
2019 Nominal Load
10-Day LTR Allocated TX Capacity
Normal Allocated TX Capacity
Emergency Capacity
Normal Capacity

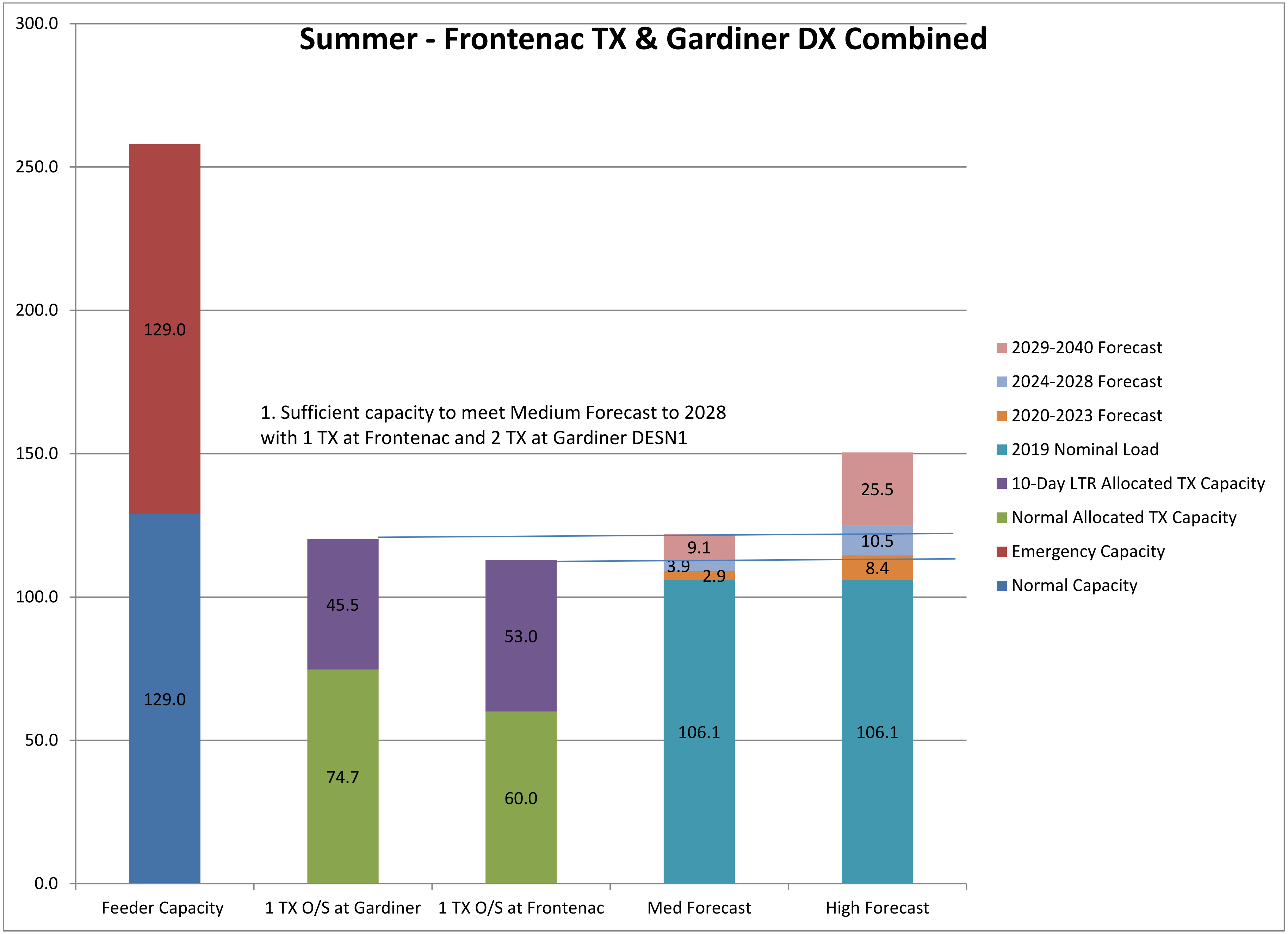

Summer - Gardiner DX Supply
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
64.5
64.5
60.0
58.1
45.5
54.8
1.6
2.1
4.9
54.8
4.6
5.8
14.1
1. Sufficient capacity to meet Medium Forecast to 2028 with Normal Supply (2 TX)
2. Load must be temporarily transferred to Frontenac when 1 TX O/S
Feeder Capacity
Normal TX Capacity
CCRA
10-Day LTR
Med Forecast
High Forecast
2029-2040 Forecast
2024-2028 Forecast
2020-2023 Forecast
2019 Nominal Load
10-Day LTR Allocated TX Capacity
Normal Allocated TX Capacity
Emergency Capacity
Normal Capacity



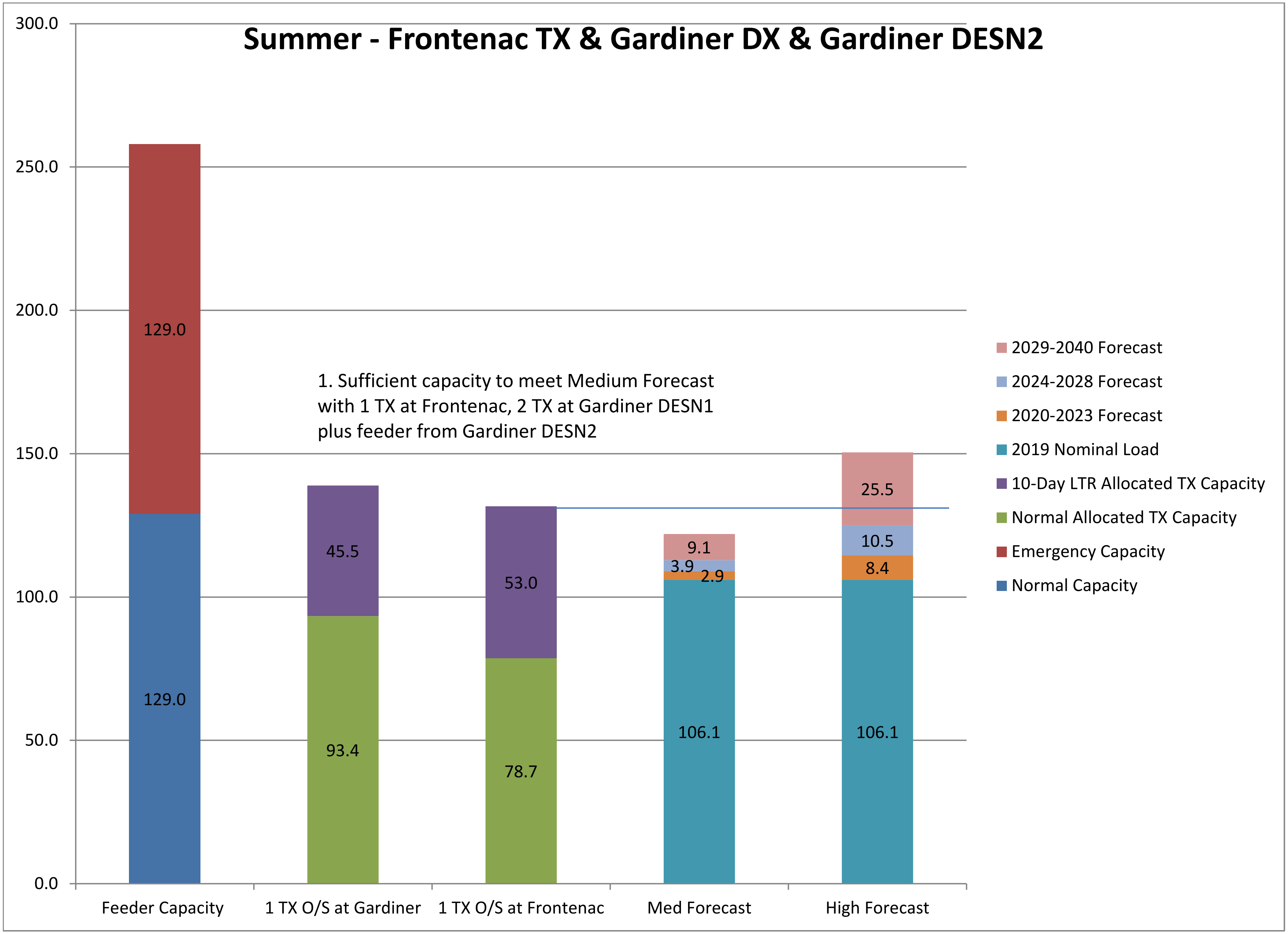
Summer - Frontenac TX Supply
140
120
100
80
60
40
20
0
64.5
64.5
1. Sufficient capacity in Normal state to meet Medium and High Forecast
74.7
2. Sufficient capacity with 1 TX O/S to meet Medium Forecast to 2023
53.0
4.2
1.8
1.4
51.2
11.4
4.7
3.9
51.2
Feeder Capacity
Normal TX Capacity
10-Day LTR
Med Forecast
High Forecast
2029-2040 Forecast
2024-2028 Forecast
2020-2023 Forecast
2019 Nominal Load
10-Day LTR Allocated TX Capacity
Normal Allocated TX Capacity
Emergency Capacity
Normal Capacity



Summer - Gardiner DESN2
50
45
40
35
30
25
20
15
10
5
0
21.5
21.5
18.7
21.0
Feeder Capacity
Normal TX Capacity
10-Day LTR
Med Forecast
High Forecast
2029-2040 Forecast
2024-2028 Forecast
2020-2023 Forecast
2019 Nominal Load
10-Day LTR Allocated TX Capacity
Normal Allocated TX Capacity
Emergency Capacity
Normal Capacity



Summer - Frontenac TX & Gardiner DX Combined
300.0
250.0
200.0
150.0
100.0
50.0
0.0
129.0
129.0
45.5
74.7
53.0
60.0
9.1
3.9
2.9
106.1
25.5
10.5
8.4
106.1
1. Sufficient capacity to meet Medium Forecast to 2028
with 1 TX at Frontenac and 2 TX at Gardiner DESN1
Feeder Capacity
1 TX O/S at Gardiner
1 TX O/S at Frontenac
Med Forecast
High Forecast
2029-2040 Forecast
2024-2028 Forecast
2020-2023 Forecast
2019 Nominal Load
10-Day LTR Allocated TX Capacity
Normal Allocated TX Capacity
Emergency Capacity
Normal Capacity


Summer - Frontenac TX & Gardiner DX & Gardiner DESN2
300.0
250.0
200.0
150.0
100.0
50.0
0.0
129.0
129.0
45.5
93.4
53.0
78.7
9.1
3.9
2.9
106.1
25.5
10.5
8.4
106.1
1. Sufficient capacity to meet Medium Forecast with 1 TX at Frontenac, 2 TX at Gardiner DESN1 plus feeder from Gardiner DESN2
Feeder Capacity
1 TX O/S at Gardiner
1 TX O/S at Frontenac
Med Forecast
High Forecast
2029-2040 Forecast
2024-2028 Forecast
2020-2023 Forecast
2019 Nominal Load
10-Day LTR Allocated TX Capacity
Normal Allocated TX Capacity
Emergency Capacity
Normal Capacity

Response to Ontario Energy Board (OEB)

Interrogatory #1-Staff-26 (a)

Attachment 2 of 3

(Memo: 2009-2019 Electric System Loading Trends)

Memorandum

To: File (K00_07_18 - 2017 Master Plan Update)

From: Tom Brackenbury, P.Eng., Utilities Engineer

Date: November 7, 2019

Subject: 2009-2019 Electric System Loading Trends

Cc: Chris Phippen, P.Eng., Manager, Utilities Engineering

Jim Miller, Director, Utilities Engineering

Purpose

The purpose of this memo is to summarize the 2009-2019 loading trends for the Kingston Hydro 44kV Distribution system.

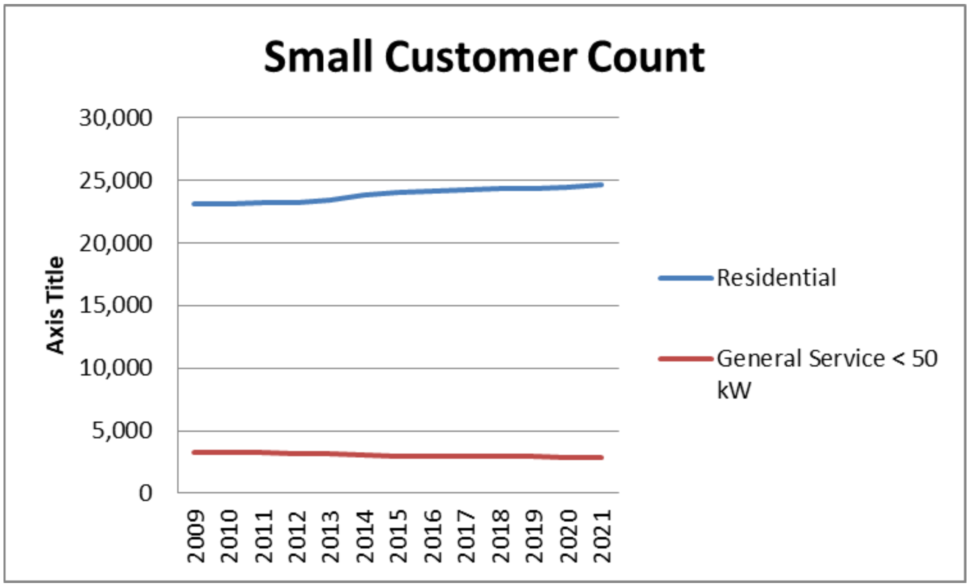
The table below summarizes the Hydro One Stations and Feeders that supply Kingston Hydro's 44kV distribution system:

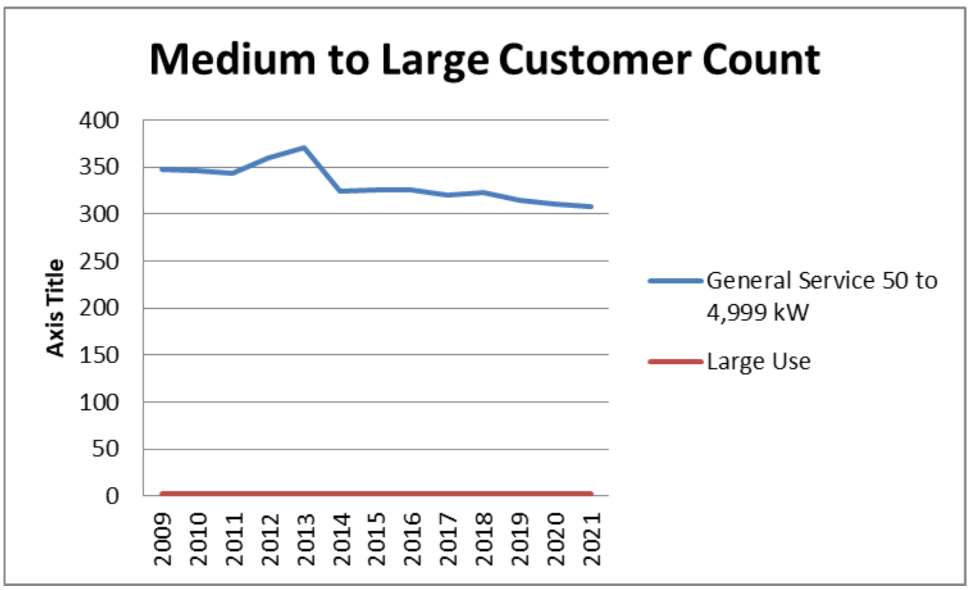
Hydro One Station	Settlement Type	Hydro One Feeders
Frontenac	Transmission	M2, M4, M5
Gardiner	Distribution	M7, M9, M12
Frontenac	Distribution	M3

Historic and Forecast Customer Count

- Customer count has been relatively stable since 2009 and the latest forecast predicts this trend will continue to 2021. Generally speaking, Residential customer count is increasing by less than 1% per year while GS<50kW and GS>50kW are decreasing by 1% per year

Subject: 2009-2019 Electric System Loading Trends

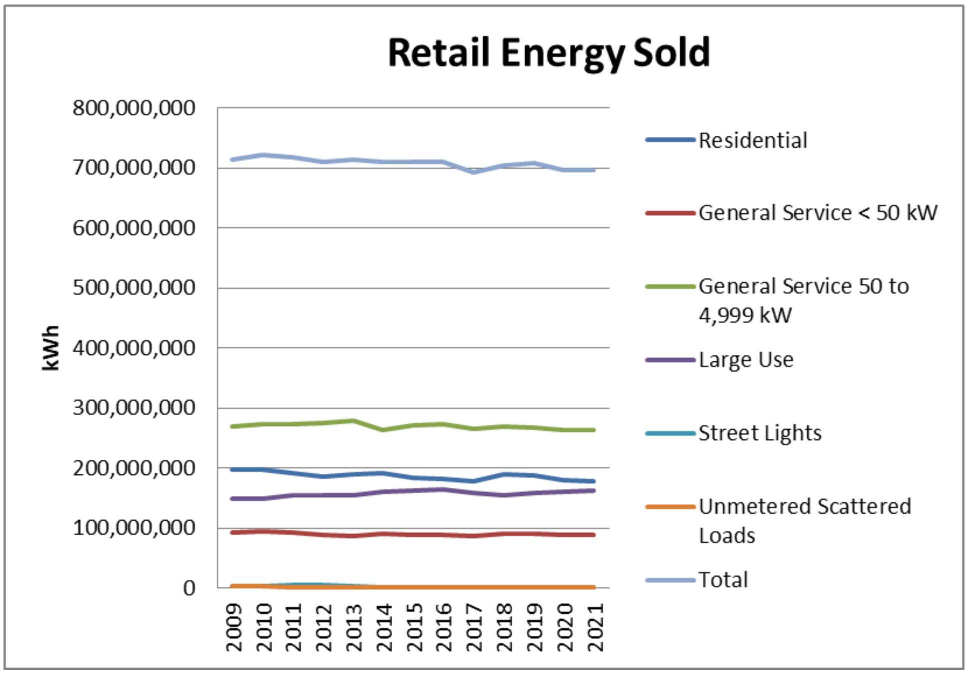


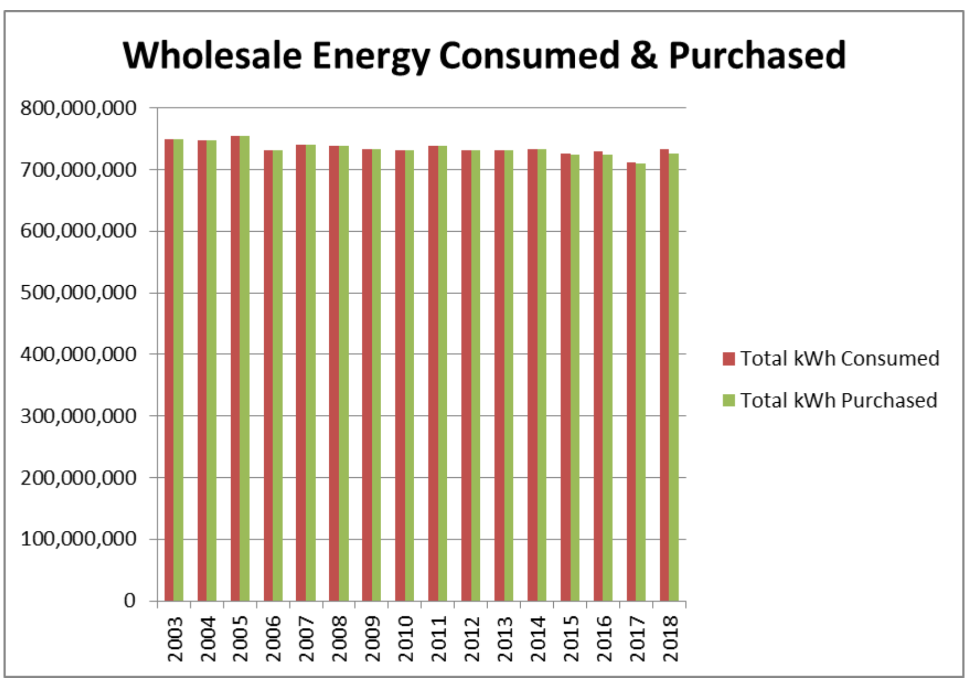


Subject: 2009-2019 Electric System Loading Trends

Annual Retail and Wholesale Energy

- Annual retail energy sold to customers has essentially flat-lined since 2009 and is expected to continue to 2021. Similarly, the total wholesale energy purchased from the IESO and the total energy consumed by customers (IESO plus Load Displacement Generation) has essentially flat-lined over the past 15 years.

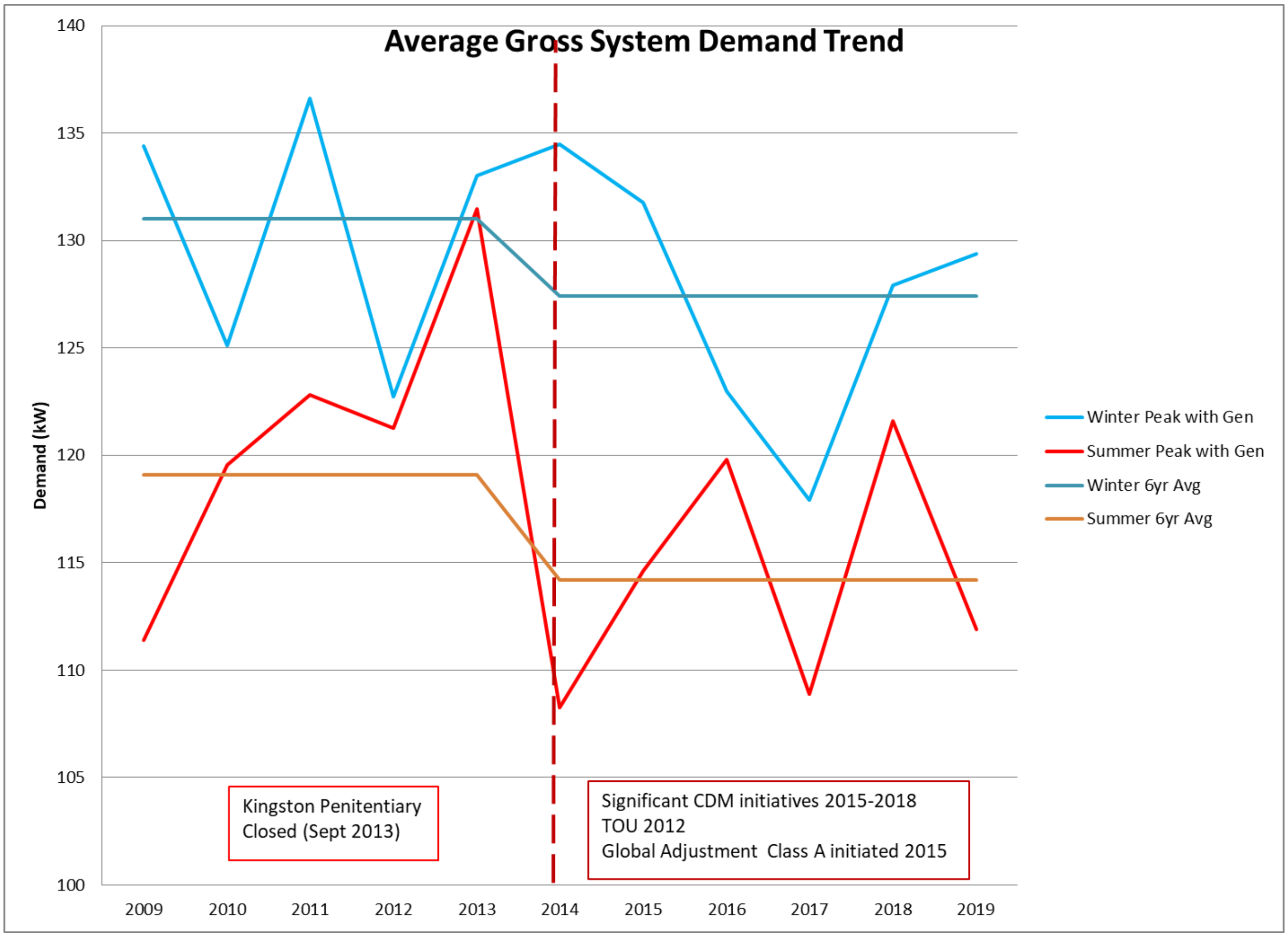




Subject: 2009-2019 Electric System Loading Trends

Annual System Demand

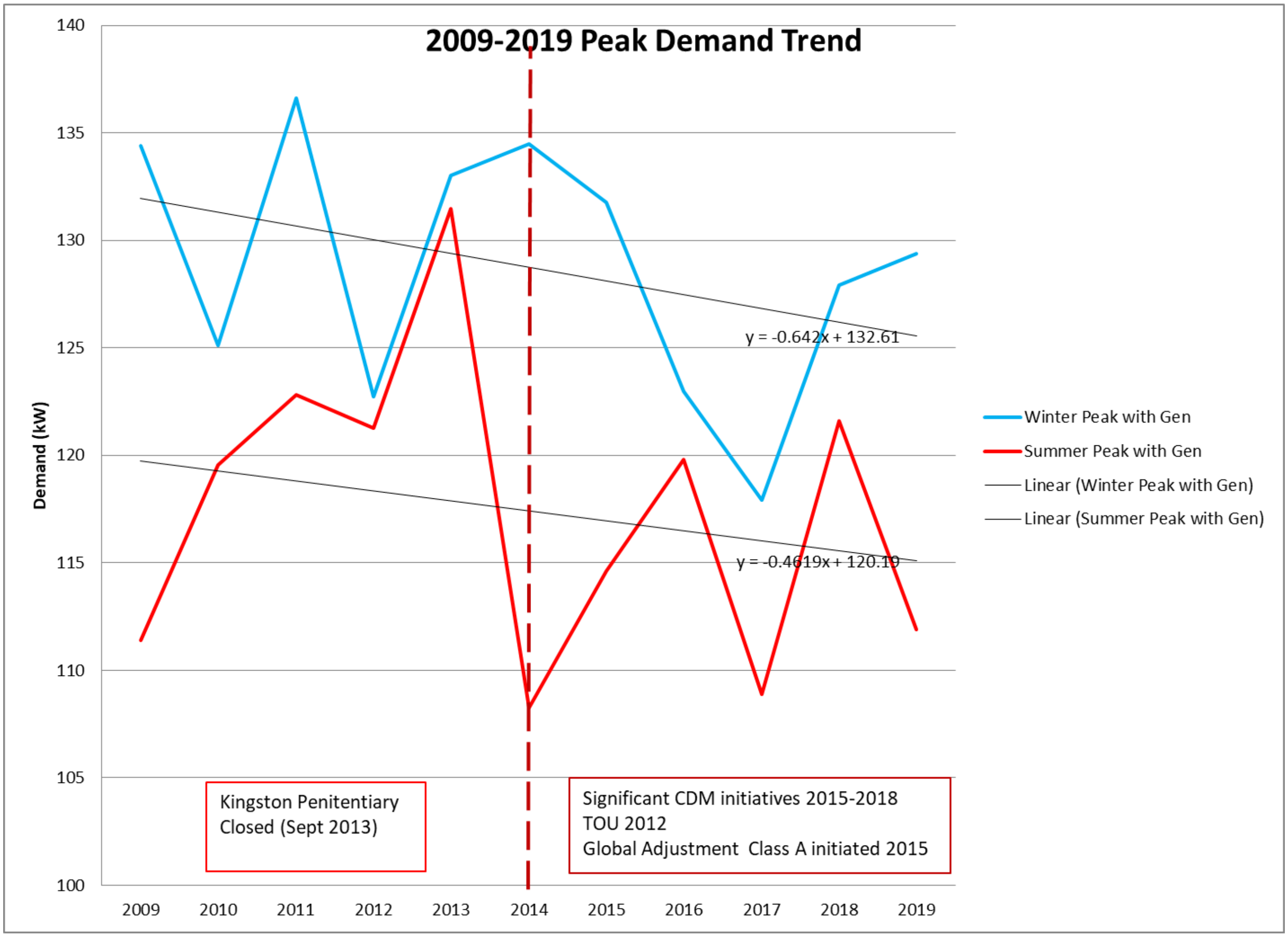
- The average gross system demand (IESO plus embedded generation) trend is as follows:
  - Winter dropped from 131MW (2009-2014) to 127MW (2014-2019)
  - Summer dropped from 119MW (2009-2014) to 114MW (2014-2019)



  - The average baseline winter demand for 2016-2019 was 124.1MW
  - The average baseline summer demand for 2016-2019 was 115.3MW.
  - The average baseline demand for 2016-2019 will be used as the starting point for the 2020-2040 Forecast

Subject: 2009-2019 Electric System Loading Trends

Over the past 11 year period (2009-2019), the annual peak demand had the

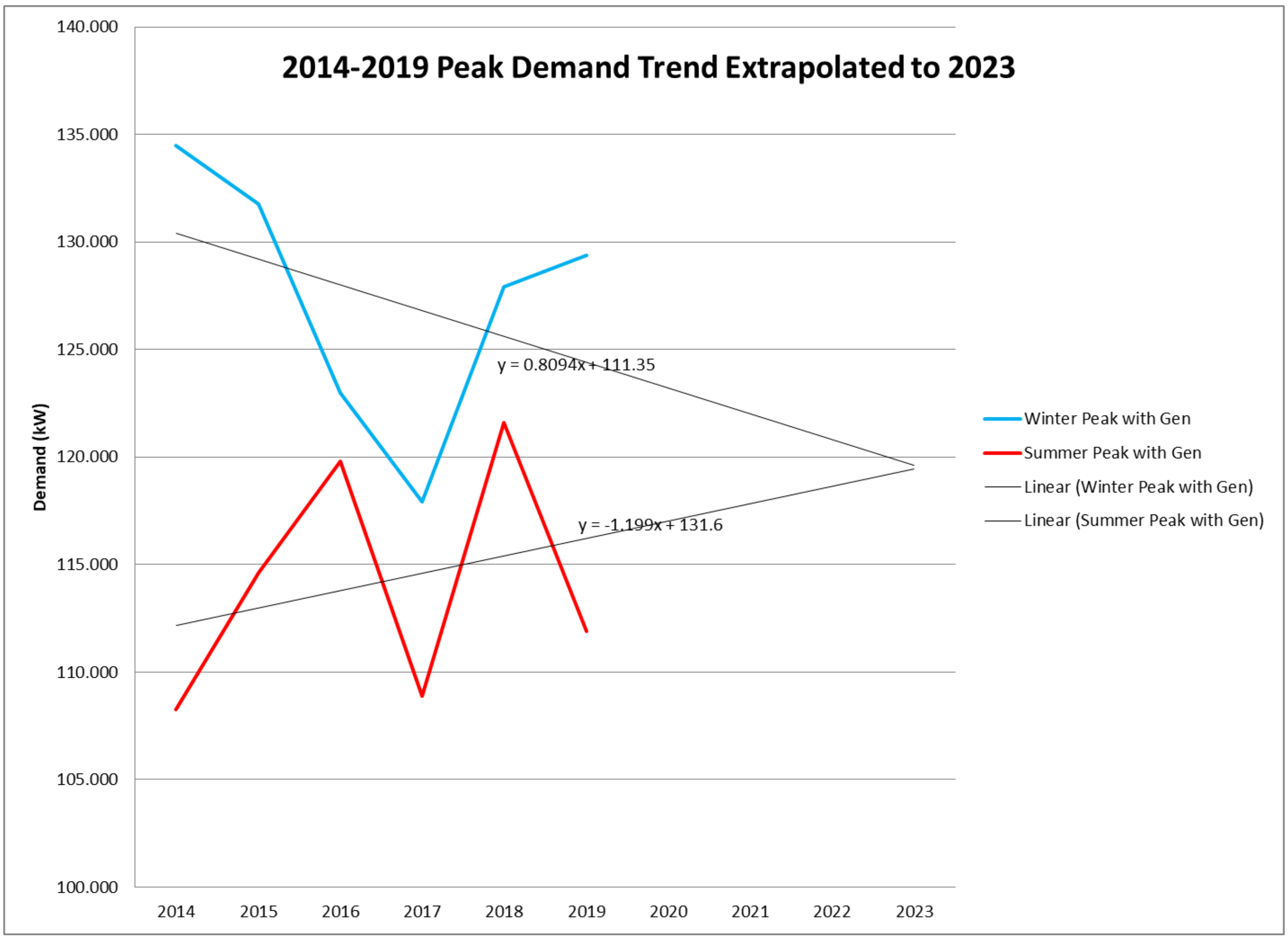


following trend:

- Winter – decreasing at 0.64MW/year
- Summer – decreasing at 0.46MW/year
- The declining summer and winter peak trends for this period suggest that Kingston Hydro will remain a winter peaking utility in the near to medium term

Subject: 2009-2019 Electric System Loading Trends

- Over the past 6 year period (2014-2019), the annual peak demand had the following trend:
  - Summer – increasing at 1.20MW/year
  - Winter – decreasing 0.81MW/year
  - The summer and winter trends for this period suggest that the annual Kingston Hydro system peak will shift from a winter to summer peaking utility around 2023



- The historic summer system demand for 2009-2019 tends to vary as much as +/- 10.9% relative to the nominal historic demand trend. This fluctuation is due to many factors including the annual variation in Cooling Degree Days (CDD), CDM and DR initiatives.
- The historic winter demand for 2009-2019 tends to vary as much as +/- 5.6% relative to the nominal historic demand trend. This fluctuation is due to many factors including the annual variation in Heating Degree Days (HDD), CDM and DR initiatives.
- The following tables summarize Kingston Hydro's historic coincident peak gross system load aggregated by the three Hydro One delivery points:

SUMMER 2016-2019 System Peak and Coincident Station Loading

Hydro One Station	Settlement Type	Feeder ID	Type	2016	2017	2018	2019
Gardiner TS	Dx	33M7 33M9 33M12	Load	38.9	50.2	65.3	53.9
			DG	0.2	0.4	0.3	0.4
			CDM	0.0	0.0	0.0	0.0
Frontenac TS	Dx	3M3	Load	9.2	8.7	9.5	9.0
			DG	0.0	0.0	0.0	0.0
			CDM	0.0	0.0	0.0	0.0
Frontenac TS	Tx	3M2 3M4 3M5	Load	58.7	47.4	34.0	36.5
			DG	12.1	2.2	12.4	12.0
			CDM	0.0	0.0	0.0	0.0
			Total	119.1	108.9	121.6	111.9

Hydro One Station	Settlement Type	Feeder ID	Average % of System Peak
Gardiner TS	DX	33M7 33M9 33M12	47.5%
Frontenac TS	DX	3M3	8.0%
Frontenac TS	TX	3M2 3M4 3M5	44.4%

Subject: 2009-2019 Electric System Loading Trends

Winter 2016-2019 System Peak and Coincident Station Loading

Hydro One Station	Settlement Type	Feeder ID	Type	2016	2017	2018	2019
Gardiner TS	Dx	33M7 33M9 33M12	Load	44.8	61.9	63.9	62.8
			DG	0.0	0.0	0.0	0.1
			CDM	0.0	0.0	0.0	0.0
Frontenac TS	Dx	3M3	Load	7.1	6.8	7.1	8.1
			DG	0.0	0.0	0.0	0.0
			CDM	0.0	0.0	0.0	0.0
Frontenac TS	Tx	3M2 3M4 3M5	Load	69.6	49.0	45.4	51.3
			DG	0.0	0.0	11.5	7.0
			CDM	0.0	0.0	0.0	0.0
			Total	121.6	117.7	127.9	129.4

Hydro One Station	Settlement Type	Feeder ID	Average % of System Peak
Gardiner TS	DX	33M7 33M9 33M12	50.3%
Frontenac TS	DX	3M3	5.9%
Frontenac TS	TX	3M2 3M4 3M5	43.8%

- The figures highlighted in yellow represent abnormal load transfers between the Gardiner M12 and Frontenac M2 that contributed to a Facility loading variance of approximately 15 to 20MW

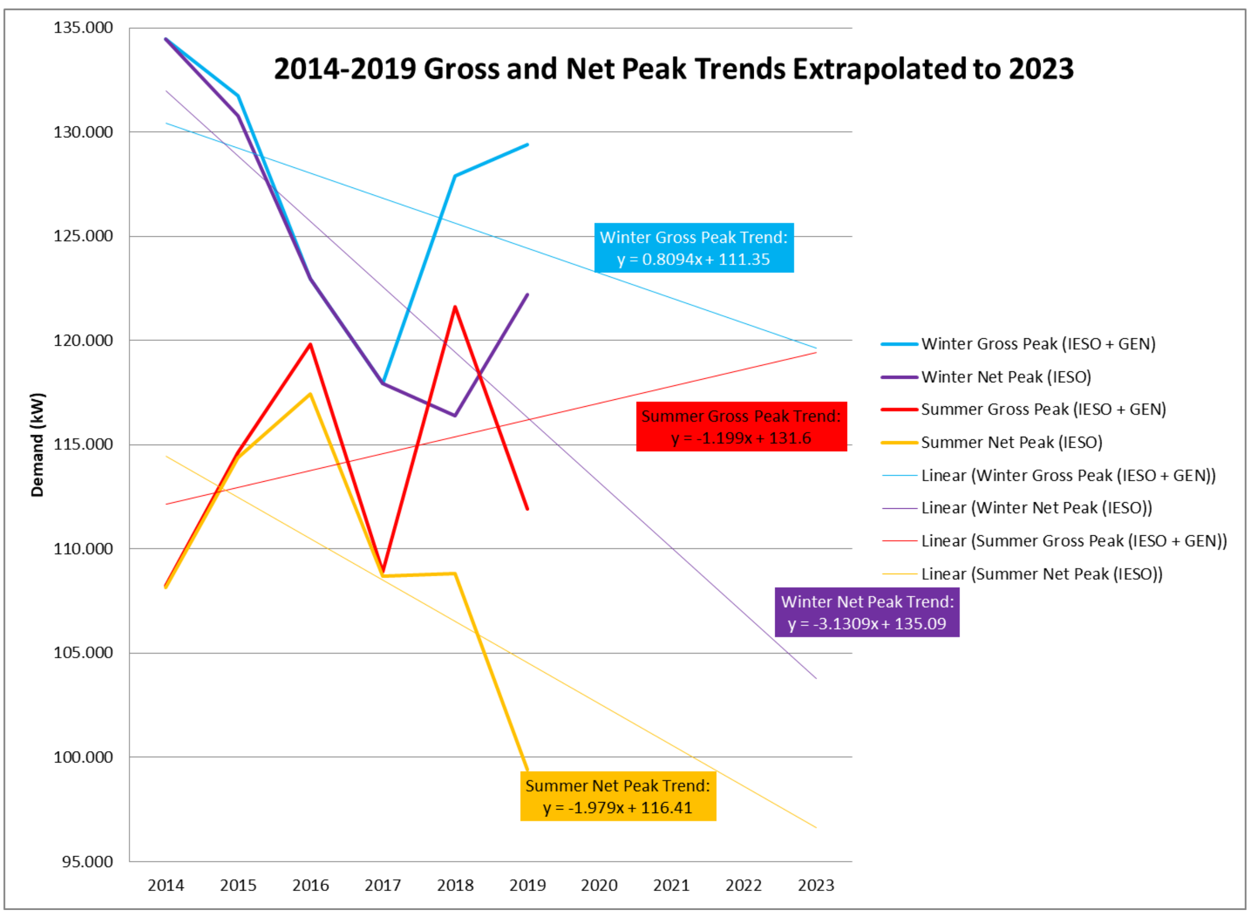
Subject: 2009-2019 Electric System Loading Trends

2016-2019 Relationship between Non-Coincident and Coincident Demand

It's difficult to accurately assess the relationship between Non-Coincident demand (e.g. a Feeder or a Station) and Coincident demand on peak loading days without knowing the exact state of the system for the entire day (e.g. constant normal state or intermittent abnormal load transfers). However, staff estimate the ratio of Coincident to Non-Coincident demand is between 91% and 95%. In other words, the non-coincident peak demand of a feeder or station may be 5% to 10% higher than its coincident demand with the aggregate system peak.

2014-2019 Gross and Net Peak Demand Trends

The net system peak demand has declined since 2014. This is mainly attributed to DR and load displacement generation initiatives to reduce GA charges. The challenge is that GA charges are set by the IESO and depend upon the timing of provincial peak demand use. Therefore, LDCs do not currently have the ability to influence the hourly spot market price of energy or to develop a TOU distribution charge to incentivize customers to shift their peak usage or shave their peak with DER to benefit the local distribution system.

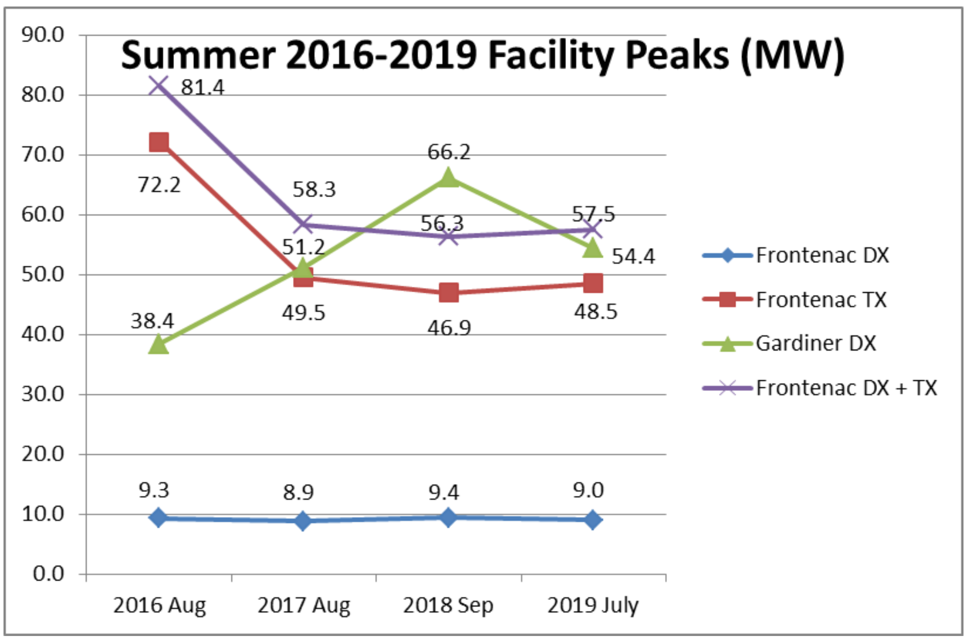


Subject: 2009-2019 Electric System Loading Trends

<u>2016-2019 Aggregate Trends of Facility Supply Points</u>

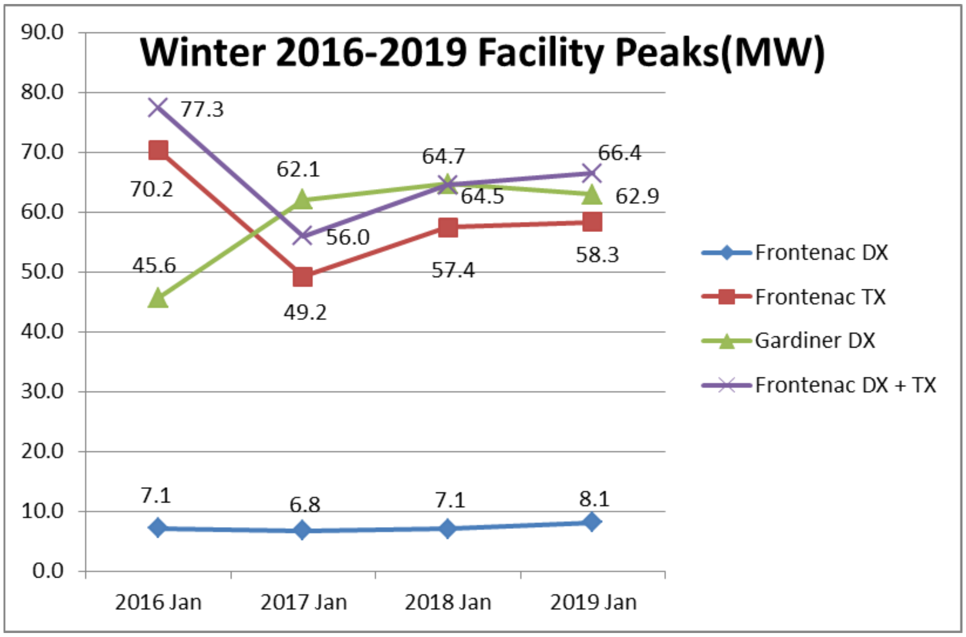
The peak aggregate Summer demand has:

- decreased for the Frontenac TX supply (Feeders M2, M4, M5),
- increased for the Gardiner DX supply (Feeders M7, M9, M12) and
- remained relatively stable for the Frontenac DX supply (Feeder M3).



The peak aggregate Winter demand has:

- decreased for the Frontenac TX supply (Feeders M2, M4, M5),
- increased for the Gardiner DX supply (Feeders M7, M9, M12) and
- increased slightly for the Frontenac DX supply (Feeder M3).



Suggested Discussion Points with IESO/Hydro One for the Upcoming Regional Plan

The following points should be discussed at the upcoming Regional Planning meetings:

1. Frontenac & Gardiner TS peak loading data:

    a. What are the historic dates/times of the annual summer and winter peaks for the Gardiner and Frontenac TS facility?

    b. What is the coincident load of each Kingston Hydro supply point at the date/time of the annual facility peaks?

    c. Did any abnormal operating conditions occur (e.g. load transfers between Frontenac and Gardiner TS) at the time of the annual facility peak?

References:

1. **File: Peak data.xlsx** Folder: X:\Kingston Hydro 2021 Custom IR\Ch5 DSP\Regional Plan\1_Prelim Load Forecast\Historic Data

2. **File: Historic Demand Energy updated 2019-10-31.xls**
   Folder: N:\K_Electric\K00_General\K00_07 Planning\K00_07_18 2017 44kV Master Plan Update

Response to Ontario Energy Board (OEB)

Interrogatory #1-Staff-26 (a)

Attachment 3 of 3

(Memo: 5kV Electric Master Plan - Update)

Utilities Kingston

Memorandum

To: File (K00_07_19 - 2018 Master Plan Update)

From: Tom Brackenbury, P.Eng., Utilities Engineer

Date: June 3, 2020

Subject: 5kV Electric Master Plan – Update

Cc: Jim Miller, Director, Utilities Engineering

Scott Neilson, Manager, Hydro Business & Services

Operations Centre Staff, Hydro & UK Engineering Staff involved with planning Electric Capital projects

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Purpose

To provide an update on emerging load growth trends and capacity needs due to intensification and decarbonization.

Background

In recent years, City Planning has conducted intensification potential for the following study areas of Kingston:

1. Williamsville
2. North Block
3. North King's Town
4. Central Kingston Growth Strategy (CKGS)

The incremental electrical load growth associated with "Ultimate Development Intensification" scenarios was developed for each study area based on planning bylaws (e.g. max. square footage, # of stories, etc.). All studies include basic estimates of incremental residential unit load growth. Some studies also include estimates of incremental Industrial/Commercial/Institutional (ICI) load growth. The North King's Town and CKGS studies also attempt to estimate the incremental load growth due to residential EV chargers.

Ultimate Load Predictions

Table 1 summarizes the total estimated incremental load (coincident system peak) which is estimated to be approximately 60% of the ultimate connected load calculated by each study.

Subject: 2017 Electric Master Plan Update

Table 1 – Incremental Load Summary by Study Area

	Max # of Residential Units				Inc. Load (kW)		
	Short Term	Mid Term	Long Term	Total units	Res.	ICI	Total
North Block	NA	NA	NA	NA	NA	NA	3,720
North King's Town	NA	NA	NA	4,786	7,658	3,300	10,958
Williamsville*	*	*	3,000	3,000	4,800	NA	4,800
CKGS**	1,289	2,835	3,905	8,029	12,847	NA	12,847
NOTES:					25,305	3,300	32,325

NA - Not Available

* Short/Mid Term growth in Williamsville will be suppled from existing 5kV dist.

**Max # of Residential Units for CKGS based on High Density Scenario

The incremental load predictions in Table 1 do not include aggressive carbon reduction measures such as large scale electrification of transportation (e.g. transit, corporate fleets, etc.) or electrification of heating. Evolving government policies are currently proposing targets for 2040 and 2050. Preliminary assessments by UK staff suggest that electrification could increase Kingston Hydro's current energy consumption by a factor of 2 or 3.

Feeder Capacity vs. Distribution Voltage

The typical feeder capacities are summarized below in Table 2 for various operating voltages.

Table 2 – Typical Feeder Capacities

		Normal		Emergency		Comparison
Voltage Class kV	Operating Voltage kV	Max Rated Amps	Max Rated kVA	Max Rated Amps	Max Rated kVA	Multiples of 5kV Capacity
5	4.16	210	1,500	420	3,000	1.0
15	13.8	210	5,000	420	10,000	3.3
28	27.6	210	10,000	420	20,000	6.7
46	44	210	16,000	420	32,000	10.7

*NOTES:

Capacities based on 336ASC Overhead and 500MCM Cu Underground

Grounding at 44kV is more onerous compared to 27.6kV or less

Table 3 was developed using the total incremental load from Table 1 and the normal feeder capacities from Table 2 were used to estimate the number of incremental feeders required to service the new development contemplated for the four study areas.

Subject: 2017 Electric Master Plan Update

Table 3 – # of Incremental Feeders for various Distribution Voltages

	Total Inc. Load (kW)	# of Incremental Feeders 4.16kV	13.8kV	27.6kV	44kV
North Block	3,720	2	1	0.4	0.2
North King's Town	10,958	7	2	1	1
Williamsville	4,800	3	1	0.5	0.3
CKGS	12,847	9	3	1	1
Total	32,325	22	6	3	2

Typical Substation Transformer Sizes

Typical substation transformer sizes are summarized in Table 4 below.

Table 4 – Typical Substation Transformer Sizes

Primary (kV)	Secondary (kV)	TX Size (kVA)	# of Feeders	Normal Feeder Loading (Amps)	Normal Station Loading (kVA)
44	4.16	10000	4	210	6045
44	13.8	8000	1	210	5014
44	27.6	16000	1	210	10027

Table 5 - # of Incremental Substation Transformers

	Total Inc. Load	# of Substation Transformers 4.16kV	13.8kV	27.6kV
North Block	3,720	0.6	0.7	0.4
North King's Town	10,958	2	2	1
Williamsville	4,800	1	1	0
CKGS	12,847	2	3	1
Total	32,325	5	6	3

Subject: 2017 Electric Master Plan Update

Maximum Distribution Transformer Size vs. Distribution Voltage

Table 6 summarizes acceptable distribution transformer sizes based on Table 11 of CSA C227.4 (3 phase pad-mount transformers)

Table 6 – Typical Distribution Transformer Sizes

	Standard Transformer Size(kVA) available @ Voltage(kV)?		
kVA \ kV*	4.16	13.8	27.6
75	Yes	Yes	Yes
150	Yes	Yes	Yes
225	Yes	Yes	Yes
300	Yes	Yes	Yes
500	Yes	Yes	Yes
750	Yes	Yes	Yes
1000	No	Yes	Yes
1500	No	Yes	Yes
2000	No	Yes	Yes
2500	No	Yes	Yes

*specified kV is Line-Line voltage

The transformer sizes and quantities that may be required to service the ultimate contemplated development of the CKGS study area are summarized in Table 7 below.

Table 7 - Transformer Sizes and Quantities Identified by CKGS Study

TX Size (kVA)	Quantity
250	7
500	11
750	14
1000	11
1500	3
2000	4

Based on the above information, Kingston Hydro could facilitate development intensification of the CKGS study area through a voltage conversion to 13.8kV or 27.6kV and by increaseing the maximum allowable transformer size in the Conditions of Service to 2500kVA.

Voltage Conversion Considerations

The following issues should be considered before undertaking a voltage conversion:

1. Facilitation of New Development

    a. Kingston Hydro's existing 44kV and 4.16kV distribution voltages are not compatible with the development intensification that is being contemplated by City Planning or the decarbonization policies that are being contemplated by all levels of government (Federal, Provincial and Municipal)

    b. A 13.8kV or 27.6kV distribution voltage can accommodate pad mount transformers up to 2500kVA in size.

    c. Hydro One has adopted 28kV construction standards for all new construction in Kingston. Most of Hydro One's distribution throughout Kingston still operates at the legacy 8.32kV however, Hydro One supplies some new distribution networks in the East end of Kingston at 27.6kV (e.g. St. Lawrence Business Park and various high rise developments along Highway 15). The City may prefer both Kingston Hydro and Hydro One to adopt 27.6kV as a common distribution voltage throughout greater Kingston moving forward.

    d. For the CKGS study, the intensification study suggests that 6 amalgamated block developments may require transformers rated between 1000kVA and 2500kVA.

    e. The 44kV sub-transmission voltage is not ideal for an urban setting and was primarily intended for rural areas where bulk power transfer over large distances is required. 44kV stations can be very onerous in an urban setting due to the complexity of grounding, increased real estate demands of distribution equipment as well as higher installation and operating costs compared to the 28kV or less distribution voltage classes.

2. Overhead Distribution - Insulation Class and Clearances

    a. Low cost per pole to convert from 5kV to 15kV as most new construction has been built with 15kV clearances and insulators since 2005 or earlier

    b. Higher cost per pole to convert from 5kV to 28kV due to need to upgrade more poles to achieve 28kV clearances and install 28kV insulators

    c. Pole transformers need to be upgraded to new voltage rating and can be replaced with dual voltage transformers in advance of the official "cut-over". Dual voltage transformers are about 10% more costly than a standard transformer. A planned outage is required on the "cut-over" day to switch taps on dual voltage transformers and re-fuse transformers.

3. Underground Distribution – Insulation Class and Underground Structures

    a. Low cost per cable to convert from 5kV to 15kV as most cables installed since 2005 are 15kV rated and we can likely reuse more of the existing duct structures.

    b. Higher cost per cable to convert from 5kV to 28kV since 28kV cables have larger diameter than 15kV cables and will likely require new ducts to be installed.

    c. Pad transformers need to be upgraded to new voltage rating and can be replaced with dual voltage transformers in advance of the official “cut-over”. Dual voltage transformers are about 10% more costly than a standard transformer. A planned outage is required on the “cut-over” day to switch taps on dual voltage transformers and re-fuse transformers.

    d. Switchgear rated 600Amps @ 15kV has similar dimensions compared to existing 5kV gear which means most existing 5kV underground structures could be used for 15kV distribution equipment.

    e. Switchgear rated 600Amps @28kV has larger dimensions compared to existing 5kV gear which means most existing 5kV underground structures would need to be upgraded for 28kV distribution equipment.

    f. Depending on proximity of new development to a new 15kV or 28kV substation, it may be more cost-effective to install a 200Amp looped branch feeder instead of a 400/600Amp main feeder which could greatly reduce expansion costs.

4. Conversion Strategy

    a. There are many ways to implement a voltage conversion. However, it may make most sense to introduce new voltage(s) wherever new development intensification is contemplated such as the CKGS study area.

5. Short Term Financing vs. Long Term Savings

    a. The increase in short term financing costs to undertake a voltage conversion would have to be justified by long term savings

6. Future Transformer Station

    a. A moratorium should be placed on expansion of the 44kV distribution system in the greater Kingston area and the next Transformer Station built in Kingston to service incremental load should operate at 27.6kV. This would eventually eliminate the need for Kingston Hydro to build and maintain new 44kV substations since Kingston Hydro could service all customers from 27.6kV distribution system.

7. Work Practices and Personal Protective Equipment

    a. A voltage conversion would trigger the need to review and update work practices and personal protective equipment due to the higher voltage.

8. Reliability

    a.

9. Reduced System Losses

    a. In theory, system losses would be reduced as follows:

        i. 13.8kV losses would be less than 10% of 4.16kV losses

        ii. 27.6kV losses would be less than 3% of 4.16kV losses

    b. The annual reduction in system losses could help to fund a voltage conversion.

10. Miscellaneous Benefits

    a. Adopting a higher distribution voltage such as 13.8kV and 27.6kV will result in fewer substations, feeders and P&C to maintain

    b. Fewer substations will reduce land requirements

    c. Fewer feeders will simplify feeder egress from substations and reduce feeder congestion in the right-of-way.

Non-Wires Solutions

1. Energy Storage

    a. On its own, energy storage has the potential to defer investments in new feeders and/or substations but will not be able to meet the total load growth of the ultimate development contemplated by City Planning. Installation and maintenance costs of energy storage are currently evolving.

2. Renewable Generation

    a. Renewable generation combined with energy storage is a reliable energy source that could be used to meet some of the future capacity needs of Kingston Hydro, however, there may not be many sites within the Kingston Hydro distribution territory for large scale implementation of renewable generation and energy storage. As a result, Kingston Hydro may need to pursue a distributed approach involving many small generation sources located throughout the City and develop a means to dispatch the generation at the local district or neighbourhood level.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-27

Asset Management Process

Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1 pages 96-97, 176

Preamble:

Kingston Hydro states that potential Capital Projects are considered and evaluated against how they satisfy identified Asset Management Objectives and other factors. Kingston Hydro state they use both qualitative and objective criteria to its decision making.

Question(s):

a) What are the qualitative criteria used in the decision making?
b) What are the subjective criteria used in the decision making?
c) Are any quantitative criteria used in the decision making?
d) Are all criteria weighted equally in terms of decision making outcomes?
e) Please provide examples of the criteria and priority ranking decision for the top 5 ranked projects.
f) Has Kingston Hydro investigated quantitative methods to determine Risk of deferral and Project Value for its proposed capital investments?

Response

a) The qualitative criteria used in the decision making is based on the Subject Matter Expert (SME) knowledge of Hydro and Engineering staff. For example, qualitative criteria, based on the SME's experience and knowledge, is used in determining the correct health indice category used in evaluating the condition of wooden poles. The risk of a deferral of a project is also undertaken within a qualitative assessment by experienced staff.

b) Subjective criteria used in the prioritization and selection of projects would include criticality, risk, customer input.

c) The quantitative criteria used in the decision making varies and includes but is not limited to consideration of Asset Condition Assessment (ACA) data from the Kinectrics report and high level cost estimates of alternatives and options.

d) The weighting of qualitative, objective and quantitative criteria varies with each asset depending upon the information available and knowledge of the asset. For major assets such as Substation Transformers, staff value/weight the quantitative ACA results heavily since the methodology is mature and based on trending of annual oil analysis and maintenance records. For more common assets such as poles, staff give less value/weight to the quantitative ACA results because the inspection and ACA methodology is still evolving and not mature yet.

e) The ranking of programs/projects summarized in Table 5.4-8 of the DSP is only one of the many factors used to establish the annual capital budgets. As described in the responses to part a through d above, the process depends heavily on SME knowledge. As noted in the DSP, the assessment of assets being considered for inclusion in our capital plans and the criteria used in the ranking of the top 5 priorities would include regulatory requirements, ACA results, available budget, risk, number and type of customers affected if we do nothing, redundancy, parts and equipment availability and safety.

f) No, Kingston Hydro has not formally investigated quantitative methods to determine Risk of deferral and Project Value for its proposed capital investments. However Kingston Hydro staff have reviewed some systems used in enterprise risk management and other risk evaluation methodologies. Further work in quantitative methods to determine risk of deferral is being considered.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-28</u>

Asset Management Process
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1 pages 98, 173

Preamble:

Kingston Hydro states that it undertakes regular, planned inspection and maintenance programs in accordance with regulatory requirements and good practices. One-third of system poles are inspected annually.

Question(s):

a) What pole tests are done in conjunction with the annual inspection program?

<u>Response</u>

a) Pole tests consist mainly of visual inspections and a hammer test by competent hydro staff. We also use a Polux device selectively to validate hammer test results.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-29

Climate Change Adaptation
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, pages 18, 81, 102, 103

Preamble:

Kingston Hydro states that a Strategic Planning exercise was undertaken by the Utilities Kingston Board in November 2020. One of the items supported by the 2021 Work Plan was Climate Action.

Kingston Hydro has indicated that climate change is expected to result in hotter summers and an increase in annual freezing rain and extreme wind events. Kingston Hydro has not identified any specific projects related to climate change adaptation and is monitoring the situation. With respect to vegetation management, Kingston Hydro states that it follows a three-year pruning cycle and follows clearances as established in the Electrical and Utilities Safety Association Line Clearing Operations Safe Practice Guide 2008.

Question(s):

a) What were the specific Climate Action items proposed in the 2021 Work
b) How are these Climate Action items reflected in the 2023-2027 DSP?
c) Has Kingston Hydro determined what the impact of increased freezing rain and extreme weather events will have on its distribution system?

d) Is Kingston Hydro reviewing or plans to review its overhead construction standards and vegetation management programs with respect to system hardening and resiliency in the face of increasing freezing rain and severe weather events?

e) Does Kingston Hydro perform any additional out-of-cycle vegetation management for faster growing tree species that the 3-year cycle cannot accommodate?

Response

a) The Utilities Kingston 2021 Work Plan included the following Climate Action theme:

> *The Municipality of the City of Kingston has declared a climate emergency. Utilities Kingston will plan for a changing environment and determine how we might reduce the greenhouse gas emissions that are a by-product of delivering utility services.*

However, the Utilities Kingston 2021 work plan item on Climate Action theme had no impact on Kingston Hydro.

b) There are no items in the Kingston Hydro 2023-2027 DSP forecast related to the Utilities Kingston 2021 workplan. However, the electrification forecasts developed with large customer input during the most recent Peterborough to Kingston Regional Planning process and preliminary design work for a new MTS forecast in 2024-2025 are related to Climate Action.

c) No, Kingston Hydro has not determined the impact of increased freezing rain and extreme weather events will have on its distribution system. However, the Metsco report submitted in response 1-Staff-3a) includes analysis of historic poor weather and confirms that our historic investments over the past 5-10 years have improved system reliability during poor weather events.

d) Yes, Kingston Hydro is a member of the Utilities Standards Forum (USF) and USF is a participating member of the CSA standards working group. USF and CSA standards are constantly evolving to meet changing business and environmental conditions. Kingston Hydro has reviewed the new, higher weather loads of the most recent CSA overhead standard (CSA C22.3 No.1 - 20) and is working to incorporate the higher weather loads into it's overhead design analysis application, SpidaCalc.

e) Yes. Kingston Hydro performs some additional out-of-cycle vegetation management for faster growing tree species that the 3-year cycle cannot accommodate.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-30

Overview of Assets Managed

Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, pages 161

Preamble:

Kingston Hydro states that the length and location of primary cable assets are well documented in the GIS system, but the cable size, type and age is not.

Question(s):

a) What GIS system is currently in use by Kingston Hydro?
b) Does Kingston Hydro plan to transfer cable information from its maintenance hole sketches to the GIS?
c) What plans does Kingston Hydro have for upgrading or replacing its GIS system?

Response

a) Kingston Hydro uses the following ESRI GIS products:
- Arc Pro and ArcMap for database and spatial analysis.
- ArcOnline, Fieldmaps, Survey123, Workforce for field inspections.

b) Yes, Kingston Hydro plans to eventually transfer cable size, cable type and splice info from its maintenance hole sketches to its GIS cable asset registry.

c) Yes. We plan to update upgrade the Electric Geometric model to the Utility Network model between 2023 and 2027.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-31</u>

Asset Lifecycle Optimization

Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, page 178, 207

Preamble:

Table 5.3-19 provides the annual asset replacement plan for Kingston Hydro distribution assets along with the ACA Flag for Action quantities for the 2019-2023 period.

Replacement quantity is based on proactive or reactive actions based on asset category. Kingston Hydro also states that the System Renewal expenditures for the 2023-2027 forecast period will be significantly lower compared to the 2016-2022 historical period.

Question(s):

a) Please provide the number of replaced assets for each of the categories in Table 5.3-19 for each of the 2015-2022 historical years.
b) Please provide the numbers of proactive and expected reactive asset replacement needs for each of the 2023-2027 forecast years.
c) Please advise Kingston Hydro's transformer replacement strategy with respect to unit size.
d) When replacing transformers, what does Kingston Hydro do to determine if

upsizing is warranted for future potential needs (i.e. EV load)?

<u>Response</u>

a) Due to limited time and resources we are unable to provide the requested data for the specified timeframes. However, the response to CCC-17 provides some of the requested detail.

b) Please refer to the response to CCC-17 for the 2022-2023 forecast plan quantities. The 2024-2027 capital plans have not been prioritized or approved by the Kingston Hydro Board yet so we are unable to provide this info.

c) We typically assess connected loads and size the replacement transformer according to USF construction standards with consideration of the square footage, type of heating and cooling and type of house (detached, semi-detached, town or row house). We also use amperage data recorders to assess existing transformer loading.

d) If we know the size/type of existing or proposed EV chargers then we will upsize the replacement transformer accordingly. We do not currently upsize transformers for future potential needs (i.e. EV loads).

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-32

Analysis of Historic Capital Expenditures by Investment Category
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1 pages 20, Appendix F

Preamble:

In Table 5.2.5, Kingston Hydro has presented a summary of its key investments for the 2023 – 2027 period. A number of programs seem to be placed in categories that would normally not be the trigger driver for the investment.

Question(s):

a) Why is the 13.8kV conversion program placed in the System Access category instead of the System Service category?
b) Why is the 5kV Line upgrade program placed in the System Access category instead of the System Service category?
c) Why is the Substations program placed in the System Access category instead of the System Service category?
d) Why is the Transformer PCB program placed in the System Access category instead of the System Renewal category?
e) Why is the Services program placed in the System Service category instead of the System Access category?

Response

a) We categorized the 13.8kV conversion program as System Access because the majority of the investments are related to construction of a new express feeder on an existing overhead pole line to serve expansions for customer connections or property development. This is a multi-year program and we anticipate that expenditures for future rate applications may be classified as System Service as the majority of the investments shift to actual voltage conversion work on an existing feeder from 4.16kV to 13.8kV.

b) This question is regarding DSP Table 5.2-5 on page 20 that shows 2023 to 2027 Key Investments by OEB Category and Main Budget Category. The main budget category “5kV OH Line Upgrades” is a program that has been used in previous budgets prior to Kingston Hydro introducing the new 13.8kV operating voltage (15kV voltage class). Kingston Hydro will update the name of this category to “5kV/15kV OH Line Upgrades” for clarification in future budgets. In Table 5.2-5, the main budget category for “5kV OH Line upgrades” appears under System Access and System Renewal because some specific projects in this main budget category meet the criteria of System Access.

c) The substations program is classified as System Access because it involves preliminary design work in 2024-2025 for a new Municipal Transformer Station to serve expansions and new customer load anticipated due to electrification of heating and transportation.

d) The transformer PCB program is classified as System Access because it is a mandated service obligation established by a federal regulation.

e) The services program is classified as System Service because the majority of the investments are related to existing service upgrades due to change in load that are required to provide consistent service delivery.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-33

Analysis of Forecast Capital Expenditures by Investment Category
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, page 193

Preamble:

Kingston Hydro allocated work related to the Bell Fibre-to-the-Home (FTTH) project to the System Renewal category. Capital contributions for this project were also allocated to the System Renewal category. The provision of capital contributions by Bell indicates that the need for this work was due to Bell needs to access the distribution system pole infrastructure. The System Access category is intended to cover other 3rd party infrastructure development requirements (e.g. pole relocation, pole replacement, etc.).

Question(s):

a) Why was work related to the Bell Fibre-to-the-Home (FTTH) project allocated to System Renewal instead of System Access?

Response

a) The Bell FTTH project was allocated to System Renewal because it involved make-ready costs to bring existing legacy overhead distribution system up to current standards to accommodate existing and new attachments. For example, we replaced deteriorated poles and installed additional anchoring.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-34

Analysis of Forecast Capital Expenditures by Investment Category
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, page 207-208

Preamble:

Kingston Hydro states that System Access expenditures for the 2023-2027 forecast period will be higher than the 2016-2022 historic period. System Access also includes the removal of transformers containing PCBs.

Question(s):

a) Please provide the number of connections by year for the historical and forecast periods.
b) Please confirm which load forecast (Reference, Medium or High) is used for determining the connections for the forecast period of the DSP.
c) Please provide the number of transformers containing PCBs removed/to be removed for each year in the historical and forecast periods.
d) What is the concentration level (mg/kg) of PCBs in transformers that require removal by 2025?

Response

a) The following table contains a detailed breakdown of data that is used to generate

Kingston Hydro's annual regulatory reporting requirements (RRR) to the OEB for new low voltage (LV) and high voltage (HV) connections and upgrades:

Annual New Connections and Upgrades as per Kingston Hydro RRR

Year	Upgrade LV	New LV	Upgrade HV	New HV	Total
2022	74	16	1	3	94
2021	141	37	0	5	183
2020	111	34	3	1	149
2019	105	13	0	9	127
2018	71	20	0	8	99
2017	48	12	0	4	64
2016	45	14	0	4	63

*NOTE: 2022 quantities are completed connections for year-to-date as of Aug 31, 2022. There are currently 70 pending service requests but some may never happen.

b) It's important to note that there isn't a direct one-to-one relationship between the incremental historic customer counts in the economic load forecast and the new LV/HV connections reported in the table above. Also, the Reference forecast is not used to estimate the number of new transformers or new connections for the capital plan forecast. The Reference forecast is used to estimate the worst case system demand for system capacity planning purposes.

c) Approximately 21 transformers containing PCBs were removed in the 2016-2021 historic period and approximately 68 are planned for removal in the 2022-2025 forecast period.

d) Equipment that contains between 50 and 500 mg/kg of PCBs must be removed from service by December 31, 2025 in accordance with federal PCB Regulations (SOR/2008-273).

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-35

Analysis of Forecast Capital Expenditures by Investment Category
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, page 208

Preamble:

Kingston Hydro states it has very limited investments planned for the System Service category over the 2023-2027 forecast period. Annual programs consist of service upgrades and SCADA equipment and plans to upgrade obsolete electro-mechanical relays and SCADA equipment.

Question(s):

a) Please provide the annual forecast quantities and cost of each of the annual programs noted above.
b) Please provide details on the nature of the "service upgrade" program.

Response

a) The requested project detail for 2023 is provided in App-2AA of the DSP. The table following summarizes the forecast year of investment for each of the 2023-2027 System Service projects but does not include costs because the 2024-2027 project prioritization and costs have not been finalized or approved by the Kingston Hydro board yet.

Program	Project	Forecast year
SCADA	SCADA	2023-2027 annual program
Services	Annual Service Upgrade program	2023-2027 annual program
Substations	MS13 5kV Relay/SCADA Upgrade	2026
Substations	MS7 5kV Relay/SCADA Upgrade	2023
		2026
Substations	MS9 5kV Relay/SCADA Upgrade	

The following are some additional program/project clarifications:

- The SCADA program consists of an annual budget envelope for miscellaneous tools and materials to support a SCADA testbench.
- The Services program consists of an annual budget envelope for annual service upgrades.
- The Substations program consists of three projects planned for Substation MS7, MS9 and MS13 involving the upgrade of 6, 11 and 5 protection relays at the respective substations.

b) The majority of the “service upgrade” program is attributed to redevelopment and/or infill of multi-unit residential dwellings that replace existing single family residential dwellings.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-36</u>

Analysis of Forecast Capital Expenditures by Investment Category
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, page 208

Preamble:

Kingston Hydro states that General Plant investments are forecast to increase to maintain secure and reliable customer service. Annual programs include Cybersecurity, Customer Information Systems (CIS) and Non-CIS Systems and vehicles.

Question(s):

a) Please provide annual forecast quantities and cost for each of the annual programs noted above.

<u>Response</u>

a) The table following summarizes the forecast year of investment for each of the 2023-2027 General Plant projects but does not include costs because the 2024-2027 project prioritization and costs have not been finalized or approved by the Kingston Hydro board yet.

Program	Project	Forecast Year
Computer Misc.	CIS/Work Management/Customer Engagement	2023-2027 annual Program
Computer Misc.	Cybersecurity	2023-2027 annual program
Computer Misc.	Non CIS systems (TTS, HRMS, etc.)	2023-2027 annual program
Office Equipment/Furniture	Office Equipment/Furniture	2023-2027 annual program
Radios	Radios	2023-2027 annual program
Substations	MS5 Decommission South Side Station	2026 project
Tools/Equipment	Tools/Equipment	2023-2027 annual program
Vehicles	Vehicles	2023-2025 multi-year program

The following are some additional program/project clarifications:

- The Computer Misc. program consists of annual budget envelopes for:
  - CIS/Work Management/Customer Engagement systems,
  - Cybersecurity
  - Non CIS systems.
- The Office Equipment/Furniture program consists of an annual budget envelope for office equipment and furniture.
- The Radios program consists of an annual budget envelope for maintaining existing Radio equipment.
- The Tools/Equipment program consists of an annual budget envelope for purchasing new tools and equipment.
- The Vehicles program consists of the following specific replacement budgets:
  - 2023: 2003 Bucket Material Handling Aerial Device
  - 2024: Based on condition assessment data; either the 1997 or 2005 Radial Boom Derricks
  - 2025: 2004 Cube Van

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-37

Summary of Material Capital Projects
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, page 219

Preamble:

Table 5.4-17 lists a summary of material projects for the 2016-2023 period.

Question(s):

a) Are the Regulatory Meter Replacements/Seal Updates costs listed in the table for the replacement of functionally obsolete meters?
b) If so, why is this cost not captured in System Renewal spend?
c) How many meters are covered by the expenditures listed in each of the historical years?

Response

a) Yes, Regulatory Meter Replacements/Seal Updates costs listed in Table 5.4-17 includes any functionally obsolete meters.

b) As per Chapter 5 filing requirements, the major driver for meter replacements is the mandated regulatory obligation.

c) For the 2016 to 2022 period the following number of meters are part of the expenditures noted:

- 2016 – 143
- 2017 – 114
- 2018 – 178
- 2019 – 169
- 2020 – 163
- 2021 - 292
- 2022 – 95 (Jan to Aug)

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-38</u>

Summary of Material Capital Projects
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, page 220

Preamble:

Table 5.4-19 lists a summary of material General Plant investments for the 2016-2023 period.

Question(s):

a) Please clarify why Substation Structures is in the General Plant category instead of in System Renewal or System Service.

<u>Response</u>

a) Projects under the Substation Structures program in the General Plant category refers to substation roof replacements and/or repairs to the exterior of substation buildings such as brick veneer and windows.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-39</u>

Justifying Capital Expenditures
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, page 226

Preamble:

Table 5.4-8 summarizes the prioritization of material capital expenditure projects/programs proposed for the 2023 Test Year.

Question(s):

a) Please provide the methodology of how the priority/rank of each of the investments in Table 5.4-8 was determined.
b) Are there any investments not shown in the Table that are ranked 4 and 6?

<u>Response</u>

a) Engineering and Hydro staff ranked the programs according to the typical level of discretion/flexibility expected when selecting/scheduling projects from these programs. Programs ranked 1 have the least scheduling discretion/flexibility and programs with a higher rank have progressively more scheduling discretion/flexibility. Staff do not select projects based solely on their program rank. Many other factors are used to select projects including knowledge of condition and risk.

b) The following additional program investments were ranked but were not included in Table 5.4-8 because they were below the 2023 materiality threshold:

Rank	**Parent Program**	Program Description	**Project Description**	**2023 Project Budget**
4	100448	SCADA	SCADA	$15,000
6	100451	Tools/Locating Equip/Radios	Radios	$5,000
			Tools/Equipment	$55,000
8	100453	Equipment & Furniture	Office Equipment/Furniture	$5,000

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-40</u>

Justifying Capital Expenditures
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, page 229-230

Preamble:

Kingston Hydro states it plans to upgrade the following major assets over the 2023- 2027 forecast period - Deteriorated Overhead Infrastructures, Substation No.5 Rebuild, Substation No.8 Transformer T2 Replacement, Queen Street Cable Replacement, Overhead and Underground Transformer Replacement, Princess Street Joint Reconstruction – Division to Alfred, Substation No. 6 – Structural Rehabilitation.

Question(s):

a) For each of the projects noted above, please provide the expenditure amount and the forecast year(s) the funds are to be spent in.

<u>Response</u>

a) The table following summarizes the forecast year of investment for each of the requested 2023-2027 System Renewal projects but does not include costs because the 2024-2027 project prioritization and costs have not been finalized or approved by the Kingston Hydro board yet.

Brief Project Description	Forecast Year
Annual Deteriorated Overhead Infrastructure	2023-2027 annual program
Substation No. 5 Rebuild	2022
Substation No. 8 Transformer Replacement	2024
Queen Street Cable Replacement	2023
Overhead and Underground Transformer Replacement	2023-2027 annual program
Princess Street Joint Reconstruction – Division to Alfred	2023
Substation No. 6 - Structural Rehabilitation	2022

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-41

Asset Condition Assessment
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, Appendix B page vi

Preamble:

The Kinectrics ACA report provided several recommendations for Kingston Hydro to enhance data collection to improve the quality of future ACA studies.

Question(s):

a) Please advise whether and, if so, when Kingston Hydro will implement the Kinectrics recommendations. Please explain your response.

Response

a. Please refer to response for CCC-21.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-42</u>

Material Project Sheets
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, Appendix F

Preamble:

Kingston Hydro has plans to implement a new Customer Information System (CIS) over the forecast period. The estimated cost of the new CIS is approximately $6 million of which 40% is to be allocated to Kingston Hydro.

Question(s):

a) How was the priority level of 5 determined?
b) Please confirm whether the $6 million forecast costs are solely for a new CIS, or for a CIS and Work Management System.
c) Please provide the missing/truncated wording in section 5.4.3.2 GP-D1.1 (page 4 of 4) of this material summary sheet.
d) Please explain why Kingston Hydro considers a $6 million expenditure as "not substantially exceed[ing] the materiality threshold".
e) Please confirm that Kingston Hydro has no business case for this $6 million expenditure, or provide the business case.

Response

a) As part of the work prioritization process, UK staff ranked projects by program (refer to Table 5.4-8 of DSP). Computer hardware and software systems (Program 100450) were given a priority level of 5, The program/project rank is only one of the many factors that go into selecting our capital projects.

b) The $6 million forecasted costs are for a CIS with a desire to add in a Work Management System but this will depend on the competitive responses to request for proposal and the features and functions of the various options presented compared to costs proposed.

c) The missing/truncated wording in section 5.4.3.2 GP-D1.1 (page 4 of 4) of the Customer Information System / Work Management System / Customer Experience System Material Project Summary Sheet is as follows:

> *"Implementation of new software will allow benefits to customers that could include:*
> ** More online options for interfacing with Utilities Kingston for move in/move outs.*
> ** More online options for data from the billing system (in addition to green button requirements).*
> ** Increased efficiency of Utilities Kingston processes,*
> *Implementation of "Off the Shelf" systems will reduce costs from both a maintenance perspective as well as implementing new features in a custom (existing) system."*

d) The last statement in section 5.4.3.2 GP-D1.2 (page 4 of 4) has a typo. We intended to state that:

> *The 2023 expenditures proposed for this program do not substantially exceed the materiality threshold.*

e) Confirmed, Kingston Hydro does not have a current business case for the CIS replacement but conducted a comprehensive business case and RFP in 2017 for a CIS replacement and will undertake an updated version of this before proceeding with procurement for the new CIS.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-43

Material Project Sheets

Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, Appendix F

Preamble:

Kingston Hydro plans to procure a new bucket truck in 2023 to replace an existing unit that will be 22 years old. Replacement is based on qualitative mechanic assessment.

Question(s):

a) How was the priority level 7 determined?
b) Has Kingston Hydro investigated any quantitative assessment methodology, that would act as a business case, for assessing when fleet vehicles should be replaced?

Response

a) As part of the work prioritization process, UK staff ranked projects by program (refer to Table 5.4-8 of DSP). The “Vehicles” Program (Program 100454) was given a priority level 7. The program/project rank is only one of the many factors that go into selecting our capital projects. Other factors include, but are not limited to, vehicle maintenance history and mileage.

b) As noted in other IR questions received about vehicles the following criteria are utilized in assessing vehicles: Age/Year; Engine Hours; Condition of vehicle and mounted equipment; Third Party Engineering structure reports; Preventative maintenance reports; Unscheduled repairs/maintenance; Parts availability; Historical Reliability; Mechanics observations on future reliability. These factors are reviewed and discussed for each vehicle with Subject Matter Experts that include mechanics, crews and Third-Party experts who have assessed the vehicles. Kingston Hydro has not formally investigated quantitative assessment methods to determine when fleet vehicles should be replaced. However, Kingston Hydro staff have reviewed some systems used in enterprise risk management and other risk evaluation methodologies. Further work in quantitative methods to assist in determining asset replacement is being considered.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-44

Material Project Sheets
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, Appendix F

Preamble:

Kingston Hydro has a program for New Transformers or New Connections funded by Capital Contributions over the forecast period.

Question(s):

a) Please provide the annual number of new transformers or new connections and cost for this program over the 2023-2027 forecast period.

Response

a) The forecast for new transformers or new connections funded by capital contributions for the 2023 test year is $150,000. This forecast is an annual budget envelope based on historic trends. It is difficult to estimate the number of new transformers because the budget includes primary cabling which varies in length and the transformer unit cost varies with size and type (e.g. pole vs. pad, 1phase vs. 3phase). The 2024-2027 forecast has not been finalized or approved by the Kingston Hydro board yet.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-45

Material Project Sheets

Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, Appendix F

Preamble:

Kingston Hydro material sheet for Annual New Development.

Question(s):

a) Please provide the missing/truncated wording in section 5.4.3.2 B.1.d.i) (page 2 of 4) of this material summary sheet.

Response

a) The complete wording for the "**Analysis of project & Alternatives – Effect of the investment on system operation efficiency and cost-effectiveness (5.4.3.2 B.1.d.i)**" on page 2 of 4 of the Annual New Development Project Description is as follows:

> *For each project and project alternative provide the following quantitative and/or qualitative analyses on the design, scheduling, funding and/or ownership options (e.g. whole or part ownership solely by or jointly with 3rd parties):*

(i) The effect of the investment on system operation efficiency and cost-effectiveness.

New development requests are reviewed in accordance with the Kingston Hydro conditions of service and the Capital Cost Recovery model. Various options are reviewed and evaluated for system operation efficiency and cost-effectiveness before a final project scope is determined.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-46</u>

Material Project Sheets

Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, Appendix F

Preamble:

Kingston Hydro material sheet for UK-KHC- 44KV & 5KV Pole replacement Sir John A Macdonald Ave. from Union St towards Johnson.

Question(s):

a) How many poles are to be replaced with this project?
b) How was the priority level 3 determined?

<u>Response</u>

a) 8 poles will be replaced for this project. The pole condition is “minor” however these poles were flagged for replacement because they have 44kV and 5kV circuit attachments with legacy framing and clearances.
b) As part of the work prioritization process, UK staff ranked projects by program (refer to Table 5.4-8 of DSP). The “Annual Deteriorated Poles” Program (Program 100439) was ranked 3 and that rank was assigned to all projects within that program. The program/project rank is only one of the many factors that go into selecting our capital projects. Other factors include the review of pole condition and

other work proposed in the area by Hydro operations staff as Subject Matter Experts (SMEs). The level of deterioration in some of the poles in this project suggested they are lower priority than other projects in this category; however, the city is planning infrastructure upgrades in the area, triggered by a combination of multi-utility work and new proposed redevelopment. The pole line work must be completed prior to commencement of the multi-utility work and city work. The main driver is “System Renewal” but “System Access” is also a driver of this project.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-47</u>

Material Project Sheets
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, Appendix F

Preamble:

Kingston Hydro material sheet for UK-KHC- Bagot St - Complete 5kV loop feed for Circuit 805 including pole replacements for end of life poles and 44kV switch replacement.

Question(s):

a) How many poles are to be replaced with this project?

<u>Response</u>

a) 8 poles will be replaced with this project and some of the poles are in critical condition.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-48

Material Project Sheets
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, Appendix F

Preamble:

Kingston Hydro material sheet for Annual Deteriorated Pole Replacement - Spot Pole Replacement

Question(s):

a) How many poles are to be replaced with this project?

Response

a) For the 2023 Annual Deteriorated Pole Replacement program, Kingston Hydro is forecasting spot replacement of 14 to 15 poles.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-49</u>

Material Project Sheets
Ref: Exhibit 2, Tab 4, Attachment 2.4.1.1, Appendix F

Preamble:

Kingston Hydro material sheet for Queen Street - 5kV PILC Cable Replacement - 104, 105, 106 and 110 Circuits. This project entails the complete replacement of the existing PILC cables for 103, 104, 105 106 and 110 circuits.

Question(s):

a) What is the total length of cable to be replaced for each of the above noted circuits?

<u>Response</u>

a) The scope of work involves installation of new ducts for 5 feeders but only replacement of cabling for 2 of 5 feeders. Approximately quantities are below:
   - 600m cable per circuit x 2 circuits =1200m cable
   - 160m Duct x 16 ducts (4 x 4) = 2560m duct

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

Interrogatory 2-Staff-50

Distribution System Plan – CDM Activities
Ref 1: Exhibit 2, Tab 4, Attachment 2.4.1.1, page 189
Ref 2: 2021 CDM Guidelines, Chapter 3.1

Preamble:

Kingston Kingston states that it has no plans to seek a partnership with the IESO's LIP, nor any rate-based CDM activities to address system needs.

Question(s):

a) Please describe how Kingston Hydro has addressed or plans to address the requirement in OEB's CDM Guidelines for distributors to "make reasonable efforts to incorporate consideration of CDM activities into their distribution system planning process, by considering whether distribution rate- funded CDM activities may be a preferred approach to meeting a system need, thus avoiding or deferring spending on traditional infrastructure."

Response

a) Kingston Hydro will use the results of the study to develop impactful non-wires alternatives (nwas) or rate-based CDM that will assist with capacity availability.

EXHIBIT 2 – RATE BASE AND DISTRIBUTION SYSTEM PLAN

<u>Interrogatory 2-Staff-51</u>

Distribution System Plan – CDM Activities
Ref 1: Exhibit 2, Tab 4, Attachment 2.4.1.1 pages 228 and 388 (IRRP Report hyperlink)
Ref 2: 2021 CDM Guidelines, Chapter 3.1
Ref 3: Peterborough to Kingston IRRP report, pages 10, 43-46

Preamble:

Kingston Hydro states that $400,000 has been allocated for pre-design of a new Municipal Transformer Station (MTS). Kingston Hydro further states that it is forecasting increased demand due to intensification and electrification and the existing Hydro One transformer stations are reaching capacity.

Question(s):

a) The Peterborough to Kingston IRRP Main Report (page 10) indicates that “the development of a non-wire alternative, specifically additional energy efficiency or a local storage solution, could defer the new station ultimately required to accommodate load growth in the City of Kingston” and is a potentially viable and cost-effective solution (pages 43-46). Is Kingston Hydro giving more detailed consideration to CDM/non-wire solutions that may defer or avoid the need to construct a new MTS to meet anticipated load growth? If so, please describe. If not, why not?

If the MTS has not yet been selected as the preferred option to address this system need, please describe why the proposed level of spending on pre-design work ($400,000) is warranted at this time.

Response

a) We offer the following responses to this two-part question:

- Yes, Kingston Hydro will give consideration to Non-Wire Alternatives (NWA) such as CDM, Combined Heat Power generation or Battery Storage to defer the timing of a new MTS however, a new MTS will eventually be required, regardless of NWA solutions, should electrical demand double or triple in the Kingston area, as preliminary forecasts suggest, due to electrification.

- The proposed level of spending on pre-design/assessment work of an MTS is warranted in 2024-2025 for several reasons. First, it typically takes 7 to 15 years to build a new MTS so Kingston Hydro needs to determine transmission connections, feeder construction and overall cost to construct for long term planning purposes before developing a formal business case for a new MTS and making any formal filings to seek approval (regulatory and Kingston Hydro Board) for a new station. Second, pre-design/assessment work will also help assess reliability and potential savings to our customers in areas of distribution versus transmission connections and will examine the feasibility of potential NWA solutions.

CCC Interrogatory #10

Ref: Ex. 2/T4/S1/p. 14/Table 5.2-2

Table 5.2-2 provides the summary totals of proposed capital spending by category.

Please provide the rationale and methodology used to determine capital contributions of $200,000/year for each of the years 2023 to 2027.

Response

Please refer to response to VECC-9 and SEC-12.

CCC Interrogatory #11

Ref: Ex. 2/T4/S1/p. 26

With respect to new Energy Efficiency Requirements for distribution transformers, Kingston Hydro indicates more stringent energy efficiency standards for distribution transformers prescribed in O.Reg. 509/18 Energy and Water Efficiency – Appliance and Products are scheduled to come into effect January 1, 2023. USF and its members (including Kingston Hydro) will be attending a meeting with the Ministry of Energy on June 24, 2022, to raise concerns about the timing of when this regulation comes into effect given the current supply chain increased scheduled outages for 2016 through 2020 issues. This new regulation has the potential to impact the cost and availability of distribution transformers during the forecast period of this DSP.

Please discuss the outcome of the meeting and how the regulation will impact the cost and availability of distribution transformers in 2022 to 2027.

Response

On June 24, 2022 Kingston Hydro participated in a meeting with the Ministry of Energy as a member of USF. The meeting was also attended by the EFC. The key outcome of the meeting was the following proposed amendment by the Ministry:

1. *Liquid-filled distribution transformers*
    a. *Use of the CSA standard specified under current requirements for this product would be allowed as an alternative compliance option to DOE*

> *requirements beginning on January 1, 2023. The intent is to include an ambulatory reference to the CSA standard so that if it is updated in the future those new, updated requirements would be automatically adopted into the efficiency regulation.*

The proposed amendment will allow Ontario distributors to continue to purchase transformers that conform to the existing CSA standards until such time that the CSA standards are updated to meet the equivalent DOE requirements specified in O.Reg. 509/18. Manufacturers will eventually need to purchase higher quality core steel and perform more detailed factory testing to meet the new CSA standards for transformers which is expected to increase future transformer costs. The timing of when the CSA standards will be updated has not been established but it will likely take at least 18 months. In the meantime, Ontario distributors are hopeful that a deferral of 18months or more may provide enough time for the supply chain impacts of the COVID-19 pandemic to subside.

CCC Interrogatory #12

Ref: Ex. 2/T4/S1/p. 57

Approximately 5 years ago, staff analyzed the historic impact of tree contacts on Total Customer Hour Interruptions (TCHI) and adjusted the Tree Trimming program. Kingston Hydro will continue to monitor expenses against this program over the 2023-2027 timeframe:

a) Please summarize the historic impact of tree contacts on Total Customer Hour Interruptions (TCHI) referred to above.
b) Please provide the adjustments made to the Tree Trimming program in terms of scope of work and costs and the effective date.
c) Please discuss the impact of the adjustments made to the Tree Trimming program on tree contact Total Customer Hour Interruptions post implementation.
d) Please provide tree contact targets over the period 2023 to 2027.

Response

a) The TCHI due to tree contact for 2008 to 2021 is summarized in the following chart.

b) The minimum vegetation to electrical plant clearance was increased in 2013 and the public was informed of the changes to vegetation management via flyer handouts.

c) Before adjustments were made to the tree trimming program in 2013, the average TCHI due to tree contact for 2008 to 2012 was 5371. After the tree trimming program was adjusted in 2013, the TCHI due to tree contact significantly decreased in 2013-2014 and remained below 4000 except in 2018 and 2020 when there were anomalies. In 2018, a large tree limb that had more than adequate clearance to electrical plant contacted a 44kV overhead line during a high wind day, causing a total of 5890 customer-hours of interruption by the single event. In 2020, another tree branch with more than adequate clearance to electrical plant contacted a 5kV overhead line then caused an upstream 44kV breaker trip. This outage contributed a total of 4256 customer-hours of interruption. These single outages in 2018 and 2020 respectively caused the annual TCHI due to tree contact to be extremely high.

Since 2013, the tree trimming program has enabled a high level of line clearing and had a positive correlated effect on unplanned outages.

d) Kingston Hydro established overall reliability performance targets in accordance with Section 5.2.3 of the Chapter 5 filing requirements but it did not establish a target for each cause of interruption.

CCC Interrogatory #13

Ref: Ex. 2/T4/S1/p. 68

With the investment level back to normal in the next planning horizon (2022-2027), Kingston Hydro expects the SAIDI and SAIFI due to Scheduled Outage for asset upgrades will decrease.

Please provide the target for Scheduled Outage contribution to SAIDI and SAIFI for the years 2023-2027.

Response

Kingston Hydro established overall reliability performance targets in accordance with Section 5.2.3 of the Chapter 5 filing requirements but it did not establish a target for each cause of interruption.

CCC Interrogatory #14

Ref: Ex. 2/T4/S1/p. 72 Table 5.2-25

Please provide SAIDI and SAIFI data for the years 2017 to 2021 excluding Major Event Days, Excluding Loss of Supply and Excluding Scheduled Outages.

Response

The following table summarizes the 2017-2021 SAIDI and SAIFI data excluding Major Event Days, Excluding Loss of Supply and Excluding Scheduled Outages:

Index	Excluding Loss of Supply, Major Event Days and Scheduled Outages				
	2017	2018	2019	2020	2021
SAIDI	0.85	1.21	0.58	1.32	1.26
SAIFI	0.66	0.78	0.64	0.69	2.00

CCC Interrogatory #15

Ref: Ex. 2/T4/S1/p. 96-97

Kingston Hydro explains its capital expenditure decision making process:

a) Please provide the capital budget top-down threshold for 2023 to 2027.
b) Please provide the Project Value for each project/program in Appendix 2-AA in 2023.
c) Please explain Kingston Hydro's oversight strategy to identify and monitor material changes to scope, cost or schedule.
d) Please identify projects/programs in 2016 to 2021 that had material changes in scope, cost or schedule and provide the project/program variances.

Response

a) There is a total net-capital expenditure target of $3.2million per year for 2023-2027 and a 5 year total net-capital expenditure target of $16million. If significant expenditures cannot be smoothed or deferred in a given year (e.g. meter seal expiry/replacement program) then the total net-capital expenditure targets for a given year may be adjusted to accommodate the work but Kingston Hydro would still meet the 5 year total net-capital expenditure target.

b) Appendix 2-AA already presents the requested granularity of project value for each project/program.

c) We monitor project/program expenditures, total net-capital expenditures and capital contributions throughout the year and make adjustments to projects as needed to meet the total net-capital expenditure target for the year.

d) Due to limited time and resources we are unable to provide the requested detail. The review was further complicated by the fact that in 2016 we transitioned to a new financial reporting system which means some of the historic and budget data is in different formats. However, we offer a summary for 2016-2020 which represents the 5 year period covered by our previous 2016 Cost of Service application.

Response to Consumers Council of Canada (CCC)

Interrogatory #CCC-15 (d)

Attachment 1 of 1

(2016-2020 Capital Data)

Row Labels	Description	Sub-Program	Sum of Total Budget	Sum of Total Actual	Total Variance
General Plant			**2,630,000.00**	**2,117,496.10**	**512,503.90**
100435	**Substation structures**	100435-02		171,372.09	-171,372.09
100448	**UK-KHC-SCADA Equipment**	100448-01		2,965.26	-2,965.26
100450	**FMS**	100450-01	740,000.00	61,860.01	678,139.99
	UK-KHC-Business Systems-Mapping Software	100450-06		11,016.79	-11,016.79
	UK-KHC-CRM-Computer Software	100450-04	0.00	204,068.79	-204,068.79
	UK-KHC-Dynamics AX 365-Computer	100450-10		4,541.05	-4,541.05
	UK-KHC-GIS Software-Computers	100450-02		33,710.00	-33,710.00
	UK-KHC-IS&T Expenditures from City	100450-07		151,763.75	-151,763.75
	UK-KHC-Outage Management System-Computer Software	100450-05		90,266.83	-90,266.83
	UK-KHC-Computer Hardware-SCADA group	100450-03	120,000.00	25,329.04	94,670.96
100451	**Radio System**	100451-05	100,000.00	4,190.00	95,810.00
	Tools & Equipment	100451-02	180,000.00	386,948.95	-206,948.95
	UK-KHC-Security System-Communication Equipment	100451-03		28,252.88	-28,252.88
	UK-KHC-Storage Yard-Fencing for Copper Compound	100451-04		9,000.00	-9,000.00
100454	**UK-KHC-Vehicles & Vehicle Modifications**	100454-01	0.00	932,210.66	-932,210.66
DBR	**Add'l Vehicles - 100454?**	DBR	1,490,000.00	0.00	1,490,000.00
System Access			**2,838,000.00**	**3,011,247.82**	**-173,247.82**
100438	**UK-KHC-TV3 & TV73 (Princess & Wellington)-Design Inspection**	100438-04	230,000.00	13,774.64	216,225.36
100439	**E CAP-169 Union St**	100439-16		20,855.82	-20,855.82
	Services-Overhead & Undergrnd	100439-01	360,000.00	442,414.53	-82,414.53
	UK-KHC-91 Harvey St-Pole Replacement	100439-50		7,896.07	-7,896.07
	UK-KHC-Elm St-Single Phase 5kV Extension	100439-63		11,099.84	-11,099.84
	UK-KHC-Frontenac St-Pole Line Rebuild	100439-52		142,358.04	-142,358.04
	UK-KHC-OHD Connection-637-655 Johnson St-Overhead Conductors	100439-35		29,302.73	-29,302.73
	UK-KHC-Pole Replacement-27 Wright Cres-P&F	100439-64		249.41	-249.41
	UK-KHC-Pole Replacement-Baiden and McDonald St.-Des&Insp	100439-65		597.95	-597.95
	UK-KHC-Pole Replacement-Harvey St.-Design & Insp	100439-37		12,392.02	-12,392.02
	UK-KHC-Pole Replacement-Terry Fox Dr.	100439-36		30,900.86	-30,900.86
	UK-KHC-Victoria Street-OH to UG Reconfig	100439-62		100,270.46	-100,270.46
	University Ave Rebuild	100439-05	160,000.00	112,926.44	47,073.56
100440	**Elect Cap-40 Cliff Cres**	100440-01	0.00	162,013.90	-162,013.90
100446	**UK-KHC-Transformer Replacement-130 Johnson St.-Design&Insp**	100446-04		20,796.00	-20,796.00
	UK-KHC-Transformer Replacement-294 Concession St.- TX	100446-02		18,345.30	-18,345.30
	UK-KHC-Transformer Replacement-33 Benson- Cables	100446-03	0.00	25,750.03	-25,750.03
	UK-KHC-Transformer Replacement-35 Centre St-Cables	100446-01	0.00	34,610.28	-34,610.28
100449	**Electric Interval Meters**	100449-02	0.00	582,483.16	-582,483.16
	Electric Meters	100449-01	2,088,000.00	877,645.15	1,210,354.85
100450	**UK-KHC-RNI Upgrades**	100450-08		196,354.80	-196,354.80
ERC	**0**	ERC	0.00	168,210.39	-168,210.39
System Renewal			**18,649,143.14**	**18,346,298.53**	**302,844.61**
100434	**Transformer Installations**	100434-02	0.00	653,905.36	-653,905.36
	Transformers - unallocated	100434-01	0.00	271,915.14	-271,915.14
100435	**Substation Equipment**	100435-01		21,361.65	-21,361.65
	UK-KHC-Decommissioning of MS17-Conductors/Switches	100435-05	90,000.00	52,819.01	37,180.99
	UK-KHC-MS#4 5KV Switchgear Replacement Design-Design	100435-06	1,100,000.00	978,585.22	121,414.78

Row Labels	Description	Sub-Program	Sum of Total Budget	Sum of Total Actual	Total Variance
100436	**MS#1 Complete Rebuild**	100436-02	3,191,000.00	3,357,111.07	-166,111.07
100437	**Duct Work Princess - Mac & Vic**	100437-02	570,000.00	629,977.95	-59,977.95
	MS#11 Cable Install	100437-01	100,000.00	5,999.52	94,000.48
	UK-KHC-Concession St-1304 CCT Line Rebuild	100437-04		1,935.06	-1,935.06
	UK-KHC-Gore St and Ontario St TV 63 Removal	100437-06		20,100.56	-20,100.56
	UK-KHC-MS#2-201&208 CCT Cable Replace-Cable	100437-03	220,000.00	44,796.03	175,203.97
	UK-KHC-MS2-201&208 CCT PILC Cable Replacement-Duct	100437-07		49,750.00	-49,750.00
	UK-KHC-TV13 - 102 Circuit Reconfiguration	100437-05		48,474.24	-48,474.24
100438	**Clergy @Princess installation**	100438-02	470,000.00	0.00	470,000.00
	Sydenham@Princess install	100438-01	385,000.00	0.00	385,000.00
	TV37-Princess at Drayton	100438-03	0.00	100,837.32	-100,837.32
	UK-KHC-TV29 Oil Switch & 2ndry Breaker	100438-05	210,000.00	268,912.75	-58,912.75
	UK-KHC-TV3 Rebuild	100438-07		608.77	-608.77
	UK-KHC-TV85(TV38 Replacement)-Dsg/Insp/Adv	100438-06	0.00	449,585.13	-449,585.13
100439	**Assoro Cr and Sicily Drive**	100439-12	0.00	135,497.60	-135,497.60
	CAP-Division-Hamilton-Colborne	100439-07	0.00	248,784.97	-248,784.97
	CAP-King St-Pembroke-Sir JA	100439-06		45,643.03	-45,643.03
	Deteriorated Pole Replcmnt Prj	100439-02	7,347,000.00	2,516,562.06	4,830,437.94
	Drayton Ave Pole Line Reconst	100439-11	0.00	107,459.18	-107,459.18
	ECAP-Division-Adelaide-Stanley	100439-18	0.00	423,109.42	-423,109.42
	ECAP-Division-York-Chatham	100439-17	0.00	333,042.14	-333,042.14
	Glen Garry Road	100439-13		14,301.25	-14,301.25
	Grosvenor Court-Pole Replace	100439-10	0.00	113,126.04	-113,126.04
	King St -Queen-Pl D'Arms	100439-15	90,000.00	113,082.31	-23,082.31
	Manhole EM64 Lower University	100439-14		7,513.63	-7,513.63
	Pole line-Wellington, Barrack	100439-03	0.00	184,836.74	-184,836.74
	Pole Line-Hickson Ave	100439-04	0.00	240,788.34	-240,788.34
	Portsmouth Ave-Howard to Valle	100439-09	0.00	117,561.42	-117,561.42
	Robert Wallace Mackenzie Campb	100439-08	0.00	73,290.46	-73,290.46
	UK-KHC-44kV LBS Installation-776 Johnson St.	100439-58		44,974.59	-44,974.59
	UK-KHC-44kV LBS Replacement-100 Portsmouth	100439-56		42,707.14	-42,707.14
	UK-KHC-44kV LBS Replacement-392 Palace Rd	100439-57		32,623.46	-32,623.46
	UK-KHC-850 & 890 Princess St-Design and Reconstruction	100439-46		1,588.20	-1,588.20
	UK-KHC-Bagot & Cataraqui Pole Line- OHD Line	100439-20	0.00	352,032.85	-352,032.85
	UK-KHC-Barriefield,Regent & Drummond-Tx	100439-19	0.00	267,528.76	-267,528.76
	UK-KHC-CFB- OHD Line	100439-22		43,553.13	-43,553.13
	UK-KHC-Durham St Pole Line- OHD Line	100439-21	0.00	126,584.14	-126,584.14
	UK-KHC-Gilmour Street -Poles & Fixtures	100439-27		67,070.84	-67,070.84
	UK-KHC-Johnson Backyard Poles-Design	100439-25		89,529.16	-89,529.16
	UK-KHC-Lundy's Lane-Backyard Pole Replacement	100439-47		1,595.69	-1,595.69
	UK-KHC-MS#12-Design Inspection	100439-23	0.00	83,839.85	-83,839.85
	UK-KHC-MS#12-GM7 & GM9 OH Tie	100439-59		42,347.31	-42,347.31
	UK-KHC-Neilson St, Princess to Mack St-Design	100439-24	0.00	93,331.04	-93,331.04
	UK-KHC-Old Quarry Rd-Backyard Pole Replacements	100439-48		84,937.21	-84,937.21
	UK-KHC-Pole Line-MacDonnell-207 CCT	100439-54		212,890.21	-212,890.21
	UK-KHC-Pole Replacement - Hawthorne Ave	100439-28	0.00	68,283.25	-68,283.25

Row Labels	Description	Sub-Program	Sum of Total Budget	Sum of Total Actual	Total Variance
100439	**UK-KHC-Pole Replacement - McMichael St**	100439-31	0.00	197,924.28	-197,924.28
	UK-KHC-Pole Replacement -Johnson-Portsmouth-Old Oak-Dsgn/Ins	100439-33	0.00	92,757.08	-92,757.08
	UK-KHC-Pole Replacement MS16 & 17-Dalton Ave	100439-60		190,063.84	-190,063.84
	UK-KHC-Pole Replacement-540 Bagot St.	100439-61		2,195.88	-2,195.88
	UK-KHC-Pole Replacement-Alamein Dr. Backyard-Design & Recon	100439-38		56,311.97	-56,311.97
	UK-KHC-Pole Replacement-Bath Rd Gren to Arm	100439-55		147,340.35	-147,340.35
	UK-KHC-Pole Replacement-CFB Kingston Hwy2-Design & Recon	100439-45		17,746.11	-17,746.11
	UK-KHC-Pole Replacement-Francis & Churchill	100439-30	0.00	171,978.92	-171,978.92
	UK-KHC-Pole Replacement-John St-Design & Recon	100439-41		15,515.15	-15,515.15
	UK-KHC-Pole Replacement-McMahon Ave-Dsgn/Inspect	100439-34		9,322.57	-9,322.57
	UK-KHC-Pole Replacement-Patrick & Railway-Design & Recon	100439-44	0.00	166,596.74	-166,596.74
	UK-KHC-Pole Replacement-Ports Ave - Princess to JCB	100439-53		13,587.72	-13,587.72
	UK-KHC-Pole Replacement-Portsmouth Ave-Design & Insp	100439-29		5,268.88	-5,268.88
	UK-KHC-Pole Replacement-Russel & Patrick-Design & Insp	100439-39	80,000.00	166,991.44	-86,991.44
	UK-KHC-Pole Replacement-Storm Damage Oct 31 2019	100439-51		66,419.87	-66,419.87
	UK-KHC-Pole Replacement-Victoria, Mack to Princess-Design	100439-43	0.00	170,772.20	-170,772.20
	UK-KHC-Pole Replacement-Victoria-Johnson to Union-Design&Ins	100439-32	0.00	111,858.25	-111,858.25
100441	**Princess St Recon Phase 3**	100441-01	3,150,000.00	1,939,327.88	1,210,672.12
100446	**UK-KHC-850&890 Princess-Transformer Replacement**	100446-07		12,384.32	-12,384.32
	UK-KHC-Transformer Replacement-1225 Princess St.	100446-09		25,516.71	-25,516.71
	UK-KHC-Transformer Replacement-89 Joyce Cres.	100446-08		4,882.10	-4,882.10
	UK-KHC-Transformer Upgrade-MS#4-Dsgn/Inspect	100446-05		0.20	-0.20
100447	**UK-KHC-CN Rail Montreal St Cable- OHD Line**	100447-01	0.00	82,772.73	-82,772.73
100457	**UK-KHC-Princess St Reconstruction Phase 4-Design & Recon**	100457-01	1,276,143.14	1,276,143.14	0.00
DWU	**Pole Line-James St-Patrick St**	DWU	0.00	0.00	0.00
DWY	**Pole Line-MacDonnell-Third**	DWY	0.00	0.00	0.00
DWZ	**Connaught Pole Replacement**	DWZ	0.00	0.00	0.00
ECJ	**0**	ECJ	135,000.00	0.00	135,000.00
EEF	**0**	EEF	165,000.00	0.00	165,000.00
EIO	**0**	EIO	70,000.00	0.00	70,000.00
EPG	**0**	EPG	0.00	115,930.00	-115,930.00
System Service			**480,000.00**	**739,540.36**	**-259,540.36**
100435	**UK-KHC-Frontenac TS-Coordination Study**	100435-08		43,236.03	-43,236.03
	UK-KHC-Frontenac TS-Fibre Install	100435-09		45,077.92	-45,077.92
	UK-KHC-MS16-New Feeder-Substation Work	100435-07		82,668.87	-82,668.87
	UK-KHC-MS4 Relay Upgrade-Design Inspection	100435-03	60,000.00	60,338.92	-338.92
	UK-KHC-MS4 Transformer Upgrade-Design Inspection	100435-04	420,000.00	403,845.48	16,154.52
100439	**UK-KHC-MS16-New Feeder-Overhead Work**	100439-49		30,182.37	-30,182.37
	UK-KHC-Training Ovh Line Const-3 Terry Fox-Desgn & Recon	100439-40		19,433.16	-19,433.16
100446	**UK-KHC-Binnington Crt-Design and Insp**	100446-06		38,906.87	-38,906.87
100448	**Elect SCADA Test Devel Lab**	100448-02	0.00	15,850.74	-15,850.74
Grand Total			**24,597,143.14**	**24,214,582.81**	**382,560.33**

CCC Interrogatory #16

Ref: Ex. 2/T4/S1/p. 159 Figure 5.3-49

Figure 5.3-49 provides the age of Fleet Vehicles based on 2021 asset inventory:

a) Please provide a schedule that sets out the vehicle type (class of vehicle), age, normal useful life, odometer reading, prescribed odometer reading, hours of service and unscheduled maintenance costs for 2019 to 2021 for each of the vehicles represented in Figure 5.3-49

b) Please identify the vehicles in the table in part a) that will be replaced in 2023-2027.

Response

a) Please refer to Attachment 1.

b) 2023: 2003 Bucket Material Handling Aerial Device

   2024: Based on condition assessment data; either the 1997 or 2005 Radial Boom Derricks

   2025: 2004 Cube Van

Response to Consumers Council of Canada (CCC)

Interrogatory #16

Attachment 1 of 1

(Vehicles)

IR - CCC- 16

Class	Year	Odometer Read	Hours of service	$ Unscheduled Maintenance 2019	2020	2021
Bucket Material Handling Aerial Device	2021	16,629	1,725	$ -	$ 36	$ 61
Cargo Van	2005	102,301	N/A	$ -	$ 607	$ 607
Cube Van	2004	111,718	8,959	$ 117	$ 2,827	$ 163
Radial Boom Derrick (RBD)	1997	88,202	5,915	$ 4,386	$ 3,791	$ 3,001
Bucket Material Handling Aerial Device	2003	90,865	11,935	$ 4,621	$ 13,469	$ 7,961
Radial Boom Derrick (RBD)	2005	71,662	8,935	$ 5,924	$ 13,394	$ 11,626
Pick-up	2016	53,827	5,911	$ -	$ 1,627	$ 100
Pick-up	2016	53,530	3,653	$ 429	$ -	$ -
Passenger car	2009	70,626	N/A	$ -	$ 65	$ 65
Pick-up	2015	35,853	1,062	$ -	$ -	$ -
Pick-up	2015	53,022	1,049	$ -	$ -	$ -
Bucket Material Handling Aerial Device	2012	73,537	8,023	$ 7,459	$ 11,460	$ 11,302
Bucket Material Handling Aerial Device	2012	71,436	8,236	$ 3,834	$ 9,049	$ 949
Bucket Material Handling Aerial Device	2012	41,828	5,146	$ 3,308	$ 3,662	$ 1,828
Pick-up	2016	58,344	6,693	$ 40	$ 4,433	$ 4,433
Van	2019	20,549	1,616	$ 430	$ -	$ -
Van	2019	17,546	1,659	$ 110	$ 162	$ -
Dump Body	2008	10,883	6,229	$ 208	$ 503	$ 160
Bucket Material Handling Aerial Device	2017	30,217	3,335	$ 392	$ 3,282	$ 2,841
Van	2009	79,505	6,869	$ -	$ 2,140	$ 268
Pick-up	2012	80,422	N/A	$ 1,468	$ 1,750	$ 235
Roll-off Bodies - Dump & Flatbed	2017	16,644	1,883	$ -	$ 864	$ 864

<u>CCC Interrogatory #17</u>

Ref: Ex. 2/T4/S1/p. 178 Table 5.3-19

Kingston Hydro provides total plan quantities from 2019 to 2023:

a) Please add the following columns to Table 5.3-19
- ***2018 to 2021 actuals***
- ***Forecast 2022***
- ***Forecast 2023***
- ***Forecast 2024 to 2027***

b) Please provide an excel version of Table 5.3-19 that incorporates part a).

<u>Response</u>

a) Due to limited time and resources, we are unable to provide the requested breakdown of asset data. However, we offer the following summary below that shows the breakdown of the 2019-2023 total plan quantity of DSP Table 5.3-19 by 2019-2021 Actuals and 2022-2023 plan quantities:

Modified DSP Table 5.3-19

Asset Group	Asset Category	Pop.	2019-2023					
			5 Year Flag For Action		2019-2021	2022-2023	5 Year Plan Total	
			Total FFA Qty	% FFA of Pop.	Actual	Plan	Total Plan Qty	% Plan of Pop.
Stations	Station Transformers	37	7	18.9%	8	3	11	29.7%
	Station Breakers	140	18	12.9%	7	8	15	10.7%
	Station Ganged Switches MV	29	21	72.4%	0	1	1	3.4%
	Station Ganged Switches 44 kV	53	30	56.6%	4	0	4	7.5%
Distribution Transformers	Pole Mounted Transformers 1-Ph	976	233	23.9%	54	42	96	9.8%
	Pole Mounted Transformers 3-Ph	119	24	20.2%	10	1	11	9.2%
	Pad Mounted Transformers 1-Ph	359	101	28.1%	4	11	15	4.2%
	Pad Mounted Transformers 3-Ph	237	38	16.0%	23	1	24	10.1%
Poles	Poles (Wood & Concrete)	6366	718	11.3%	227	114	341	5.4%
Underground Distribution	Pad Mounted Switchgear	22	5	22.7%	1	1	2	9.1%
	Vault Transformers	64	21	32.8%	1	1	2	3.1%
	Vault Switchgear	26	5	19.2%	1	2	3	11.5%
	Transformer Vault Structures	36	5	13.9%	0	0	0	0.0%
UG Primary Cables (km)	44kV	21.53	0.00	0.00%	0.122	0	0.122	0.001%
	5kV/15kV	214.34	27.70	0.01%	10.74	1.34	12.08	0.01%

Note: The modified table above shows the corrected total pole population (Wood & Concrete)

b) The EXCEL file for part a) is filed as a live excel spreadsheet.

<u>CCC Interrogatory #18</u>

Ref: Ex. 2/T4/S1/p. 178

Please explain the variances in System O&M for the years 2016, 2017 and 2018.

<u>Response</u>

Kingston Hydro is answering this question referencing Table 5.4-2 in the DSP.

The 2016 variances are as follows:

- OEB 5005: Operating Supervision and Engineering over budget by $180,000
- OEB 5010: Load Dispatching under budget by ($95,000)
- OEB 5114: Maintenance of Distribution Station Equipment over budget by $81,000
- OEB 5120: Maintenance of Poles, Towers and Fixtures over budget by $90,000
- OEB 5125: Maintenance of Overhead Conductors and Devices over budget by $132,000

The 2017 variances are as follows:

- OEB 5114: Maintenance of Distribution Station Equipment over budget by $75,000
- OEB 5120: Maintenance of Poles, Towers and Fixtures over budget by $28,000
- OEB 5135: Overhead Distribution Lines and Feeders - Right of Way over budget by $53,000

The 2018 variances are as follows:

- OEB 5020: Overhead Distribution Lines and Feeders - Operation Labour over budget by $82,000
- OEB 5085: Miscellaneous Distribution Expense over budget by $176,000
- OEB 5105: Maintenance Supervision and Engineering over budget by $73,000
- OEB 5114: Maintenance of Distribution Station Equipment over budget by $40,000
- OEB 5125: Maintenance of Overhead Conductors and Devices over budget by $124,000
- OEB 5130: Maintenance of Overhead Services over budget by $37,000

CCC Interrogatory #19

Ref: Ex. 2/T4/S1/p. 203

The material decrease in 2016 is attributed to delays in vehicle purchases and computer system upgrades:

Please explain the nature of the delays in vehicle purchases and computer system upgrades in 2016.

Response

Based on our annual vehicle condition assessment review, a decision was made to defer the replacement of a major vehicle that had been scheduled to be replaced in 2016. This resulted in a material decrease in 2016 expenditures.

In late 2016 and into 2017, Kingston Hydro performed some preliminary investigation and market research into a replacement Customer Information System (CIS) as a member of a consortium. As a result of that research and the withdrawal of a consortium member, the decision was made to continue with the current in-house CIS for the foreseeable future.

<u>CCC Interrogatory #20</u>

Ref: Ex. 2/T4/S1/p. 203

The material decrease in 2020 and 2021 is mainly attributed to a change in prioritization of vehicle replacement strategy:

a) Please explain the change in prioritization of the vehicle replacement strategy compared to the original strategy;
b) Please provide copies of both strategies;
c) Please provide a breakdown of the amount of the decrease in 2020 and 2021 due to a change in prioritization of vehicle replacement strategy;
d) Please discuss the impact of the change on 2023-2027 vehicle replacement costs.

<u>Response</u>

a) The original vehicle replacement strategy involved the replacement of two Workhorse P3 vans in 2020 and one Bucket Material Handling Aerial Vehicle in 2021. These vehicles were replaced in the following manner:

- For 2020 two Workhorse P3 two vans (2001) were scheduled to be replaced. During our annual assessment of vehicles in 2019, these two vehicles were identified for immediate replacement due to condition and maintenance issues. As a result their replacement was accelerated and occurred in 2019. The funds allocated in 2020 were not utilized creating the material decrease in 2020.

- For 2021 a budget of $375,000 was established to replace a 2010 Bucket Material Handing Aerial Device vehicle. In our assessment of a new replacement vehicle our procurement requirements changed resulting in a new aerial bucket vehicle, but one based on a smaller platform. This resulted in a significant dollar saving on the overall cost of the replacement. Those savings created the material decrease in spending.

b) Please refer to answer a) above.

c) For 2020, the estimated budget was $284,000. As these vehicles were purchased in 2019, no vehicle expenditures occurred in 2020.

For 2021, the original budget estimate was $375,000 and the actual expenditure to purchase the vehicle noted earlier was $206,622.65, representing a material decrease of $168,377.35.

d) The material decreases identified for 2020 and 2021 will not have any impact on the 2023-2027 vehicle replacement costs.

<u>CCC Interrogatory #21</u>

Ref: Ex. 2/T4/S1/Appendix B/p. 23

Kinectrics provides recommendations based on the Asset Condition Assessment study results.

Please provide Kingston Hydro's response to each recommendation.

<u>Response</u>

The Kinectrics Asset Condition Assessment (ACA) report issued April 2020 contains recommendations in the Executive Summary and Section V of the report. Kingston Hydro's response to each recommendation is provided below.

<u>Executive Summary Recommendations (page vi – vii of Kinectrics ACA)</u>

Compared to other local distribution utilities, Kingston had above average amount of data for 2019 ACA study, based on which informed decisions could be made. For the purpose of improving ACA study in the future, it is recommended that Kingston enhance data collection in the following areas:

<u>Recommendation 1</u>

- Acquisition of loading data for all the distribution transformers outside stations.

Response

Loading data for distribution transformers could benefit asset condition assessment of transformers and flag new loading trends due to electrification of heating and transportation. However, it is very costly and time consuming to install data loggers on distribution transformers. Alternatively, we could try to leverage smart meter and SCADA data to determine the load of distribution transformers. Unfortunately, existing Kingston Hydro smart meters cannot be aggregated to assess the instantaneous loading of distribution transformers due to their limited time resolution and it will be at least 8 to 10 years before a sufficient number of new smart meters with aggregation capability are deployed. For now, Kingston Hydro will monitor advancements in asset condition assessment of distribution transformers over the next 5 years to determine feasible options for acquisition of loading data for distribution transformers.

Recommendation 2

- Operation cycle counts, for both the normal operation and fault interruption for Station Breakers, as well as manufacturer specification limits on contact resistance and operation cycles, for the purpose of estimating breaker degradation due to usage.

Response

Kingston Hydro currently uses annual IR scans to identify breaker anomalies and initiate preventative maintenance. Kingston Hydro will endeavour to collect cycle counts and merge the annual IR scan data with other inspection/test data for station breakers.

Recommendation 3

- Adoption of a single file (instead of separate files) to contain the inspection and test data for all the individual units, for the asset groups inside stations (Station Transformers, Station Breakers, Station Ganged Switches).

Response

Kingston Hydro will endeavour to merge test data for individual units under the same asset group database.

Recommendation 4

- Historic records of asset removal for all the asset groups inside stations as well as for Pad Mounted Switchgear, Vault Switchgear, Transformer Vaults and UG Primary Cables, for the purpose of developing Kingston specific asset degradation curves in the future.

Response

Implementing this recommendation would require a lot of staff time and effort. For now, Kingston Hydro will monitor advancements in asset condition assessment over the next 5 years in an effort to identify the most useful and practical data that can/should be collected for the noted assets.

Recommendation 5

- Continuous tracking of Underground Cables failures by location in the outage database. Such information has been collected by Kingston for many years. Once sufficient data are available in the future, they could be incorporated in ACA study.

Response

Kingston Hydro will endeavour to track cable faults by cable segments.

Section V Recommendations (Page 23 of Kinectrics ACA)

The following recommendations were made based on the study results:

Recommendation

a. In the future, historic records of asset removal need to be collected for all the asset groups, so as to improve the accuracy of asset degradation curves.

Response

Kingston Hydro will endeavour to improve our asset removal data but sees very little value in developing asset degradation curves given the relatively low population of its asset groups.

Recommendation

b. Inspection records at component level need to be collected for UG Primary Cables, so as to improve the input granularity for better assessment of component condition status.

Response

Kingston Hydro currently uses annual IR scans to identify anomalies with cable terminations/elbows and initiate preventative maintenance. Kingston Hydro will endeavour to merge the annual IR scan data with other inspection/test data for UG Primary Cables.

Recommendation

c. Manufacturer Specification limits for contact resistance and operation cycles need to be collected for Station Breakers and Station Ganged Switches, so as to set up the thresholds for assessing breaker and switch usage.

Response

Kingston Hydro currently uses annual IR scans to identify breaker or switch anomalies and initiate preventative maintenance. Kingston Hydro will endeavour to collect operation cycles and merge the annual IR scan data with other inspection/test data for station breakers and station ganged switches to better assess the asset condition.

Recommendation

d. Operation cycle counts need to be collected for Station Breakers, for both the normal operation and fault interruption. This will help determine the degradation due to different usage.

Response

Kingston Hydro will endeavour to start collecting this additional asset information.

Recommendation

e. Inspection and test data for the individual units under the same asset group need to be merged under one data file for each asset group. This applies to the asset groups inside stations.

Response

Kingston Hydro will endeavour to merge test data for individual units under the same asset group database.

Recommendation

f. Underground Cables failures need to be tracked and recorded. Such information could indicate historic trend in cable degradation in the future when sufficient data have been collected. Efforts would be taken to sort such data by cable segments for statistical processing before being incorporated in ACA study.

Response

Kingston Hydro will endeavour to track cable faults by cable segments.

CCC Interrogatory #22

Ref: Ex. 2/T4/S1/Appendix F General Plant -100454-01 2023 New Vehicle/ p. 1

A 2003 Freightliner M4 aerial bucket truck will be replaced in 2023 with a similar truck. The truck will be 22 years old by the time of its replacement and Fleet mechanics have recommended that it not be extended beyond the in-service date of 2023 Q4:

a) Please discuss the factors considered for Fleet mechanics to recommend that replacement not be extended beyond 2023 Q4;
b) A risk for this project is "under current supply chain issues, a new vehicle can sometimes be delayed for procurement". Please provide the latest forecast in-service date and discuss any current supply chain issues that could impact the latest forecast in-service date.

Response

a) The following factors were considered by Fleet Mechanics in making that recommendation:

Age/Year; Engine Hours; Condition of vehicle and mounted equipment; Third Party Engineering structure reports; Preventative maintenance reports; Unscheduled repairs/maintenance; Parts availability; Historical Reliability; Mechanics observations on future reliability.

b) The most recent information indicates delivery in the last quarter of 2023. We have no additional information to suggest otherwise at this time, from the supplier.

Interrogatory 2-SEC-9

[Ex.2, Appendices 2-AA, 2-BA & BA, Kingston Hydro Responses to OEB Staff Error Checking Q1]:

a) Please provide a revised version of Appendix 2-AB that includes three additional columns that provide 2022 year-to-date actuals, and year-to-date actuals at the same point in time for each of 2020 and 2021.

b) Please provide a revised version of Appendix 2-AB that includes a revised forecast of Kingston Hydro's 2022 net capital expenditures based on 2022 actuals and forecast year-end amounts.

c) The 2022 and 2023 balances ($3,797k and $3,230k) in Appendix 2-AB and 2-BA match and when compared to 2-AA, adjusted for Contributed Capital, also match. Please confirm that Kingston Hydro is assuming no Work in Progress in 2022 and 2023.

Response

a) The table following is a revised version of Appendix 2-AB that includes additional yellow highlighted columns to show the "Year-to-Date Actuals as of Aug 31" for 2020, 2021 and 2022. The cells that are highlighted in blue represent corrections to 2021 data that were included in the response to 2-Staff-11.

Appendix 2-AB
Table 2 - Capital Expenditure Summary from Chapter 5

2023

CATEGORY	Historical Period (previous plan[1] & actual)											
	2020				2021				2022			
	Plan	Actual	YTD	Var	Plan	Actual	YTD	Var	Plan	Actual[2]	YTD	Var
	$ '000		Aug31	%	$ '000		Aug31	%	$ '000		Aug31	%
System Access	364	751	530	106.3%	833	700	494	-16.0%	1,195	114	410	-90.4%
System Renewal	3,054	3,223	2,236	5.5%	3,457	3,192	2,501	-7.7%	2,258	312	1,299	-86.2%
System Service	186	25	6	-86.5%	15	380	271	2433.0%	248	37	115	-85.0%
General Plant	298	168	35	-43.5%	707	467	403	-34.0%	297	3	125	-98.9%
TOTAL EXPENDITURE	3,903	4,168	2,807	6.8%	5,012	4,739	3,669	-5.5%	3,997	466	1,948	-88.3%
Capital Contributions	-	247	81	--	-	133	135	–	200	117	115	-41.4%
Net Capital Expenditures	3,903	3,921	2,726	0.5%	5,012	4,606	3,534	-8.1%	3,797	349	1,834	-90.8%
System O&M	3,449	3,508	1,897	1.7%	3,484	3,467	1,862	-0.5%	3,580	1,201	2,055	-66.5%

b) We currently have no revisions to Kingston Hydro's 2022 net capital expenditure year-end forecast.

c) Confirmed, no WIP has been included in 2022 and 2023 summary of 2-AB, 2-BA or 2-AA.

<u>Interrogatory 2-SEC-10</u>

[Ex.2, Appendix 2-AA] Please provide a revised version of Appendix 2-AA that shows the capital spending for years 2024-2027 that form the basis of the numbers included in Appendix 2-AB for those years.

<u>Response</u>

We don’t have a completed or detailed capital list for 2024-2027 that has been prioritized and approved by the Kingston Hydro board.

Interrogatory 2-SEC-11

[Ex.2, Appendix 2-AA] 2-AA shows spending in 2016 to 2021 and forecasted budget for 2022 and 2023 for Annual Deteriorated Pole Replacement – spot replacements under System Renewal:

a) For 2016 the actual is $1.1M, please provide the approved amount.
b) For each year, please indicate the number of poles replaced.
c) For each year, please detail any other projects that also replaced deteriorated poles and the number of replaced poles associated with each project.

Response

a) The approved 2016 budget amount for the Annual Deteriorated Pole Replacement program was $1,177,000.

b) Due to limited time and resources we are unable to provide the requested breakdown. However, please refer to CCC-17 for a partial response.

c) Due to limited time and resources we are unable to provide the requested info.

Interrogatory 2-SEC-12

[Ex.2, Appendix 2-AB, DSP Table 5.2.2 and p. 207] System Access average spending between 2016-2021 is $609k. The forecasted spending for 2022 is $1,195k, and an average for 2023 – 2027 is $1,170k. Capital Contributions, which are typically associated with System Access are not forecasted to increase, remaining at $200k. Please explain why contributions are not forecasted to increase.

Response

The capital contribution forecast is based on a historic average. There are many variables beyond Kingston Hydro's control that affect the timing of when we receive capital contributions. At this time, we forecast that the total annual capital contributions will be approximately the same as prior years. Having said that, if the capital contributions exceed the forecast in any given year and the "net" capital expenditures for system access are less than forecast, Kingston Hydro will accelerate some projects from system renewal in order to utilize available funds and smooth net capital expenditures over the period covered by the DSP.

<u>Interrogatory 2-SEC-13</u>

[Ex. 2, DSP] Vehicles

Kingston Hydro has not provided a condition assessment report for its fleet and states (p. 91 of DSP) 'Depending on the class of vehicle (i.e. line truck vs. service van) replacement is recommended when the vehicle reaches a prescribed odometer reading, hours of service, or age combined with an upward trend of unscheduled maintenance costs over the last 2-3 years.'

Kingston Hydro states (p. 27 of DSP) 'Some fleet vehicle suppliers are taking orders for delivery in 2024/2025 and in one instance as far out as 2026. Suppliers are also asking for more dollars up front to secure the order due to cost increases including freight costs.':

a) Please provide any condition assessment that Kingston Hydro has done on its fleet as part of its replacement strategy.
b) With respect to historic General Plant expenditures Kingston Hydro states (p. 203 of DSP) 'The material decrease in 2020 and 2021 is mainly attributed to a change in prioritization of vehicle replacement strategy.' Please provide Kingston Hydro's original replacement strategy and the updated one, including plans for 2024 to 2027.
c) Historical annual spending on vehicles (p. 220 of DSP) is an average of $163k between 2016 and 2022. Please explain the low historical spending compared to the forecast ($450k) in 2023.
d) How confident is Kingston Hydro that the new vehicle will be delivered in 2023 given the statement above from page 27 of the DSP.

Response

a) Condition assessment reviews for fleet vehicles consider the following elements used to assess the vehicle and to determine if their useful life has now been reached. The criteria utilized to assess vehicles includes the following: Age/Year; Engine Hours; Condition of vehicle and mounted equipment; Third Party Engineering structure reports; Preventative maintenance reports; Unscheduled repairs/maintenance; Parts availability; Historical Reliability; Mechanics observations on future reliability. These factors are reviewed and discussed for each vehicle with Subject Matter Experts that include mechanics, crews and Third-Party experts who have assessed the vehicles.

The above noted criteria used for evaluating vehicles are then assigned a weighting that is similar for each class of vehicle but varies between classes of vehicles. Vehicles which are critical for operational purposes, such as an aerial bucket truck will have a different weighting than that assigned to a pick-up truck.

Together these elements will influence decisions about replacement, deferral, maintenance and repair activities on each vehicle.

b) For 2020 two Workhorse P3 two vans (2001) were scheduled to be replaced. During our annual assessment of vehicles in 2019, these two vehicles were identified for immediate replacement due to condition and maintenance issues. As a result their replacement was accelerated and occurred in 2019. The funds allocated in 2020 were not utilized creating the material decrease in 2020.

For 2021 a budget of $375,000 was established to replace a 2010 Bucket Material

Handing Aerial Device vehicle. In our assessment of a new replacement vehicle our procurement requirements changed resulting in a new aerial bucket vehicle, but one based on a smaller platform. This resulted in a significant dollar saving on the overall cost of the replacement. That savings created the material decrease in spending.

c) The historical expenditure pattern as measured over a 7 year period contains various expenditure amounts per year based on the size and type of vehicle being purchased. For example, we note the 2017 purchase of $440,994 as compared to $0 expenditures in 2020. The more direct comparison regarding expenditure patterns is between 2017 and 2023 where similar vehicles (Bucket Material Handing Aerial Device vehicles) are being compared, as against the replacement of a pickup truck.

d) The most recent information indicates delivery in the last quarter of 2023. We have no additional information to suggest otherwise at this time.

<u>Interrogatory 2-SEC-14</u>

[Ex.2, DSP pp. 178 & 184, F9, F10 & F12] Poles

Table 5.3-19 shows Summary of Asset Population, Poor Health Distribution, Flagged for Action (FFA) and Total Plan Quantities for 2019-2023 and indicates that there are 6,213 poles (Wood & Concrete); 652 + 1,196 = 1,849 poles are in very poor or poor conditions; 718 are Flagged for FFA and 341 are to be replaced. Page 184 of the DSP states 'Kingston Hydro has a total of 6,213 wood poles in its distribution system with 1,804 poles or 29% of the pole assets in Poor or Very Poor condition and a suggested FFA quantity of 718 poles for the 2019-2023 timeframe. Kingston Hydro will replace approximately 341 poles over this time frame.':

a) Please confirm whether these figures are referring only to wood poles or both wood and concrete poles and explain the discrepancy between the 1,849 in the table and the 1,804.
b) What number of wood and concrete poles have been replaced to date for the 2019-2023 period and what number are forecast to be replace for the remainder of 2022 and for 2023.
c) How many poles will be replaced in each of the projects described in F9, F10 and F12?
d) How many poles are planned to be replaced in the 2024-2027 period?

Response

a) DSP Table 5.3-19 was intended to be a consolidation of the data presented in Table 1 and Table 2 of the Kinectrics Asset Condition Assessment (ACA) report filed as Appendix B of the DSP however, there are some errors as you have noted. The total population of poles (wood and concrete) in DSP Table 5.3-19 should be 6366 (6213 wood poles + 153 concrete poles).

b) Please refer to response to CCC-17.

c) The following is a summary of the number of poles that will be replaced in specific material 2023 projects:

- F.9 System Renewal – Pole Replacement Sir John A Macdonald Ave. – Union to Johnson – Quantity of 8
- F.10 System Renewal – Princess St. Reconstruction – Phase 5 – Division to Alfred – Quantity of 0
- F.12 System Renewal – Annual Deteriorated Pole Replacement Spot Replacements – Quantity of approximately 14 to 15 poles

d) We don’t have a completed or detailed capital list for 2024-2027 that has been prioritized and approved by the Kingston Hydro board.

<u>Interrogatory 2-SEC-15</u>

[Ex.2, DSP p. 43] Please provide a table showing Kingston Hydro's 2023 to 2027 targets for each of the Metrics below, where not shown. Also provide information on metric C2, if there is one.

Category		**Metric**	**Target**
Customer-Oriented Performance	A1	Average Customer Hours of Interruption (CHI) During Severe Weather Days	
	A2	Customer Average Interruption Duration (CAIDI) of Top 10 Days	
	A3	Automated Outage Capability Detection Implementation Progress Definition:	100% Complete
Planning and Execution Efficiency and Effectiveness Measures	B1	Warehouse Inventory Turnover (Days in Inventory)	
	B2	Group Procurement Materials Cost Savings (%)	Discontinued
	B3	Progress of OMS / GIS / CIS Integration Activities	100% Completed
Equipment-Specific Performance Measures	C1	Gas Insulated Switches Planned Outage CHI Avoided	
	C2	?	
	C3	Average CHI for Defective Equipment Outages.	
	C4	System Average Interruption Frequency Index – Defective Equipment by 5 Major Asset Class: Poles, Underground Cables, Transformers.	

Response

We have not determined if these are meaningful metrics or developed targets for these metrics yet. We will endeavour to do so prior to our next rate application filing. There is no C2 metric, this was a numbering error.

<u>Interrogatory 2-SEC-16</u>

[Ex.2, DSP, p. 26] The DSP refers to O. Reg. 509/18 and the impact it may have on the cost and availability of distribution transformers:

a) Has Kingston Hydro factored this impact into its budgeting?
b) If yes, what is the impact?
c) If no, how does Kingston Hydro plan to adjust for any impact?

<u>Response</u>

a) No, we have not factored the potential impact of O.Reg.509/18 into our 2023-2027 forecast.

b) Not applicable.

c) We will monitor our actual costs throughout the year and may need to adjust our capital plans.

Interrogatory 2-SEC-17

[Ex.2, DSP pp. 26 and 228] Page 26 of the DSP states 'Electrification may become a significant planning issue for Kingston Hydro within the timeframe of the current DSP' and on page 228 Kingston Hydro indicates it has allocated some funds to address increased electrification, e.g. a new MTS design and voltage conversion:

a) What is Kingston Hydro's forecast for increased load due to electrification from 2023 to 2027?
b) How has Kingston Hydro factored in this increased load in the load forecast developed in Exhibit 3?
c) How has Kingston Hydro included, if at all, the impact of electrification in its load forecast?

Response

a) Kingston Hydro's "system demand scenarios" showing the potential for increased load due to electrification from 2023 to 2027 can be found in DSP Section 5.3.2(d) (Table 5.3-12 and Table 5.3-13) and come from the 2019-2040 long term planning forecast that Kingston Hydro submitted to the IESO for the recent Peterborough to Kingston region IRRP. To be clear, the system demand electrification forecasts are "what if" scenarios developed from emerging net-zero targets set by federal, provincial and municipal customers who do not yet have implementation plans. The system demand forecasts for electrification do not necessarily have a direct relationship to the annual billed demand forecast used to develop 2023 rates. As further clarification, the system demand scenarios for electrification were developed by adding the estimates of incremental electrification demand to the pre-COVID 2019 system demand and they ignore the current economic impact of the ongoing COVID pandemic.

b) The Reference planning forecast was prepared in 2020/2021 and included an estimate of incremental electric demand for the new electric ferry which was expected to connect as early as 2022. Current project timelines suggest the electric ferry will likely come into service in 2024.

c) The 2023 economic load forecast of Exhibit 3 was developed to predict the total load growth based on historic data and future economic forecasts. The 2023 economic load forecast does not have any specific variable(s) that distinguish the effects of load growth due to electrification from other load growth factors. Kingston Hydro does not anticipate material load growth due to electrification in the test year.

Interrogatory 2-SEC-18

[Ex.2, DSP, Appendix F] Please provide a similar version of the material capital project descriptions sheets that provided for 2023 (Appendix F), for all material capital projects for 2021 and 2022.

Response

The material capital project descriptions for 2021-2022 are included as attachments to these interrogatory responses however, they are based on an older project write-up template version used for filing Kingston Hydro's previous DSP rather than the newer project write-up template version (Appendix F) of the current DSP.

Response to School Energy Coalition (SEC)

Interrogatory #2-SEC-18

Attachment 1 of 2

(2021 Historic Project write-up)

	Project Name: Business Applications (IS&T)	
Kingston Hydro	**Investment Category**: General Plant **Start Date**: 2019-2021 **In Service Date**: 2019-2021	
	Proposed Budget: $261,029	
	System Access: 0%	System Renewal: 0%
	System Service: 0%	General Plant: 100%

A. GENERAL INFORMATION

Kingston Hydro currently shares technology systems with its affiliate, Utilities Kingston and its parent Company, the City of Kingston. This project covers the capital costs associated with maintaining Kingston Hydro's share of software and hardware applications that support the effective and efficient operations of Kingston Hydro.

This project along with Kingston Hydro's percentage of costs are:

Business Applications (IS&T) – 25%

The remaining costs related to the above technology systems are paid for by the other utilities under the management of Utilities Kingston. IS&T costs are split between Kingston Hydro and the natural gas, water, and wastewater utilities as all four of these utilities utilize the software.

Forecast Amount

Total $261,029

2021 Total.. $109,260

Actual Cost Breakdown

2021 Materials $109,260

2020 Materials $66,162

2019 Materials $85,602

Total $261,024

The actual cost variance was $5 lower than the forecast amount.

1. O&M Costs To Be Recovered Through Rates

O&M cost recovery was not expected for this project.

2. Related Customer Attachments and Load

There are no directly related customer attachments and load for this project.

3. Risks to Completion and Risk Mitigation:

Kingston Hydro bears a reduced amount of risk as this project is being jointly implemented with a cost sharing split with Utilities Kingston and the City of Kingston.

4. Comparative Information for Equivalent Projects:

There was no comparable information or equivalent project expected for the project.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG)

No renewable energy elements are expected for the project.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

Efficiency and customer value will be achieved by ensuring that the most cost-effective solution is identified. Reliability will be maintained by managing risks with strong project management methodology.

2. Safety

There were no direct safety concerns expected with the project.

3. Cyber-security, Privacy

Cyber security and privacy were identified early as a mandatory requirement and were reviewed and tested during implementation and post implementation.

4. Co-ordination, Interoperability

There is no direct interoperability or coordination expected for the project.

5. Environmental Benefits

System requirements will include enhanced ability to provide paperless operations.

6. Conservation and Demand Management

No conservation and demand management elements were expected for the project.

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

Not Applicable

Kingston Hydro	**Project Name**: 100439-55 - Bath Rd, Grenville to Armstrong Pole Replacement **Investment Category**: System Renewal **Start Year**: 2020	
	Proposed Budget: $225,000	
	System Access: 0%	System Renewal: 100%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

This project involved the replacement of 14 deteriorated wood poles, and 3 distribution transformers with 14 new wood poles and 3 distribution transformers.

These poles were identified in the annual overhead infrastructure inspection as seriously deteriorated with insufficient clearances for proper worker safety.

Additionally, insufficient clearances caused problems with lines making contact with tree limbs in high winds which caused outages.

This is a multi year project starting in 2020.

Forecast Amount

Total $225,000

2020 Actual Cost Breakdown

Labour & Vehicles $69,322

Materials $55,656

Contracts $22,362

Total $147,340

2021 Actual Cost Breakdown

Labour & Vehicles $38,814

Materials $14,034

Contracts $19,081

Total $82,735

Total Actual Cost...................................... $219,269

1. O&M Costs To Be Recovered Through Rates

No O&M costs for this project will be recovered through rates.

2. Related Customer Attachments and Load

The existing pole mounted transformers affected primarily commercial customers. The pole line contains one 44kV sub-transmission circuit and two 5kV distribution circuits. This pole line was listed as a high priority for the potential number of customers affected by an outage if the pole line were to fail.

3. Risks to Completion and Risk Mitigation:

There was minimal risk to completion.

4. Comparative Information for Equivalent Projects:

KH drew on its costing experience from past projects to develop its budget for this project.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG)

There was no Renewable Energy Generation project associated with this program.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

120/240V spun bus conductor helps avoid unplanned outages caused by contact from tree limbs. The 3 transformers were replaced with 3 transformers, and relocated to new poles with proper clearance and configured to better distribute the load.

2. Safety

The poles in this project were nearing end of useful life, renewal of these assets was necessary to avoid potential risk to public safety that could result from a failure of a wood pole.

3. Cyber-security, Privacy

There were no cyber security concerns related to this project.

4. Co-ordination, Interoperability

This project was coordinated with third party telecoms identified as attachers on assets identified for replacement.

5. Environmental Benefits

No specific clean technology or conservation benefits were associated with this project.

6. Conservation and Demand Management

Conservation and Demand Management were not a factor for this project.

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

1. Condition and Performance Record of Asset

The existing poles have deteriorated due to age.

2. Customer Impacts

Spun bus 120/240V conductor helps avoid unplanned outages caused by contact from tree limbs.

3. Factors Affecting Project Timing/Priority

These poles were identified in the annual overhead infrastructure inspection as seriously deteriorated with insufficient clearances for proper worker safety. This pole line was listed as a high priority for the potential number of customers affected by an outage if the pole line were to fail.

4. Consequence for System O&M Costs

This project will not materially impact system O&M costs.

5. Impact on Reliability and Safety Factors

The old open bus 120/240V conductor were replaced with spun bus 120/240V conductor to avoid unplanned outages caused by contact from tree limbs. The 3 transformers were replaced with 3 transformers, and relocated to new poles with proper clearance and configured to better distribute the load.

D. PHOTOS

Figure 1 – Existing pole line

Figure 2 – New pole line

Kingston Hydro	**Project Name**: 2021 Regulatory Meter Replacements/Seal Updates **Investment Category**: System Access **Start Date**: Jan 2021	**In Service Date**: Dec 2021
	Actual Amount: $162,042	
	System Access: 100%	System Renewal: 0%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

This project involves the installation of electric meters for new services within the KHC service territory. The budget amount here was based on historical trends and forecasted additional services as a result of development within the KHC service territory. The forecast for new services also takes into account the trend emerging for multi-unit buildings to convert from bulk metering to unit metering. This project also involves meter exchanges due to defects, with the quantity budgeted based on a historical average.

Actual Amount

Total .... **$**162,042

Actual Cost Breakdown

Labour & Vehicles $38,050

Materials $123,992

Contracts $0

Total .... **$**162,042

1. O&M Costs to Be Recovered Through Rates

No O&M costs for this project were recovered through rates.

2. Related Customer Attachments and Load

Related customer attachments include the load customers coming onto Kingston Hydro's distribution network, and existing customers that opt to upgrade their electrical services. This project covers an estimated 300 residential GS<50 services; 20 interval type services; and one 1 Tie point.

3. Risks to Completion and Risk Mitigation:

Risks to completing this project are availability of equipment from meter manufacturers. We are mitigating these risks by communicating early with our vendors and suppliers about our needs.

4. Comparative Information for Equivalent Projects:

Comparable costs from previous years include: 2017 - $376,000; 2018 - $440,000; 2019 - $540,000 (340,000+200,000); 2020 - $650,000; 2021 - $205,888.91.

We are also experiencing an inflationary increases on meters, along with additional 5% surcharges due to COVID on freight shipments.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG)

Threr are no O&M costs associated with REG investment.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

This project was important as it related to reliability of billing customers. Accurate measurement is of utmost importance and keeping up with new installs and asset management maintenance is vital to ensuring KHC customers are billed fairly and accurately for the electricity they use.

2. Safety

Meter replacements and installations were completed to modern design standards and use of good utility practices

3. Cyber-security, Privacy

Cyber-security and privacy are important to account for, when dealing with electric meters and data from electric meters. We continue to monitor and improve Cyber Security to meet requirements of the OEB Mandate.

Co-ordination, Interoperability

The installation of smart meters allows for the future possibility of data analysis, and for further refinement of the the outage management system.

4. Environmental Benefits

Using Smart meters allows us to read and troubleshoot the meters remotely, reducing GHG emissions from dispatching staff and vehicles

5. Conservation and Demand Management

Access to smart meter data will allow customers to conserve energy usage.

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

1. Factors Affecting Project Timing/Priority

Supply chain. Due to the COVID 19 Pandemic we are seeing lead times for new meters 40+ weeks making it difficult to order and complete meter changes with-in the same calendar year.

2. Customer Preferences

There are customers that once utilized bulk metering and are moving towards multi-meter installations.

3. Cost Factors/Cost Control

A factor that could affect the final cost of the project could be the delay in being able to receive new meters from manufactures/suppliers, there was also the factor of increased inflation which could raise the cost of materials.

4. Other Planning Objectives Met

Upon completion of the project a review of the factors affecting the final costs of the project was completed and used to factor in the decision making for future projects.

5. Alternatives and Comparison

Alternative metering options, meeting the regulations and Kingston Hydro Conditions of Service, were analyzed and reviewed at the time of application for each customer driven project.

6. Results of Economic Evaluation

Preparing an adequate supply of new electric meters ensures that development projects in the KHC service territory are not delayed by KHC.

7. System Impact

There are no expected impacts of this program to the system.

Kingston Hydro	**Project Name**: Binnington Crt-Cable Upgrade-SK4 to LBC106 **Investment Category**: System Access **Start Year**: 2021	
	Proposed Budget: $80,000	
	System Access: 0%	System Renewal: 100%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

This project involved the replacement of the existing direct buried underground 5kV Tree-Retardant Cross-linked Polyethylene (TR-XLPE) cable with 15kV 500MCM (TR-XLPE) cables and complete duct structure on Binnington Court from switching kiosk (SK6) at Grant Timmins Dr. to LBC106 on Binnington Court.

Forecast Amount

Total ....$ 80,000

2021 Actual Cost Breakdown

Labour & Vehicles $10,626

Materials $47,434

Contracts $10,998

Total $69,058

1. O&M Costs To Be Recovered Through Rates

No O&M costs for this project will be recovered through rates.

2. Related Customer Attachments and Load

This sections of cable of circuit 1402 is part of the feed in the mixed commercial and industrial park in the North End of the City of Kingston. The greatest risk of failure if this project work were not completed would be a lengthy 5kV outage to the commercial and industrial customers in the Dalton Avenue, Grant Timmins Drive and Binnington Court Clyde Industrial Park area. A secondary driver for this project was a customer requested service upgrade in the area.

3. Risks to Completion and Risk Mitigation:

There was minimal risk to completion.

4. Comparative Information for Equivalent Projects:

KH drew on its costing experience from past projects to develop its budget for this project.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG)

There was no Renewable Energy Generation project associated with this program.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

The main driver of the project was assets at the end of their service life. Replacement of the direct buried cables with TR-XLPE cables installed in duct structure will improve asset performance, resulting in reduced risk to customer interruptions associated with cable failures.

2. Safety

Utilizing modern construction standards and materials will increase work and public safety

3. Cyber-security, Privacy

There were no cyber security concerns related to this project.

4. Co-ordination, Interoperability

This project was coordinated with required outages to best manage the timing needs of the commercial customers.

5. Environmental Benefits

No specific clean technology or conservation benefits were associated with this project.

6. Conservation and Demand Management

Conservation and Demand Management were not a factor for this project.

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

1. Condition and Performance Record of Asset

The records for the existing cables was not available.

2. Customer Impacts

1402 circuit is one of the primary feeds in the Clyde Industrial Park which consists of approximately 100 mixed commercial and industrial customers.

The greatest risk of failure if this project work were not completed would be a lengthy outage to the customers in the Clyde Industrial Park.

3. Factors Affecting Project Timing/Priority

This project currently depends on available capital funds but could become an urgent need project should the cable fail. Replacement is recommended because the PILC cables are obsolete and the assets have reached the end of their useful life.

4. Consequence for System O&M Costs

Cable replacement could potentially improve reliability however it is difficult to quantify this benefit in terms of system O&M costs.

5. Impact on Reliability and Safety Factors

Implementation of the project will maintain the system redundancy and system flexibility of the 5kV circuits 1401 and 1402, improving service reliability and operational efficiency, maintaining high customer satisfaction levels.

Kingston Hydro	**Project Name**: 100437-08 – Substation No. 2 5kV PILC Cable Replacement – 203 Circuit **Investment Category**: System Renewal **Start Date**: March 2020 **In Service Date**: December 2020	
	Proposed Budget: $ 100000	
	System Access: 0%	System Renewal: 100%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

This project involved the replacement of four wood poles on MacDonnell Street and Johnson Street, installing new duct work on MacDonnell Street north of Johnson Street and replacing the faulted 5kV PILC 203 circuit cable.

The 203 circuit PILC cable failed in April 2017, the cable fault was located south of the substation (MS 2) at the base of the circuit riser pole on MacDonnell Street at Johnson Street. The integrity of the existing duct work could not be confirmed due to the vintage of the cables and the construction of the duct bank, therefore the replacement of the cables without the installation of new duct would be unfeasible. In addition to the 203 circuit riser the 206 circuit riser was being supported by a shared pole.

It was decided that the most appropriate course of action was to install new ducts on MacDonnell Street out of EM40 required for the replacement of the 203 Circuit cables to a new pole on the North side of Johnson Street. This new 203 circuit riser would accomplish separating the 203 and 206 circuits from each other as well as create a new overhead circuit connection between the 203 circuit and the 1206 circuit increasing the flexibility and reliability of the 4160V distribution system in the area. End of service life poles on MacDonnell Street and Johnson Street were replaced with new poles constructed to modern standards.

Forecast Amount

Total $180,000

Actual Cost Breakdown

Labour & Vehicles .... $ 87,889.69

Materials .... $ 62,459.46

Contracts .... $ 14,370.37

Total $164,719.52

The actual cost variance was +8.2% relative to the forecast amount.

1. O&M Costs To Be Recovered Through Rates

O&M cost recovery is not expected for this capital project.

2. Related Customer Attachments and Load

The 203 Circuit at this location has direct impacts to 163 mixed residential, commercial and institutional customers. Additionally, the 203 Circuit at this location can be used as a back-up for 206 circuit as well as multiple circuits out of MS 6.

3. Risks to Completion and Risk Mitigation:

Minimal risks to completion of the project are expected.

4. Comparative Information for Equivalent Projects:

KH drew on its costing experience from these past projects to develop its budget for this project.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG:

No renewable energy elements are expected for the project.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

The main driver of the project is assets at the end of their service life and resulting failures. Replacement of the PILC cables with TR-XLPE cables will improve asset performance, resulting in reduced risk of customer interruptions associated with cable failures. Implementation of the project restored the 203 circuit back to normal network configurations, improving service reliability and operational efficiency, maintaining high customer satisfaction levels. The installation of the overhead circuit connection to the existing 1206 circuit and 205 circuits improved system flexibility and reliability.

2. Safety

Improved working clearances and pole congestion on the existing riser pole improved safety risk for workers.

3. Cyber-security, Privacy

No cyber-security or privacy concerns are expected with the project.

4. Co-ordination, Interoperability

This new 203 circuit riser would accomplish separating the 203 and 206 circuits from each other as well as create a new overhead circuit connection between the 203 circuit and the 1206 circuit increasing the flexibility and reliability of the 4160V distribution system in the area.

5. Environmental Benefits

An indirect environmental benefit will be realized by decommissioning old PILC cables as this will reduce the amount of cabling containing oil and lead.

6. Conservation and Demand Management

No conservation and demand management elements are expected for the project.

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

1. Condition and Performance Record of Asset

As one of the oldest LDCs in Ontario, Kingston Hydro maintains a large quantity of 5kV PILC cables in its service territory in ages ranging from 40 to 70 years. The majority of riser cables from substations to the first riser poles are PILC cables. Some of them have reached or exceeded their end-of-life and Kingston Hydro is experiencing more PILC cable faults. In the event of a station riser cable fault, a large scale and prolonged outage would happen.

Due to insufficient cable data, particularly cable age and quantity, KH did not perform an asset condition assessment for this asset. Kingston Hydro has monitored cable performance and recorded all cable fault events since 2000. KH monitors cable fault statistics and analyzes the performance trends to develop solutions to address cable failure issues. Reliability Performance Analysis (refer to Exhibit 2, Tab 3, Schedule 2) shows an average of three 5kV 500MCM PILC cable faults in KH distribution system per year between 2005 and 2014, affecting 1848 total customer hours or 0.068 SAIDI in a year. The PILC type cables tend to fail at the elevated cable risers over time as the oil insulation of the cable migrates from the highest point to the lowest point of the cable due to gravity. To address these high asset failure issues, Kingston Hydro has established a systematic plan to replace 5kV PILC cable risers at substations. The 1208 cable riser being in service since 1970 faulted in October 2015 and was taken out of service. The existing riser poles have 5kV cable attachments. The other 5kV cables are of similar vintage and are obsolete PILC type. .

The existing riser poles although in fair condition were built to legacy standards and had reduced working clearances.

2. Customer Impacts

Kingston Hydro's Substation NO. 2 is located on Brock Street in a residential neighborhood. This substation supplies a major strip of commercial businesses on Princess Street, as well as elementary schools, residential homes, townhomes, apartments and community centers.

3. Factors Affecting Project Timing/Priority

Coordination with other infrastructure projects being completed in 2021 at the intersection of MacDonnell Street at Johnson Street~~,~~ affected some of the planning and installation of the new poles and circuit cabling.

4. Consequence for System O&M Costs

No significant consequences for system O&M costs are expected.

5. Impact on Reliability and Safety Factors

Insufficient clearances and riser pole congestion poses a significant safety risk for workers. The lack of the 203 circuit reduces the redundancy of the system and the flexibility of backing up other circuits, which reduce outage times or eliminate them.

6. Alternatives and Comparison

An alternative would be to defer cable replacement and back in faulted cables from other sources. This could ultimately overload backup feeders and power transformers, reduce the effective life of other assets and increase the risk of asset failures.

D. PHOTOS

Figure 1 – Existing 203 and 206 Circuit riser pole showing legacy and non-standard construction with reduced working clearances and pole congestion

Figure 2 – New 203 Circuit riser constructed to modern standards and new overhead circuit connection

Figure 3 – New 206 Circuit riser pole constructed to modern standards and increased clearances

Kingston Hydro	**Project Name**: 100439-54 – Substation No. 2 5kV PILC Cable Replacement – 207 Circuit **Investment Category**: System Renewal **Start Date**: March 2020 **In Service Date**: 2021	
	Proposed Budget: $ 180,000	
	System Access: 0%	System Renewal: 100%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

This project involved the replacement of five wood poles on MacDonnell Street and Mack Street, installing new duct work for on MacDonnell Street north of Brock Street and replacing the faulted 5kV PILC 207 circuit cable.

A cable failure of the 207 circuit occurred in August 2018. The cable fault was located north of the electric maintenance hole (EM39) east of the substation (MS 2). The existing duct work had collapsed at approximately the location of the cable fault making repairs or replacement without the installation of new duct unfeasible.

It was decided that the most appropriate course of action was to install new ducts on MacDonnell Street out of EM39 required for the replacement of the 207 Circuit cables as well as future replacement requirements of two other circuits, 208 and 201 circuits. End of service life poles on MacDonnell Street between Brock Street and Dundas Street were replaced with new taller poles and constructed for future overhead circuit extensions for 201 and 208 circuit cable replacements. A one block section of a 207 circuit single phase was reconfigured to service existing properties form the new poles installed on MacDonnell Street.

Forecast Amount

Total $180,000

Actual Cost Breakdown

Labour & Vehicles ....$ 116,544.43

Materials ....$ 173,281.28

Total $289,825.71

The actual cost variance was +38% relative to the forecast amount; this is also a multi-year project.

1. O&M Costs To Be Recovered Through Rates

O&M cost recovery is not expected for this capital project.

2. Related Customer Attachments and Load

The 207 Circuit at this location have direct impacts to 775 mixed residential, commercial and institutional customers.

3. Risks to Completion and Risk Mitigation:

No risks to completion were expected with the project.

4. Comparative Information for Equivalent Projects:

Kingston Hydro drew on its costing experience from these past projects to develop its budget for this project.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG:

No renewable energy elements were expected for the project.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

The main driver of the project is assets at the end of their service life and resulting failure. Replacement of the PILC cables with TR-XLPE cables will improve asset performance, resulting in reduced risk to customer interruptions associated with cable failures. Implementation of the project restored the 207 circuit back to normal network configurations, improving service reliability and operational efficiency, maintaining high customer satisfaction levels

2. Safety

Reduced clearances and pole congestion on the existing riser pole presents a safety risk for workers.

3. Cyber-security, Privacy

No cyber-security or privacy concerns were expected with the project.

4. Co-ordination, Interoperability

No further interoperability was expected from the project.

5. Environmental Benefits

An indirect environmental benefit will be realized by decommissioning old PILC cables as this will reduce the amount of cabling containing oil and lead.

6. Conservation and Demand Management

No conservation and demand management elements were expected for the project.

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

1. Condition and Performance Record of Asset

As one of the oldest LDCs in Ontario, Kingston Hydro maintains a large quantity of 5kV PILC cables in its service territory in ages ranging from 40 to 70 years. The majority of riser cables from substations to the first riser poles are PILC cables. Some of them have reached or exceeded their end-of-life and Kingston Hydro is experiencing more PILC cable faults. In the event of a station riser cable fault, a large scale of prolonged outage would happen.

Due to insufficient cable data, particularly cable age and quantity, KH did not perform an asset condition assessment for this asset. Kingston Hydro has monitored cable performance and recorded all cable fault events since 2000. KH monitors cable fault statistics and analyzes the performance trends to develop solutions to address cable failure issues. Reliability Performance Analysis (refer to Exhibit 2, Tab 3, Schedule 2) shows an average of three 5kV 500MCM PILC cable faults in KH distribution system per year between 2005 and 2014, affecting 1848 total customer hours or 0.068 SAIDI in a year. The PILC type cables tend to fail at the elevated cable risers over time as the oil insulation of the cable migrates from the highest point to the lowest point of the cable due to gravity. To address these high asset failure issues, Kingston Hydro has established a systematic plan to replace 5kV PILC cable risers at substations. The 1208 cable riser being in service since 1970 faulted in October 2015 and was taken out of service. The existing riser poles have 5kV cable attachments. The other 5kV cables are of similar vintage and are obsolete PILC type which tend to fail at the elevated cable risers over time as the oil insulation of the cable migrates from the highest point to the lowest point of the cable due to gravity.

The existing riser poles although in fair condition were built to legacy standards and had reduced working clearances.

2. Customer Impacts

Kingston Hydro's Substation NO. 2 is located on Brock Street in a residential neighbourhood. This substation supplies a major strip of commercial businesses on Princess Street, as well as elementary schools, residential homes, townhomes, apartments and community centers.

3. Factors Affecting Project Timing/Priority

Reduction in the available budget due to COVID-19 reduced the original scope of the project to not include additional pole replacements on MacDonnell Street at Durham Street. These additional replacements and circuit improvements on MacDonnell Street and Durham Street will be completed 2021.

4. Consequence for System O&M Costs

Cable replacement could potentially improve reliability however it is difficult to quantify this benefit in terms of system O&M costs.

5. Impact on Reliability and Safety Factors

Insufficient clearances and riser pole congestion poses a significant safety risk for workers. The lack of the 207 circuit reduces the redundancy of the system and the flexibility of backing up other circuits, which reduce outage times or eliminate them.

6. Alternatives and Comparison

An alternative would be to defer cable replacement and back in faulted cables from other sources. This could ultimately overload backup feeders and power transformers, reduce the effective life of other assets and increase the risk of asset failures.

D. PHOTOS

Figure 1 – Existing 207 Circuit riser pole showing legacy and non-standard construction with reduced working clearances

Figure 2 – New 207 Circuit riser constructed to modern standards and increased clearances, note additonal space on poles for future 201 and 208 circuit extensions

Figure 3 & Figure 4 – New 207 circuit ducts, future use 201 and 208 circuit ducts installed on MacDonnell Street

Figure 5 – New pole constructed to modern standards and increased clearances in comparison to an existing pole, note additonal space on poles for future 201 and 208 circuit extensions above 207 Circuit

Kingston Hydro	**Project Name**: 100437-10 – King St. West - Beverly St to George St **Investment Category**: System Renewal **Start Date**: January 2021 **In Service Date**: August 2021	
	Proposed Budget: $355,000	
	System Access: 0%	System Renewal: 100%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

This project involves the replacement of 16 deteriorated wood poles, replaced two underground circuits, and three distribution transformers. These poles were identified in the annual overhead infrastructure inspection as seriously deteriorated with insufficient clearances for proper worker safety. In addition, there were two underground circuits that added to the new overhead pole section. Several of the poles were in a sensitive park area, and effort was made to preserve as much of the tree canopy as possible, and to protect the poles along a busy road section.

Forecast Amount

Total $355,000

Actual Cost Breakdown

Labour & Vehicles .... $ 152,319.36

Materials .... $ 185,179.30

Contracts .... $ 71,155.41

Total .... $ 408,654.07

The actual cost variance was +15% relative to the forecast amount.

1. O&M Costs To Be Recovered Through Rates

O&M cost recovery is not expected for this capital project.

2. Related Customer Attachments and Load

The existing pole mounted transformers affect primarily residential customers, and one 600V transformer fed a water pumping station. This pole line was listed as a high priority for the potential number of customers affected by an outage if the pole line were to fail.

3. Risks to Completion and Risk Mitigation:

There was risk to location of poles due to a high number of utilities in the construction area, the proximity to a high pressure water main, and traffic volumes along the road side for work. Mitigating factors included construction during the early winter months allowing crews to get off the road, and following the return of people to work places a contractor was used to help close the road for workers safety.

4. Comparative Information for Equivalent Projects:

KH drew on its costing experience from these past projects to develop its budget for this project.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG):

No renewable energy elements are expected for the project.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

The new transformers will be located strategically to better distribute the loads. The new poles will be constructed using modern materials, clearances and configured for improved worker and public safety.

2. Safety

Utilizing modern construction standards and materials will increase work and public safety

3. Cyber-security, Privacy

No cyber-security or privacy concerns are expected with the project.

4. Co-ordination, Interoperability

Restored the interconnection between circuit 608 and circuit 901.

5. Environmental Benefits

The construction was designed in such a way as to minimize the interference with the existing tree line.

6. Conservation and Demand Management

No conservation and demand management elements are expected for the project.

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

1. Condition and Performance Record of Asset

The existing poles have deteriorated due to age, and the cables had deteriorated due to age. The limited working clearances and separation between overhead circuits posed maintenance and operational restrictions. It also repaired the interconnection of circuits 608 and 901.

2. Customer Impacts

Locating the new poles to less vulnerable locations reduces the risks of unplanned outages due to vehicular impacts, and allowed for the preservation of the tree canopy in the park.

3. Factors Affecting Project Timing/Priority

These poles were identified in the annual overhead infrastructure inspection as seriously deteriorated along with the deterioration of two nearby underground circuits. This pole line was listed as a high priority for the potential number of customers affected by an outage if the pole line were to fail.

4. Consequence for System O&M Costs

No significant consequences for system O&M costs are expected.

5. Impact on Reliability and Safety Factors

The 3 transformers will be replaced with 3 transformers and relocated to new poles with proper clearance and configured to better distribute the load.

6. Alternatives and Comparison

Consideration was given to replacing the underground cables in the existing ducts, but it was determined the structures were not sound. Consideration of installing the line on the north side, in the small section between road and sidewalk, but it was not a very large area and would have required the removal of a large number of trees. Going underground along the existing pole line would have also been hampered by the other existing utilities infrastructure in close proximity, and maintaining electrical service to the area. Thus, the most efficient and economical design was the one chosen after exhausting these other options.

D. PHOTOS

Figure 1 – Existing poles showing new poles working around canopy with improved working clearances

Figure 2 – Existing pole showing legacy construction standards.

Figure 3 & 4 – New poles showing modern construction standards and equipment

Kingston Hydro	**Project Name**: 100438-08 - Manhole Rebuild – EM36 – King Street West at Beverley Street **Investment Category**: System Renewal **Start Date**: January 2021 **In Service Date**: November 2021	
	Proposed Budget: $100,000	
	System Access: 0%	System Renewal: 100%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

This project involves civil reconstruction of the existing deteriorated electrical manhole (EM36) at the intersection of King Street West at Beverley Street. This manhole houses three primary circuits with direct impacts to the King St Water Treatment Plant as well as approximately 600 mix residential and commercial properties.

Forecast Amount

Total $100,000

Actual Cost Breakdown

Labour & Vehicles ....$ 51,974.34

Materials ....$ 27,830.15

<u>Contracts..$ 60,715.21</u>

Total ....$ 140,519.70

The actual cost variance was + $40,519 (+40.5%) relative to the forecast amount.

1. O&M Costs to Be Recovered Through Rates

O&M cost recovery is not expected for this capital project.

2. Related Customer Attachments and Load

There were no customer attachments in the direct scope of the project; the load customers affected is noted above.

3. Risks to Completion and Risk Mitigation:

There is minimal risk to completion.

4. Comparative Information for Equivalent Projects:

The cost estimate for this project was based on actual costs experienced in the similar projects Kingston Hydro conducted in the past.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG):

There were no elements associated with renewable energy generation.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

The main driver of the project is assets at the end of their service life. The replacement of the existing manhole will ensure that the existing circuits can remain in service and maintained in normal operation.

2. Safety

Utilizing modern construction standards and materials will increase work and public safety

3. Cyber-security, Privacy

No present cyber-security or privacy concerns are expected with the project.

4. Co-ordination, Interoperability

This project was completed in coordination with the planned pole replacements on Leroy Grant Drive and King Street West

5. Environmental Benefits

No environmental benefits; though care was taken to minimize the environmental impact of the construction.

6. Conservation and Demand Management

No conservation and demand management elements are expected for the project.

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

1. Condition and Performance Record of Asset

The driver of the project was the failure of circuits 608 and 609 as noted below.

2. Customer Impacts

608 and 609 circuits, which both run directly though EM36, are the primary feeds to approximately 600 mixed commercial and industrial customers and are back-up circuits to support the downtown area and substations MS 1 and MS 9.

The greatest risk of failure if this project work were not completed would be lengthy outages for both 608 and 609 circuits while repairs to the existing structure are being completed.

3. Factors Affecting Project Timing/Priority

This project currently depends on available capital funds but could become an urgent need project should the cable fail. Replacement is recommended because the PILC cables are obsolete, and the assets have reached the end of their useful life. This project was expedited due to the cable failure of both 608 and 609 circuits on King Street West.

4. Consequence for System O&M Costs

No significant consequences for system O&M costs are expected.

5. Impact on Reliability and Safety Factors

Completion of the project in 2021 restored the system redundancy and system flexibility of the 5kV circuits 608 and 609 improving service reliability and operational efficiency, maintaining high customer satisfaction levels.

6. Alternatives and Comparison

Other options were not very viable, due to the interconnections required for coordinating with the King Street project. An alternate location of the north side of the street was more expensive due to the road cuts required, and would require further remediation work in EM36 as well. Thus, the choice of project location was the most efficient, economical, and provided the best location to coordinate with other work in the area.

D. <u>PHOTOS</u>

Figure 1 – New 608 and 609 circuit concrete encased duct bank

Figure 2 – New EM36 with completed cabling and transition splices to the existing PILC cables of both 608 and 609 circuits

Kingston Hydro	**Project Name**: 100439-69 – Leroy Grant Dr – John Counter Blvd to MS 13 (Third Ave) **Investment Category**: System Renewal **Start Date**: July 2021 **In Service Date**: December 2021	
	Proposed Budget: $198,800	
	System Access: 0%	System Renewal: 100%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

This project involved the replacement of twenty-four deteriorated wood poles along the Leroy Grant Drive Trail as well as the replacement of an additional eleven poles, and two distribution transformers. These poles were identified in the annual overhead infrastructure inspection as seriously deteriorated with insufficient clearances for proper worker safety. Several of the existing poles are in vulnerable locations. The new poles were relocated to behind the sidewalk to better protect them. This project was coordinated with the 13.8kV circuit expansion to the Williamsville Area.

Forecast Amount

Total $198,800

Actual Cost Breakdown

Labour & Vehicles ....$ 91,250.82

Materials ....$ 72,079.82

Contracts..$ 38,018.80

Total ....$ 201,349.35

The actual cost variance was +$2,639.35 / +2% relative to the forecast amount.

1. O&M Costs to Be Recovered Through Rates

O&M costs will not be recovered through rates.

2. Related Customer Attachments and Load

This program involved the replacement of wood poles that have a high risk of failing.

The existing pole mounted transformers affect primarily residential customers. These pole lines were listed as a high priority for the potential number of customers affected by an outage if the pole line were to fail

3. Risks to Completion and Risk Mitigation:

There is minimal risk to completion.

4. Comparative Information for Equivalent Projects:

Kingston Hydro regularly reviews pole conditions. The cost estimate for this project was based on actual costs experienced in the similar projects Kingston Hydro conducted in the past.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG:

This fund is not associated with REG facilities.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

This project was driven by Kingston Hydro's deteriorated pole program. This project involved the replacement of wood poles that have a high risk of failing.

The new transformers have been located strategically to better distribute the loads. The new poles were constructed using modern materials, clearances and configured for improved worker and public safety.

2. Safety

Renewal of these assets was necessary to avoid potential risk to public safety that could result from a failure of a wood pole. Utilizing modern construction standards and materials has increased worker and public safety

3. Cyber-security, Privacy

Not Applicable

4. Co-ordination, Interoperability

Not Applicable

5. Environmental Benefits

Not Applicable

6. Conservation and Demand Management

Not Applicable

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

1. Condition and Performance Record of Asset

Wood poles are visually inspected at least once every three years in accordance with Ontario Energy Board requirements. A competent line person may also perform a hammer test in addition to the visual inspection depending upon the pole condition and history. Many poles on Leroy Grant Drive were identified by pole inspections and prioritized for action due to condition and the assets connected to this pole line. The limited working clearances and separation between overhead circuits pose maintenance and operational restrictions.

2. Customer Impacts

Approximately 30 residential customers experienced short duration power outages for transfers,

3. Factors Affecting Project Timing/Priority

The timing for this project is dictated by the pole analysis results and the number of end-of-service-life poles in this section of line as well as well as the fact there are one 44kV and one 5kV main circuit on these poles. These poles were identified in the annual overhead infrastructure inspection as seriously deteriorated with insufficient clearances for proper worker safety.

4. Consequence for System O&M Costs

Not Applicable

5. Impact on Reliability and Safety Factors

Renewal of these assets was necessary to avoid potential risk to public safety that could result from a failure of a wood pole as well as to provide a more robust and reliable system

The 3 transformers have been replaced with 3 transformers and relocated to new poles with proper clearance and configured to better distribute the load.

6. Alternatives and Comparison

Not Applicable

D. <u>PHOTOS</u>


Figure 1 & 2 – Existing poles showing legacy construction standards, limited working space and poor pole conditions


Figure 3 & 4 – New poles constructed to modern standards and improved clearances.

	Project Name: Substation No. 1 Rebuild – 2015-2021 **Investment Category**: System Renewal **Start Date**: Jan 2015	**In Service Date**: Nov 2021
	Proposed Budget: $*See below	
	System Access: 0%	System Renewal: 100%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

B. 

C. Figure 1 - View of Substation No. 1 from Queen Street– May 2015

Project Overview

Substation No. 1 was built around 1892 and is located at 27 Queen Street in the North Block district of downtown Kingston.

The operational layout of Substation No.1 has remained largely unchanged since the last major upgrade in the 1950s.

Upgrading Substation No. 1 poses some unique challenges from an environmental and structural perspective. For example, the surrounding soil contains contaminants from coal gasification activities that took place 100 years ago and there are no original construction documents available so assessments are required (e.g. structural, designated substances, etc.) prior to planning or undertaking major alterations. To complicate things further, the Substation No. 1 building is designated under the

Ontario Heritage Act which requires additional approvals and permits if Kingston Hydro wishes to make alterations to the façade of the building.

In 2012, Kingston Hydro retained a consultant to prepare a condition assessment and options report for Substation No.1. Kingston Hydro selected upgrade Option A2 which involves reusing the existing 44kV open bus work and replacing the existing transformers and 44kV circuit breakers in generally the same location inside the substation.

The 2012 condition report noted that the existing power transformers were reaching end-of-life and recommended replacement as soon as practically possible. Recent transformer oil analysis results from oil samples taken in November 2018 indicate signs of rapid deterioration since 2012 which has prompted UK staff to explore options to fast track replacement of all six transformers by end of 2021.

For further background regarding the history, condition assessment and options report, please refer to the 2015-2021 Substation No. 1 Rebuild project description found in the Distribution System Plan of the Kingston Hydro 2016 Cost-of-Service (COS) application (EB-2015-0083).

<u>Existing Substation Layout and Distribution Arrangement</u>

The existing main floor layout and simplified single line diagram of Substation No. 1 are shown in Figure 2 and Figure 3 below respectively.

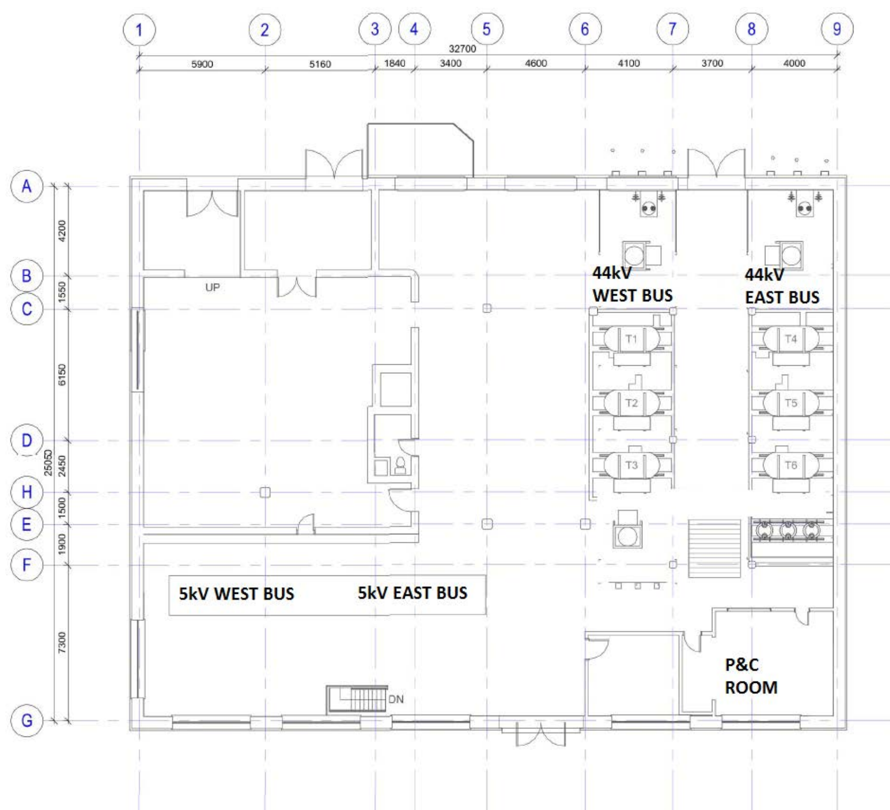


Figure 2 – Substation No.1 - Existing Floor Plan Layout

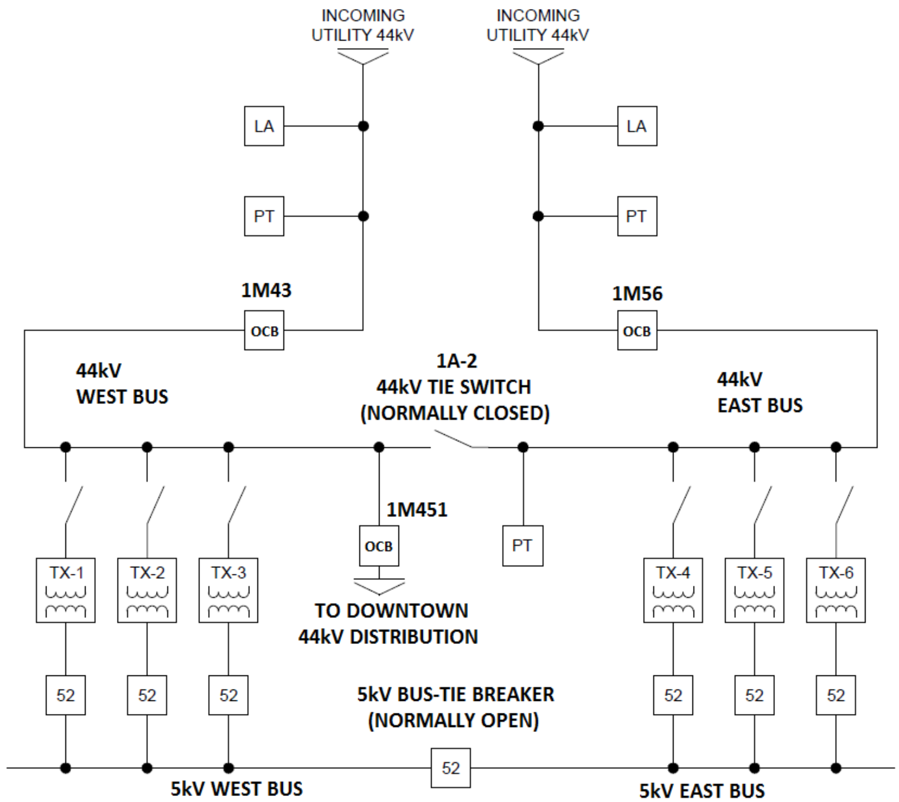


Figure 3 – Substation No. 1 – Simplified Single Line Diagram

The substation is normally supplied from two 44kV sources:

1. Frontenac 3M4 (FM4) running approx. 4.2 km from Hydro One Frontenac TS
2. Frontenac 3M5 (FM5) running approx. 4.2 km from Hydro One Frontenac TS

The existing 44kV distribution within the substation consists of open bus that can be segmented into two distinct bus sections, 44kV East Bus and 44kV West Bus, by opening a normally closed Tie Switch (1A-2).

The 44kV East Bus consists of:

- One 44kV Oil Circuit Breaker (1M56) for the incoming supply from the FM5 feeder
- One single phase Potential Transformer monitoring one phase on the line side of the 1M56 OCB
- Three 3MVA water-cooled transformers (T4, T5, T6) with 44kV primary, 4.16/2.4kV secondary
- One three phase Potential Transformer bank monitoring all three phases of the 44kV East Bus
- Various 44kV isolation switches

The 44kV West Bus consists of:

- One 44kV Oil Circuit Breaker (1M43) for the incoming supply from the FM4 feeder
- One single phase Potential Transformer monitoring one phase on the line side of the 1M43 OCB
- Three 3MVA water-cooled transformers (T1, T2, T3) with 44kV primary, 4160/2400V secondary
- One 44kV Oil Circuit Breaker (1M451) for the outgoing 44kV supply to downtown
- Various 44kV isolation switches

<u>44kV Supply Alterations</u>

Up until 2006, Substation No.1 was fed from two 44kV overhead lines. The 44kV overhead conductors were terminated at high level on the exterior rear north wall of the substation and fed the 44kV distribution inside Substation No.1 through the wall via existing 44kV bushings. In 2006, the two 44kV overhead lines were replaced with underground cable from Barrack Street to Substation No.1 to allow for the construction of a new Large Venue Entertainment Centre (LVEC) one block north of Substation No.1. Kingston Hydro had not yet developed a plan to rebuild Substation No. 1 so the new 44kV cables were terminated at high level on the exterior north wall of Substation No. 1 and the existing 44kv wall bushings were reused. In 2016, Kingston Hydro extended the 44kV ducts into Substation No.1 and relocated the 44kV cable risers from the exterior to the interior face of the rear north wall of the substation. Relocating the cable risers inside Substation No. 1 reduces the risk of foreign contact with the live 44kV cable terminations thus creating a safer and more reliable supply. Several 44kV potential transformers associated with 44kV protection had to be replaced and relocated inside Substation No. 1 to facilitate the relocation of the 44kV cable risers.

<u>Building Envelope Remediation and Seismic Screening Study</u>

In 2015, a building inspection revealed water damage along portions of the rear north wall of Substation No.1. This water damage was exasperated by the drainage of the built-up roof to leaking eavestrough along the fascia of the rear north wall. Fortunately, the rear façade of Substation No.1 has no significant architectural features and Kingston Hydro was able to quickly obtain approvals from the City to perform remediation work.

From 2015 to 2017 Kingston Hydro undertook the following building envelope remediation work to the north wall of Substation No. 1:

- Roof membrane leak repairs
- Fascia, eavestrough and downspout replacement
- Structural repairs to a pilaster that had deteriorated due to water damage
- Diverted downspouts to storm water catch basin
- Spot brick replacements and mortar repointing repairs

In 2015, Kingston Hydro retained an engineering firm to perform a seismic screening study of Substation No.1 and identify upgrade options to provide post-disaster protection. Kingston Hydro emphasized to the consultant that there was limited funding available and that the primary focus should be about protecting the electrical plant within the building with less emphasis on architectural preservation/restoration. The final Seismic Screening report issued in August 2015 concluded that the existing legacy unreinforced-masonry (URM) building cannot withstand the seismic design loads associated with post-disaster usage. The report also identified two seismic upgrade options; Option 1 considered preservation of the existing building envelope as a means to protecting the internal electrical plant while Option 2 considered internal upgrading strategies with protection priority specifically given to the internal electrical plant and not with regards to preserving the building envelope. The estimates for Option 1 and Option 2 were $1,600,000 and $950,000 respectively with Class D accuracy (between -20% and +30%).

Kingston Hydro decided to forego structural upgrades and maintain the existing structure (status quo option) after carefully considering the findings of the Seismic Screening Study and requirements of the 2010 National Building Code and the 2012 Ontario Building Code. This decision was based on the fact that the Substation No.1 structure has been standing for over 100 years and Kingston Hydro did not want to risk delaying the transformer upgrades or project cost overruns due to uncertainty of the scope of work associated with seismic upgrades.

Miscellaneous Electrical Upgrades

Renovations to the control room inside Substation No. 1 and installation of a new relay rack were deemed to be a necessary first step in 2015 to prepare for the future installation of new 44kV/5kV Bus Protection and 44kV feeder protection relays. Staff also installed cable trays in the basement of Substation No. 1 to prepare for new Protection & Control (P&C) wiring.

The Station Service was also upgraded from a 120/240V single phase service to a 120/208V three phase service. The existing station service transformer was oil-filled and had live 5kV terminations that required a metal barrier for worker safety. Upgrading the station service transformer to a dry-type transformer with primary termination barriers was deemed to be one of the most important first steps to reducing hazards and improving worker safety in the substation.

Kingston Hydro retained an engineering consultant in 2018 to prepare a DC Coordination study of the DC battery system at Substation No.1. The final report issued in June 2019 recommended increasing the DC battery size to meet existing and proposed amp-hour sizing requirements.

In 2018-2019, staff assessed the grounding resistance of the 44kV concentric neutrals and 5kV system neutrals that terminate at Substation No. 1using a handheld clamp-on ground resistance meter and determined that the effective grounding resistance of the Substation No. 1 grounding system is significantly enhanced/lowered due to the interconnection of the multi-grounded 5kV neutrals and 44kV concentric neutrals. The legacy grounding scheme at Substation No. 1 meets best industry practices prior to 1970 for 44kV substations, however, Kingston Hydro could take further action as follows:

1. Install bare copper ground bus in the 44kV East and West bus area of the building to facility grounding for work protection purposes.

2. Commission a current injection test to provide additional measurement and verification of the effectiveness of the existing grounding scheme at Substation No. 1

and/or

3. Design, construct and test an on-site ground electrode in accordance with IEEE 80 standard which is the current industry best practice when building a new 44kV station

The bare copper ground bus was installed in 2018, however, staff believe that consideration of Option 2 and Option 3 should be delayed until the power transformers are replaced. It is complex and costly (greater than $100,000) to perform current injection tests in an urban environment and it would be extremely complex and costly to construct an on-site ground electrode (approx. $1,000,000) due to the limited available surrounding real estate, shallow soil depth (limestone bedrock is typically 12" to 36" below grade), rock boring/removal and environmental risks (e.g. contaminated soil or ground water due to presence of coal tar).

In summary, Kingston Hydro is satisfied that the existing grounding system at Substation No. 1 meets best industry practices prior to 1970 and believes it is most important to focus on transformer replacement and protection upgrades. In the future Kingston Hydro may do additional investigation and/or enhancement of the grounding system but this is not a priority for the current 2020-2025 capital plan.

5kV & 44kV Protection Upgrades

The existing 5kV and 44kV protection & control (P&C) consisted of legacy electromechanical relays installed in the 1950s and SCADA monitoring and control equipment retrofitted in the 1980s-1990s that are now obsolete. The new 5kV and 44kV P&C consists of micro-processor based protection relays with SCADA networking capabilities.

Over the 2015-2019 time period, Kingston Hydro developed the new 5kV and 44kV protection schemes for Substation No.1 with assistance from an engineering consultant.

A total of fourteen 5kV protection relays were upgraded over the 2016-2018 timeframe. The first 5kV feeder protection relay (Circuit 109 fed from the 5kV East Bus) was upgraded in 2016 and served as a proto-type for the other 5kV feeders and transfer bus breakers. The remaining 5kV feeder and transfer bus protection relays of the East and West bus were upgraded in 2017 and 2018 respectively.

Protection relays for the six main 5kV breakers, bus-tie breaker and associated 5kV fast bus protection scheme were upgraded in 2019.

The 44kV west bus differential protection, 44kV east bus differential protection and the 44kV line protection associated with the 1M451 breaker were upgraded in 2020 and 2021 in conjunction with the replacement of the power transformers and 44kV oil circuit breakers.

The existing legacy 44kV pilot wire protection at Substation No.1 will be coordinated with Hydro One under a separate project. Hydro One has upgraded the 44kV M4 and M5 line protection at Frontenac TS in 2021.

<u>44kV High-voltage Equipment Upgrades</u>

The six existing 44kV legacy open-loop water cooled transformers were rebuilt in 1950s. The oil analysis suggests these transformers have reached their end of life. The existing 44kV oil breakers (OCBs) were built in 1990s, the time tests suggest the interruption time of the worst breaker has increased to 110ms compared with the maximum design rating of 75ms. There are seven 44kV OCBs in Kingston Hydro system. Kingston Hydro has replaced two failed 44kV bushings of the 44kV OCBs in other substations. All suggest that these OCBs have reached their end of life. T1, T2 and T3 transformers and two OCBs on the 44kV West Bus were replaced in 2020. The T4, T5 and T6 transformers and one OCB on the 44kV East Bus were replaced in 2021.

Forecast Amount

The following 2015-2020 budget amounts were approved for the Substation No. 1 Rebuild as part of Kingston Hydro's 2016 Cost of Service (COS) application (EB-2015-0083):

	2015 to 2020	2021	Total
Budget	$3,191,000	$2,410,000	$5,601,000

***NOTE:** Kingston Hydro increased the 2019 budget by $520,515 and the 2020 budget by $520,000 in order to fast track the replacement of six existing transformers that are in very poor condition.

Actual Cost Breakdown

The actual costs are summarized in the table below:

	2015 to 2021
Labour & Vehicles	$1,799,058
Materials	$2,844,674
Contracts	$409,340
Total Spend	$5,053,072

The actual cost variance relative to the forecast amount is summarized in the table below:

	2015 to 2020
$ Variance	$547,928
% Variance	-9.78%

Kingston Hydro's spending meets the total budget target of $5,601,000 for this project.

1. O&M Costs To Be Recovered Through Rates

Annual O&M savings for replacing water cooled transformers with air cooled transformers is approximately at $15,000 per year.

2. Related Customer Attachments and Load

There were no directly connected customer atachments to the project.

3. Risks to Completion and Risk Mitigation:

There is a risk that one or more of the six power transformers that have reached end of life could fail within the next 10 years. However, some of the 5kV circuits can be backed up by alternate feeders for a period of 12 to 24 months should one or two transformers fail.

The greatest concern is the risk of collateral damage to 44kV equipment located nearby should there be a catastrophic transformer failure. Staff have focused their attention on electrical protection maintenance and upgrades to mitigate this risk. Transformer oil analysis is also being monitored on a regular basis for signs of deterioration, especially the presence of combustible dissolved gases.

4. Comparative Information for Equivalent Projects:

Kingston Hydro has undertaken various transformer and switchgear upgrades over the past decade and has competent staff that can complete the electrical upgrades. However, Substation No. 1 poses some unique challenges from an environmental and structural perspective. For example, the surrounding soil likely contains contaminants from coal gasification activities that took place on and around the site 100 years ago and there are no construction blueprints available so assessment of the structure and materials (e.g. designated substances) is required prior to planning or undertaking any alterations. To compound things further, the Substation No. 1 building is designated under the Ontario Heritage Act which requires special approvals and permits if Kingston Hydro wishes to make alterations to the façade of the building.

Material costs related to power transformers and cables are expected to be comparable to historic substation costs. However, Kingston Hydro has no directly comparable project costs in the event it is necessary to undertake, environmental or structural remediation. With that in mind, Kingston Hydro has decided to reuse the existing 44kV bus work and transformer pad locations in an effort to minimize the need for environmental and/or structural remediation.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG):

No renewable energy elements are expected for the project.

D. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

The six power transformers at Substation No. 1 have reached the end of their useful life and are in very poor condition. The reliability of the 5kV and 44kV distribution associated with MS1 is at risk so Kingston Hydro has fast tracked the transformer replacement to be completed by end of 2021. By pacing the investments in Substation No. 1 over 7 years, Kingston Hydro can minimize the impact of this significant project on distribution rates.

2. Safety

The protection and equipment upgrades at Substation No. 1 will improve both public and worker safety. Some of the live exposed legacy 44kV bus work will not be replaced in an effort to manage overall capital and maintenance costs. UK staff will maintain safe limits of approach to the live exposed 44kV bus work through a combination of physical barriers and good work protection practices.

3. Cyber-security, Privacy

The existing protection relays are being upgraded from electro-mechanical type to micro-processor type that will be connected to the Kingston Hydro SCADA network. Kingston Hydro will ensure that its secure SCADA network continues to meet applicable Cyber-security and privacy standards.

4. Co-ordination, Interoperability

This project includes upgrades to the 44kV and 5kV protection schemes which will improve remote SCADA control and monitoring of the substation.

5. Environmental Benefits

An indirect local environmental benefit (e.g. conservation of water resources) will be realized when the legacy open-loop water cooled power transformers are decommissioned.

6. Conservation and Demand Management

Eliminating the legacy open-loop water cooled power transformers will conserve water and reduce the amount of energy consumed at local water treatment facilities.

E. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

1. Condition and Performance Record of Asset

Substation No.1 has served Kingston Hydro customers for more than 50 years since its last major refurbishment in 1957. Today, Kingston Hydro considers Substation No.1 to be one of its highest priorities for capital renewal projects due to criticality, reliability, condition and maintainability concerns about this facility. The power transformers are in very poor condition and are reaching end-of-life. The 44kV Oil Circuit Breakers were rebuilt in the 1990s but are obsolete; it is difficult to source spare replacement parts such as bushings.

In 2009, the failure of an oil-filled 44kV current transformer caused a complete outage to Substation No. 1, damaged the control wiring to one of the 44kV oil Circuit Breakers and triggered the opening of two upstream 44kV breakers at Hydro One Frontenac TS. In 2017, a 44kV bushing failed on a 44kV oil circuit breaker at Substation MS2 causing an outage and Kingston Hydro had difficulty sourcing a replacement bushing. The 44kV oil circuit breaker that failed at Substation No.2 is the same make, model and vintage as the 44kV oil circuit breakers at Substation No.1.

2. Customer Impacts

One of the key factors contributing to the criticality of Substation No.1 is the number of customers served by this substation. Substation No.1 plays a pivotal role in distributing power to the downtown core of Kingston at both 44kV and 5kV voltage levels. There is one 44kV circuit breaker protecting the 44kV underground distribution system that serves two hospitals, one data centre and two multi-use high-rise developments. These multi-use developments contain a retirement home, two hotels, residential apartments/condominiums, office space and retail space. There are also twelve 5kV circuit breakers serving approximately 2900 residential, commercial and institutional customers. A fault on the 44kV bus of Substation No. 1 would cause an outage to both the 44kV underground distribution system and the twelve 5kV circuits served by Substation No. 1 and would have a high customer impact.

3. Factors Affecting Project Timing/Priority

The six legacy power transformers are in very poor condition and have reached the end of their useful life. Originally, Kingston Hydro planned to pace this work over 10 years and complete the upgrades by 2024 but recent transformer oil analysis results suggest the transformers are deteriorating rapidly so Kingston Hydro now plans to fast track the remaining work over the 2019-2021 period and complete upgrades in 7 years instead of 10 years.

4. Consequence for System O&M Costs

The annual water bill has ranged from approximately $33,000 to $20,000 per year. Annual consumption was reduced in recent years with the installation of a flow restrictor valve with thermostatic controls. Replacing the legacy water-cooled transformers with natural air-cooled transformers will reduce the annual water bill by approximately $20,000 per year.

5. Impact on Reliability and Safety Factors

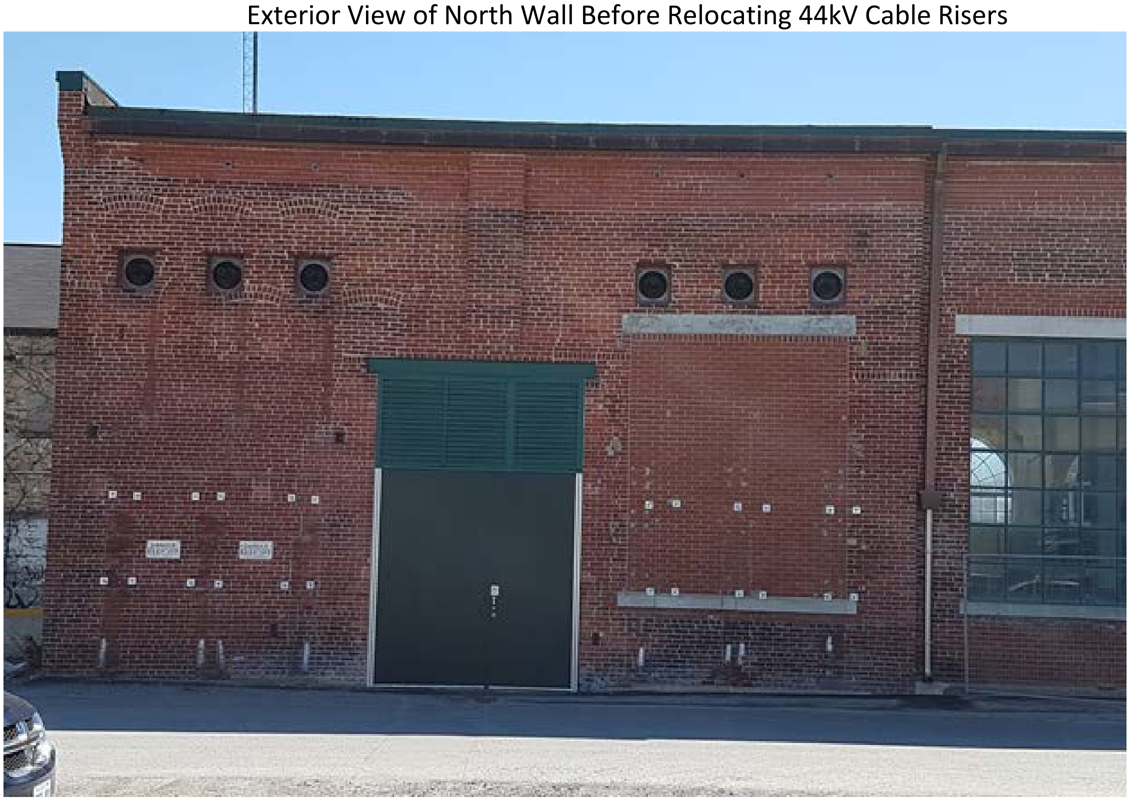
There could be a high impact on reliability and safety factors if the equipment (e.g. transformers) are run-to-failure before the upgrade is completed. However, there will be negligible impact on current reliability and safety if the existing equipment can be pro-actively replaced just-in-time before asset failure.

6. Alternatives and Comparison

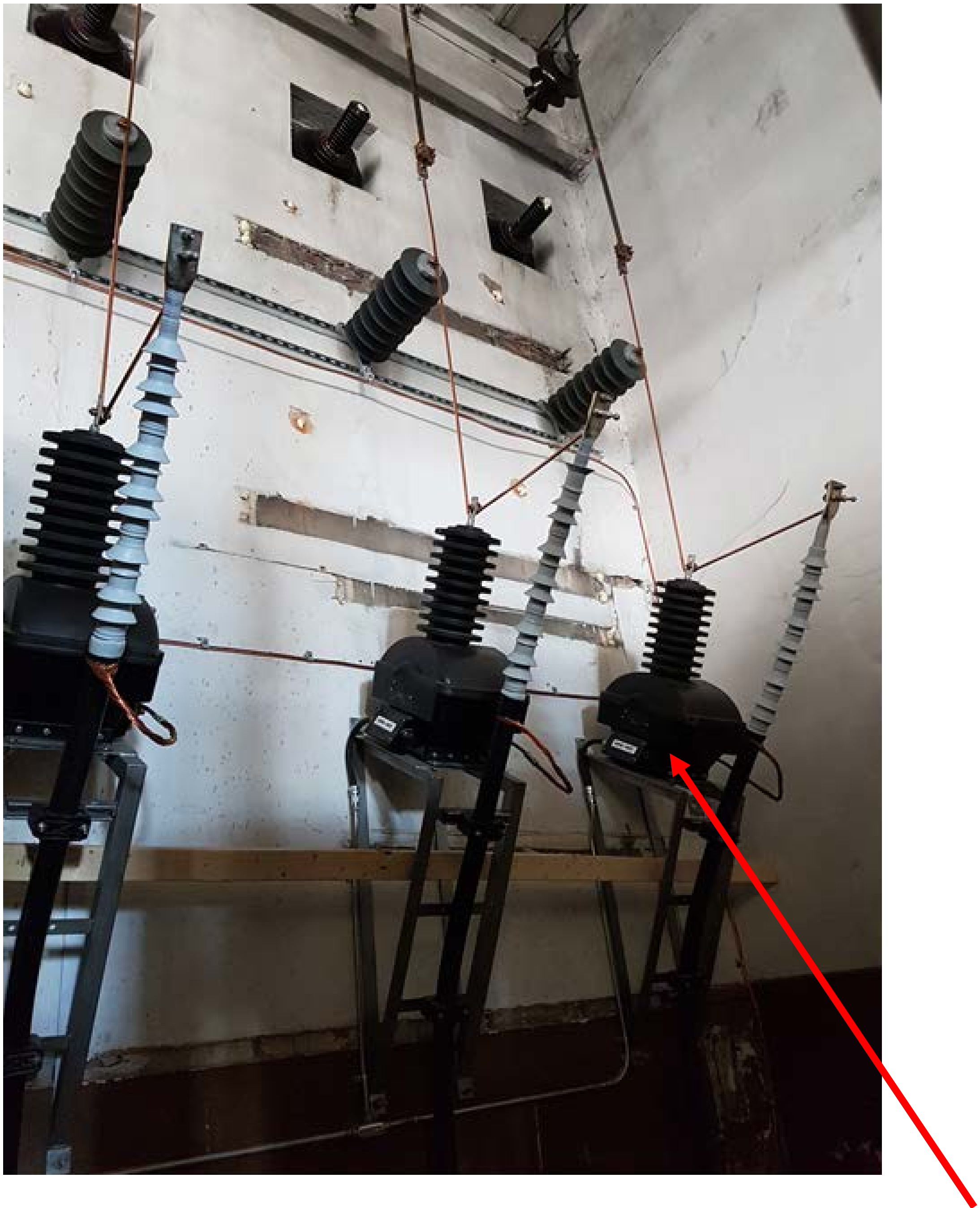
An Options Report prepared in 2013 by a consultant, identified several rebuild options. Staff recommended Option A2 which involves reusing the existing exposed 44kV bus work and transformer pad locations to minimize structural alterations.

F. PHOTOS

Exterior View of North Wall Before Relocating 44kV Cable Risers



Exterior View of North Wall After Relocating 44kV Cable Risers



Interior View of North Wall After 44kV Cable Riser Relocation & New Instrument Transformer Installation

5kV West Bus – Before Feeder Protection Relay Upgrade (6 feeders + 1 transfer bus breaker)

5kV West Bus – After Feeder Protection Relay Upgrade (6 feeders + 1 transfer bus breaker)

5kV Switchgear –West and East Bus Upgraded Protection Relays (12 feeders + 2 transfer bus breakers)

New Copper Grounding Bus (2 Examples of Upgrades Throughout Station)

Existing Water-Cooling Transformers T1, T2 and T3

Existing 44kV Oil Circuit Breaker

Upgraded 44kV SF6 Circuit Breaker and Natural Air Natural Cooling Transformers T1, T2 and T3

Upgraded 44kV Bus Protection and 5kV Bus Protection Relays

	Project Name: Transformer Vault TV#3 Upgrade **Investment Category**: System Renewal **Start Year**: 2021	
Kingston Hydro	**Proposed Budget**: $ 230,000	**Actual Costs:** $ 231,670
	System Access: 0%	System Renewal: 70%
	System Service: 30%	General Plant: 0%

A. GENERAL INFORMATION

Transformer vault TV#3 is located under the sidewalk on Wellington Street near the intersection of Princess Street and Wellington Street in the Downtown Kingston area. Electrically, TV#3 contains obsolete oil switchgear with four switch units, and a load break center. The switching equipment housed within this vault is inoperable when live.

In 2019, Kingston Hydro retained Kinectrics Inc. to perform an Asset Condition Assessment (ACA) of its key distribution assets (refer to Appendix 4 of the Exhibit 2, Tab 2, Schedule 1, Attachment 1, "Utilities Kingston 2012 Asset Condition Assessment"). The objective of the ACA was to provide KH with a quantifiable evaluation of asset condition and probability of failure, to aid in prioritizing and allocating capital resources, and facilitate the development of the KH Asset Management Plan. The ACA recommends the replacement of the existing oil switch.

This project involves replacement of the end of service life oil switch with gas switchgear, secondary breakers with a secondary breaker panel, a new load break center and associated cables.

Forecast Amount

Total ....$ 230,000

2021 Actual Cost Breakdown

Labour & Vehicles $71,399

Materials $152,598

Contracts $7,068

Total $231,065

1. O&M Costs To Be Recovered Through Rates

O&M cost recovery was not expected for this capital project.

2. Related Customer Attachments and Load

The vault supplies 4.16kV primary voltage approximately 60 businesses and residential customers located within a one block radius of the vault. This vault is routinely utilized as a tie between two separate 5kV circuits.

3. Risks to Completion and Risk Mitigation:

There is minimal risk to completion for the project. 5kV customers and secondary loads can be transferred to adjacent vaults or circuits by switching network switches. One Primary customer's service will need to be fed from an alternative source during the equipment installations.

4. Comparative Information for Equivalent Projects:

In the last five years Kingston Hydro has upgraded some vault equipment in similar condition. Kingston hydro will benefit from the experience gained on these projects in the execution of this project. The cost estimate for this project was based on actual costs experienced in the similar projects Kingston Hydro conducted in the past.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG)

No renewable energy elements were expected for the project.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

This project was driven mainly by the need to replace aging assets at the end of their service life. The second driver was low reliability caused by planned outages required by operating the oil switch. The oil switch in this vault is an obsolete switch and is unsafe to operate under load. Current safe work practice requires Kingston Hydro staff to de-energize this type of switch by opening feeder breakers at substations or operating vault gas switches further out in the distribution system before operating the oil switches, resulting in extended outages and low reliability. Kingston Hydro Reliability Performance Analysis (refer to Exhibit 2, Tab 3, Schedule 2) indicates an average of nine these events happened in the KH distribution system per year between 2004 and 2013, affecting 2980 customers and 1142 total customer hours or 0.042 SAIDI in a year.

Kingston Hydro's current standard is to replace oil switches with S&C Vista gas switches, which are rated to operate under load, thus greatly reducing customer interruption occurrences and duration, meeting customers' expectation of continuous electrical supply. The new switchgear is equipped with fault interrupters and relay protection that clear local faults at vault transformer and primary customers rather than by utilizing station breakers, this improves protection coordination and system reliabilities. The new gas switchgear and secondary panel will reduce arc flash risk and improve worker safety. Replacement of oil switch also eliminates unnecessary switching, resulting in more efficient operations and reduced O&M costs.

2. Safety

Replacement of secondary breakers with metal enclosed breaker panels reduces arc flash risk and risk of making any physical contact with bare live conductors, improving worker safety.

3. Cyber-security, Privacy

No cyber-security or privacy concerns were expected with the project.

4. Co-ordination, Interoperability

Installation of the new gas switchgear enables KH staff to operate the switchgear when the feeder is energized improving operational flexibility and simplifying switching procedures.

New gas switchgear with digital relays makes provision for future distribution system automation and smart grid implementation

5. Environmental Benefits

Replacement of the old oil-filled switchgear will significantly reduce environmental risk caused by oil leaks.

6. Conservation and Demand Management

No conservation and demand management elements are expected for the project.

C. <u>CATEGORY-SPECIFIC INFORMATION AND ANALYSES</u>

1. Condition and Performance Record of Asset

The oil switchgear in TV#3 was originally installed in the late 1960's. Kingston Hydro operates oil-filled vault switch units in ages ranging from 30 to 54 years. Deteriorated mechanical contacts in this type of switch move slowly and are prone to arcing when operated under load. This presents a worker safety concern for Kingston Hydro. Current safe work practice requires Kingston Hydro staff to de-energize and ground the switches before operating them. Due to the presence of a damp and corrosive environment, most of the vault switchgear is corroded. Bad contact and oil leaking are detected frequently.

The secondary breakers were at end-of-life and were an older style with bare connection lugs.

2. Customer Impacts

TV#3 directly supplies approximately 60 businesses and residential customers in Downtown Kingston neighbourhood. In the event of asset failure, KH would expect a prolonged outage while repairs or an alternate feed could be completed. Considering customer classes and locations, the value of customer impact is high.

Factors Affecting Project Timing/Priority

Poor asset condition and reduced reliability caused by planned outages required for operating the oil switch made this project a high priority relative to other transformer vaults and other projects. This project currently depends on available capital funds but could become an urgent need project should the oil switch fail.

3. Consequence for System O&M Costs

No significant consequences for system O&M costs were expected.

4. Impact on Reliability and Safety Factors

Implementation of the project improved the system redundancy and system flexibility of the 5kV circuits in the Downtown Kingston area surrounding TV#3, improving service reliability and operational efficiency, maintaining high customer satisfaction levels.

D. <u>PHOTOS</u>

Previous Breakers and Oil Switch

New Gas switches and Secondary Breaker

Kingston Hydro	**Project Name**: 100434-02 2021 Annual Pad-mount Transformer and Vault Transformer Replacement Program **Investment Category**: System Renewal **Start Date**: January	**In Service Date**: December
	Proposed Budget: $150,000 2021	
	System Access: 0%	System Renewal: 80%
	System Service: 20%	General Plant: 0%

A. GENERAL INFORMATION

This is an annual program for replacing pad-mount transformers and single phase vault transformers. For some projects, this work may include transformer foundation upgrades and cables replacement identified through the annual underground infrastructure inspection program. Existing pad-mount transformers was replaced with dead-front low profile pad-mount transformers. The vault transformers was 'like-for-like' replaced to match electrical parameters of the other two transformers for a three phase transformer bank. The transformer size may be increased to accommodate the actual customer load if required.

Forecast Amount

Total $150,000

2021 Actual Cost Breakdown

Labour & Vehicles $1,880

Materials $143,801

Contracts $0

Total $145,681

Risks to Completion and Risk Mitigation:

There was associated planned outages in order to replace the distribution transformers. KH tries to schedule vault transformer replacement after normal business hours to minimize impacts on commercial customers. In some instances KH will relocate transformers or install a temporary transformer to reduce the outage duration to connected customers. These customer-focused actions do however increase incrementally the cost of undertaking the work.

Comparative Information for Equivalent Projects:

Kingston Hydro installs and replaces distribution transformers on an annual basis and has the expertise and experience to complete this work.

B. <u>EVALUATION CRITERIA AND INFORMATION</u>

Efficiency, Customer Value, Reliability

The main driver of the project is assets at their end of service life. In Kingston Hydro distribution area, three-phase transformers generally supply industrial or commercial load centers. Single phase transformers generally supply 10 to 20 residential homes or units depending on the transformer size. Kingston Hydro owns a variety of legacy style pad-mount transformers, including very simple transformer kiosks consisting of an enclosure that contains one or three pole-mount transformer(s) and associated fusing. Pad-mount transformers located next to roads are prone to tank and enclosure corrosion caused by road salt. Deep frost areas or unstable soil conditions can lead to movement of the foundation. The rubber encapsulated separable insulated connectors used on dead-front style transformers can deteriorate with multiple operations and transformer oil contamination.

Single-phase vault transformers are usually located in an electrical vault/electrical room on the customer premises and consist of three single-phase oil-filled transformers. The transformers may be in a very hot electrical room, which affects the transformers' life.

Annual underground infrastructure inspection identified a number of deficiencies, such as transformer overheating, oil leaks, corrosion of the enclosure/tank and foundation deterioration. Therefore, Kingston Hydro developed this annual program to address these issues.

Safety

Installation of new dead-front pad mount transformers reduces the risk of contact with bare live components which improves worker safety.

Cyber-security, Privacy

Cyber security protection was not applicable to this project.

Co-ordination, Interoperability

This project coordinated, were possible, outage times convenient to customers.

Economic Development

This project did not directly benefit economic development.

Environmental Benefits

Replacing leaking transformers or transformers that are severely rusted will eliminate the risk of oil spilling and protect our environment.

C. <u>CATEGORY-SPECIFIC INFORMATION AND ANALYSES</u>

Condition and Performance Record of Asset

Vault and pad mount transformers have a relatively small consequence of failure and are generally replaced *reactively* or on failure. Annual underground infrastructure inspection identified a number of deficiencies related to pad-mount transformers and vault transformers, such as transformer overheating, oil leaks, corrosion of the enclosure/tank and foundation deterioration. Transformers with foundation deterioration are often repaired or monitored to pace annual capital expenditures as the cost to upgrade the foundation and associated cabling must be factored into the transformer replacement cost.

Single-phase vault transformers are among the oldest assets in the Kingston Hydro distribution system and have an average age of 34 years. In some cases, the older styles of vault and pad-mount transformers are not suited to the corrosive and wet environment in which they operate. A blend of proactive and reactive replacement of vault transformers may need to be considered in the next 6 to 10 years as the average age approaches 45 years in order to smooth the annual capital expenditures for this asset category.

In 2019, Kingston Hydro retained Kinectrics Inc. to perform an Asset Condition Assessment (ACA) of its key distribution assets (refer to Distribution System Plan Appendix 4). The objective of the ACA was to provide KH with a quantifiable evaluation of asset condition and recommend Flag-For-Action (FFA) replacement quantities based on probability of failure for Asset Management and capital planning purposes. Kingston Hydro also gauges its risk and long term asset management strategy by comparing the average annual replacement quantity of the proposed 6 year budget (2020 Bridge Year plus 2021-2025 Forecast Years) to the 10 year average annual recommended FFA quantity. This helps to identify changing trends for future capital planning purposes.

The average annual FFA quantity for Single Phase Vault transformers and Three Phase Pad Transformers appears to be relatively constant over time whereas the average annual FFA quantity for Single Phase Pad Mount Transformers is increasing over time. The reliability and financial risk of failure of single phase pad mount transformers is considered to have the lowest reliability and financial risk compared with other types of distribution transformers.

Customer Impacts

These transformers service various sizes of customer load. Typically there is a greater consequence due to a transformer failure serving larger customers such as high-rise apartments, commercial businesses and industrial businesses. Generally, Kingston Hydro takes extra care in monitoring the condition of the transformers serving these larger customers; however, a transformer failure can sometimes take considerable time to replace which may result in high customer impacts depending on site accessibility and the failure mode.

Factors Affecting Project Timing/Priority

Project timing and priority is generally reactive since Kingston Hydro takes a run-to-failure approach for distribution transformers. In some cases, the capital expenditures must be paced if the vault structure and/or concrete pad need to be upgraded before the transformer is replaced.

Consequence for System O&M Costs

Replacing older distribution transformers with new transformers built to current standards may decrease O&M costs in some instances however it is difficult to quantify.

Alternatives and Comparison

The quantity of vault and pad mount transformers planned for replacement in the 2020-2025 capital budget plan is less than the recommended ACA FFA quantity (refer to chart above). These capital expenditures may need to be increased over the next 10 years depending upon asset failure rates. Kingston Hydro recognizes that asset management requires a careful balancing of resources availability, need and risk management. Given the foregoing, Kingston Hydro believes the proposal of 2020-2025 Annual Pad-mount Transformer and Vault Transformer Replacement Program to be a prudent response to this issue.

D. <u>PHOTOS</u>

Figure 1: Flooded Pad Transformer at 95 Notch Hill Rd.

Figure 2: Rusted Enclosure & Deterrorated Foundation at TK36

Figure 3: Old Style of Transformer Kiosk at 41 Wycliffe Cres.

Figure 4: Rusted Vault Transformer at 180 Queen Mary Rd.

Figure 5: Leaking Vault Transformers at 2 Bay St.

Kingston Hydro	**Project Name**: Annual Deteriorated Overhead Infrastructure Program **Investment Category**: System Renewal **Start Date**: January 2021 **In Service Date**: December 2021	
	Proposed Budget: $180,000	
	System Access: 0%	System Renewal: 100%
	System Service: 0%	General Plant: 0%

GENERAL INFORMATION

The Annual Deteriorated Overhead Infrastructure Program focuses on replacement of deteriorated poles, pole mount transformers and other deficiencies identified through annual overhead infrastructure inspections. The program typically consists of numerous small projects involving single pole replacement as well as replacement of short sections of overhead line, many of which are below the materiality threshold.

The annual budget for this program has many drivers including pole condition, available resources and available funds. Sometimes it is necessary to allocate capital funds to other projects with competing priorities.

Forecast Amount

Total…………………………………………………….$180,000

Actual Cost Breakdown
Labour & Vehicles……………………………….…$84,327
Materials……………………………………………….…$58,683
Contracts……………………………………………………..$861

Total…………………………………………………$143,871

Risks to Completion and Risk Mitigation:

This program generally involved the replacement of wood poles that had a high risk of failing.

Comparative Information for Equivalent Projects:

Kingston Hydro regularly reviews pole conditions and switch replacements through an inspection process. The cost estimate for this project was based on previous actual costs experienced with similar projects Kingston Hydro has conducted in the past.

EVALUATION CRITERIA AND INFORMATION

Efficiency, Customer Value, Reliability

This work was required to maintain a reliable power supply as these assets reached the end of their useful life.

Safety

Renewal of these assets was necessary to avoid potential risk to public safety that could result from a failure of a wood pole.

Cyber-security, Privacy

Cyber security protection was not applicable to this project.

Co-ordination, Interoperability

This project was coordinated with third party telecoms identified as attachers on assets identified for replacement.

Economic Development

This project did not directly benefit economic development.

Environmental Benefits

No specific clean technology or conservation benefits were associated with this project.

CATEGORY-SPECIFIC INFORMATION AND ANALYSES

Condition and Performance Record of Asset

Wood poles are visually inspected at least once every three years in accordance with Ontario Energy Board requirements. A competent line person also performs a hammer test, a Polux test in addition to the visual inspection depending upon the pole condition and history. Deteriorated poles identified by pole inspections are prioritized by condition of various criteria, and are graded as follows: 1) Critical 2) Major 3) Minor.

In 2019, Kingston Hydro retained Kinectrics Inc. to perform an Asset Condition Assessment (ACA) of its key distribution assets (refer to Distribution System Plan Appendix 4). The objective of the ACA was to provide KH with a quantifiable evaluation of asset condition and recommend Flag-For-Action (FFA) replacement quantities based on probability of failure for Asset Management and capital planning purposes. Kingston Hydro also gauges its risk and long term asset management strategy by comparing the average annual replacement quantity of the proposed 6 year budget (2020 Bridge Year plus 2021-2026 Forecast Years) to the 10 year average annual recommended FFA quantity. This helps to identify changing trends for future capital planning purposes as demonstrated by the following charts for poles and pole transformers.

Kingston Hydro is proposing to pace deteriorated pole replacement and pole transformer replacement so that a greater portion of available capital funds can be allocated to renewal of other assets. The average annual FFA quantity for wood poles and pole mounted transformers appears to be decreasing over time. The reliability and financial risk of a pole failure is partially mitigated through the annual pole inspection program and continuous prioritization of pole work. For example, replacement of deteriorated poles with a 44kV circuit and/or multiple 5kV circuits would typically be prioritized over a pole with a single phase primary circuit or secondary circuit due to the higer reliability and financial risk involved.

Customer Impacts

The number and type of customers impacted varies with each pole replacement project. Poles supporting 44kV circuits are given the highest priority for replacement over other poles since they have the highest electrical loads and tend to affect the greatest number of customers.

Factors Affecting Project Timing/Priority

Wherever possible, Kingston Hydro prefers to re-design and rebuild continuous sections of an overhead line (multiple pole spans) for efficiency and to upgrade the construction to new standards. For example, the number of poles and pole transformers can often be reduced (optimized) through a re-design project whereas a like-for-like replacement approach may not always be optimal. Sections of overhead line containing multiple poles that have been identified as “Critical” or “Major” are therefore prioritized for re-design and replacement. If the re-design and replacement of a continuous section of overhead line must be deferred due to limited capital funds and/or resources then the alternative was like-for-like spot replacement within 12 months for poles identified as “Critical” status and deferral of pole replacement for poles identified as “Major” until sufficient capital funds and resources are available or until the next inspection cycle (whichever comes first).

Consequence for System O&M Costs

Generally speaking, these projects do not materially impact system O&M costs.

Alternatives and Comparison

This program is reactive in nature.

Kingston Hydro	**Project Name**: 100439-66 - Weller Ave – Montreal St to Daly St **Investment Category**: System Renewal **Start Year**: 2021	
	Proposed Budget: $75,000	
	System Access: 0%	System Renewal: 100%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

This project involved the replacement of seven deteriorated wood poles, and two distribution transformers. These poles were identified in the annual overhead infrastructure inspection as seriously deteriorated with insufficient clearances for proper worker safety. Several of the existing poles were in vulnerable locations, the new poles were located back of sidewalk.

Forecast Amount

Total $75,000

2021 Actual Cost Breakdown

Labour & Vehicles $48,725

Materials $20,384

Contracts $13,626

Total $82,735

1. O&M Costs To Be Recovered Through Rates

No O&M costs for this project will be recovered through rates.

2. Related Customer Attachments and Load

The existing pole mounted transformers affect primarily residential customers. This pole line was listed as a high priority for the potential number of customers affected by an outage if the pole line were to fail.

3. Risks to Completion and Risk Mitigation:

There is minimal risk to completion.

4. Comparative Information for Equivalent Projects:

KH drew on its costing experience from past projects to develop its budget for this project.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG)

There is no Renewable Energy Generation project associated with this program.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

The new transformers were located strategically to better distribute the loads. The new poles were constructed using modern materials, clearances and configured for improved worker and public safety.

2. Safety

Utilizing modern construction standards and materials will increase work and public safety. Some of the poles in this project are nearing end of useful life, renewal of these assets is necessary to avoid potential risk to public safety that could result from a failure of a wood pole.

3. Cyber-security, Privacy

Cyber security protection was not applicable to this project.

4. Co-ordination, Interoperability

Pole replacements were coordinated with third party attachers

5. Environmental Benefits

No specific clean technology or conservation benefits were associated with this project.

6. Conservation and Demand Management

This project has no elements relating to Conservation and Demand Management

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

1. Condition and Performance Record of Asset

The existing poles have deteriorated due to age. The limited working clearances and separation between overhead circuits pose maintenance and operational restrictions.

2. Customer Impacts

Locating the new poles to less vulnerable locations reduces the risks of unplanned outages due to vehicular impacts.

3. Factors Affecting Project Timing/Priority

These poles were identified in the annual overhead infrastructure inspection as seriously deteriorated with insufficient clearances for proper worker safety. This pole line was listed as a high priority for the potential number of customers affected by an outage if the pole line were to fail.

4. Consequence for System O&M Costs

This project will minimally reduce O&M costs.

5. Impact on Reliability and Safety Factors

The 3 transformers were replaced with 3 transformers, and relocated to new poles with proper clearance and configured to better distribute the load.

D. PHOTOS

Figure 1 – Existing poles showing poles in vulnerable locations.

Figure 1 – Existing pole showing legacy constructuion standards with the transformers below the secondary distribution bus.

Kingston Hydro	**Project Name**: 100439-67 - Railway Street Pole Replacement **Investment Category**: System Renewal **Start Year**: 2021	
	Proposed Budget: $200,000	
	System Access: 0%	System Renewal: 100%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

This project involved the replacement of 8 deteriorated wood poles, and 3 distribution transformers with 8 new wood poles and 3 distribution transformers.

These poles were identified in the annual overhead infrastructure inspection as seriously deteriorated with insufficient clearances for proper worker safety.

Additionally, insufficient clearances caused problems with lines making contact with tree limbs in high winds which caused outages.

This was a multi year project starting in 2021.

Forecast Amount

Total $200,000.00

2021 Actual Cost Breakdown

Labour & Vehicles $64,151

Materials $58,683

<u>Contracts ....$10,375</u>

Total $133,209

2022 Forecast Amount

Labour & Vehicles $29,185

Materials $13,308

<u>Contracts ....$12,203</u>

Total $54,696

Total Actual Cost... $187,905

1. O&M Costs To Be Recovered Through Rates

No O&M costs for this project will be recovered through rates.

2. Related Customer Attachments and Load

The existing pole mounted transformers affected primarily commercial customers. The pole line contains one 44kV sub-transmission circuit and two 5kV distribution circuits. This pole line was listed as a high priority for the potential number of customers affected by an outage if the pole line were to fail.

3. Risks to Completion and Risk Mitigation:

There was minimal risk to completion.

4. Comparative Information for Equivalent Projects:

KH drew on its costing experience from past projects to develop its budget for this project.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG)

There was no Renewable Energy Generation project associated with this program.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

120/240V spun bus conductor helps avoid unplanned outages caused by contact from tree limbs. The 3 transformers were replaced with 3 transformers, and relocated to new poles with proper clearance and configured to better distribute the load.

2. Safety

The poles in this project were nearing end of useful life, renewal of these assets was necessary to avoid potential risk to public safety that could result from a failure of a wood pole.

3. Cyber-security, Privacy

There were no cyber security concerns related to this project.

4. Co-ordination, Interoperability

This project was coordinated with third party telecoms identified as attachers on assets identified for replacement.

5. Environmental Benefits

No specific clean technology or conservation benefits were associated with this project.

6. Conservation and Demand Management

Conservation and Demand Management were not a factor for this project.

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

1. Condition and Performance Record of Asset

The existing poles had deteriorated due to age.

2. Customer Impacts

Changing from open bus to spun bus 120/240V conductor helps avoid unplanned outages caused by contact from tree limbs.

3. Factors Affecting Project Timing/Priority

These poles were identified in the annual overhead infrastructure inspection as seriously deteriorated with insufficient clearances for proper worker safety. This pole line was listed as a high priority for the potential number of customers affected by an outage if the pole line were to fail.

4. Consequence for System O&M Costs

This project will not materially impact system O&M costs.

5. Impact on Reliability and Safety Factors

The old open bus 120/240V conductor was replaced with spun bus 120/240V conductor to avoid unplanned outages caused by contact from tree limbs. The 3 transformers were replaced with 3 transformers and relocated to new poles with proper clearance and configured to better distribute the load.

D. PHOTOS

Figure 1 – Existing pole line

Kingston Hydro	**Project Name**: 100439-70 – 13.8kV - Leroy Grant Dr – John Counter Blvd to MS 13 (Third Ave) **Investment Category**: System Service **Start Date**: July 2021 **In Service Date**: December 2021	
	Proposed Budget: $130,000	
	System Access: 0%	System Renewal: 0%
	System Service: 100%	General Plant: 0%

A. GENERAL INFORMATION

This project involves construction of a new future use 13.8kV overhead circuit on the new poles installed on Leroy Grant Drive between John Counter Boulevard and MS 13. This work was coordinated with the planned pole replacements on Leroy Grant Drive due to pole condition. These poles were identified in the annual overhead infrastructure inspection as seriously deteriorated with insufficient clearances for proper worker safety. Several of the existing poles are in vulnerable locations the new poles will be located back of sidewalk. Kingston Hydro will look to utilizing this new circuit as a future express 13.8kV feeder to the Williamsville Area to support the proposed future development and planned intensification plans in the area.

Forecast Amount

Total $130,000

Actual Cost Breakdown

Labour & Vehicles ....$ 77,895.56

Materials ....$ 41,537.34

Contracts ....$ 26,635.32

Total ....$ 146,068.22

The actual cost variance was +12% relative to the forecast amount.

1. O&M Costs to Be Recovered Through Rates

Significant O&M costs are not expected to be recovered through rates.

2. Related Customer Attachments and Load

There are no related customer attachments or load.

3. Risks to Completion and Risk Mitigation:

There is minimal risk to completion.

4. Comparative Information for Equivalent Projects:

The cost estimate for this project was based on actual costs experienced in the similar projects Kingston Hydro conducted in the past.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG:

This fund is not associated with REG facilities.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

This project was driven by recent development and proposed future development and intensification in the Williamsville area. The extension of a future use 13.8kV circuit will increase the capacity in the Williamsville area for future development. The new 13.8kV circuit will increase the reliability and increase the capacity available for the 5kV circuits in the area.

2. Safety

This program has no effect on health and safety.

3. Cyber-security, Privacy

Cyber-security is not expected to be a concern for this project.

4. Co-ordination, Interoperability

This project was completed in coordination with the planned pole replacements on Leroy Grant Drive

5. Environmental Benefits

There are no specific clean technology or conservation benefits associated with this project.

6. Conservation and Demand Management

The higher voltage will slightly reduce system losses.

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

1. Condition and Performance Record of Asset

Some of the poles proposed to be replaced in this project are nearing the end of their usable life, however, one of the existing circuits has existing conductors that will continue to endure and will be transferred to new poles.

2. Customer Impacts

This project will not have an impact on customers.

3. Factors Affecting Project Timing/Priority

The timing for this project is dictated by the proposed development applications for the Williamsville Area. This project is the first of a three stage 13.8kV extension and expansion project to be completed over the next 4 years to support the developments and future development/intensification in the Williamsville Area.

4. Consequence for System O&M Costs

This project will not materially impact system O&M costs.

5. Impact on Reliability and Safety Factors

Some of the poles in this project are nearing their end of usable life, changing the poles to new, stronger grade poles will reduce the risk of failure. The addition of the 13.8kV service will alleviate some pressure from the 5kV system and thus reduce possible outages.

6. Alternatives and Comparison

Alternate routes were examined for possible cost savings; however, this project route was the most cost effective. It also involved poles needing to be changed as well.

D. PHOTOS

Figure 1 – New poles installed along the Leroy Grant Drive Trail with new 13.8kV circuit installed

Kingston Hydro	**Project Name**: UK-KHC-Pole Replacement-CFB Kingston Hwy2-Design & Recon 100439-45 **Investment Category**: System Renewal **Start Date**: March 2020 **In Service Date**: December 2022	
	Proposed Budget: $128,778 (2021 actual)	
	System Access: 0%	System Renewal: 100%
	System Service: 0%	General Plant: 0%

GENERAL INFORMATION

The Annual Deteriorated Overhead Infrastructure Program focuses on replacement of deteriorated poles, pole mount transformers and other deficiencies identified through annual overhead infrastructure inspections. Most of the poles on Hwy 2 from Niagra Park to Princess Mary were at or nearing end of life. There was also a pole line on CFB Kingston lands, owned by Kingston Hydro that had many poles reaching end of life.

There were short outages to residents in these areas in order to transfer loads to the new pole line.

Forecast Amount

Total $128,778

Actual Cost Breakdown

Labour & Vehicles $62,175

Materials $63,478

Contracts $3,126

Total $128,778

This is a multi-year project, the actual cost for 2021 is shown above.

Risks to Completion and Risk Mitigation:

This program generally involved the replacement of wood poles that have a high risk of failing.

Comparative Information for Equivalent Projects:

Kingston Hydro regularly reviews pole conditions. The cost estimate for this project was based on actual costs experienced in the similar projects Kingston Hydro conducted in the past.

EVALUATION CRITERIA AND INFORMATION

Efficiency, Customer Value, Reliability

This project was driven by Kingston Hydro's deteriorated pole program. This project involves the replacement of wood poles that have a high risk of failing. Two existing pole lines parallel to each other were merged to a single pole line on city right of way. The line merge utilized existing newer poles to the east of Festubert St

Safety

Renewal of these assets was necessary to avoid potential risk to public safety that could result from a failure of a wood pole.

Cyber-security, Privacy

Cyber security protection was not applicable to this project.

Co-ordination, Interoperability

This project was coordinated with third party attachers.

Economic Development

This project did not benefit economic development

Environmental Benefits

There were no environmental impacts related to this project.

CATEGORY-SPECIFIC INFORMATION AND ANALYSES

Condition and Performance Record of Asset

Wood poles are visually inspected at least once every three years in accordance with Ontario Energy Board requirements. A competent line person may also perform a hammer test in addition to the visual inspection depending upon the pole condition and history. Deteriorated poles identified by pole inspections are prioritized for action as follows: 1) immediate attention 2) attention within 5 years 3) reassess within 5-10 years.

1. Customer Impacts

Approximately 215 residential customers will have short duration power outages for transfers.

Factors Affecting Project Timing/Priority

Wherever possible, Kingston Hydro prefers to re-design and rebuild continuous sections of an overhead line (multiple pole spans) for efficiency and to upgrade the construction to new standards (optimized) through a re-design project. In this project a second pole line was merged with the main pole line. The number of poles was reduced by 27 poles and existing poles in part of the project area were utilized.

2. Consequence for System O&M Costs

This project will not materially impact system O&M costs.

3. Impact on Reliability and Safety Factors

Renewal of these assets was necessary to avoid potential risk to public safety that could result from a failure of a wood pole as well as to provide a more robust and reliable system

Alternatives and Comparison

An alternative option would be to rebuild each of the two lines in their current location.

Response to School Energy Coalition (SEC)

Interrogatory #2-SEC-18

Attachment 2 of 2

(2022 Historic Project write-up)

Kingston Hydro	**Project Name:**	
	Investment Category: General Plant **Start Date**: 2022	
	Proposed Budget: $140,000	
	System Access: 0%	System Renewal: 0%
	System Service: 0%	General Plant: 100%

GENERAL INFORMATION

Kingston Hydro currently shares technology systems with its affiliate, Utilities Kingston and its parent Company, the City of Kingston. This project covers the capital costs associated with maintaining Kingston Hydro's share of software and hardware applications that support the effective and efficient operations of Kingston Hydro.

Capital programs associated with this project along with Kingston Hydro's percentage of costs are:

Client Services CRM Solutions - 25%
Financial Management System/DAX 365 – 23%
Information Management System – 23%
Enterprise Applications – GIS – 25%
Business Applications (IS&T) – 25%

The remaining costs related to the above technology systems are paid for by the other utilities under the management of Utilities Kingston. CRM, GIS and IS&T costs are split between Kingston Hydro and the natural gas, water and wastewater utilities as all four of these utilities utilize the software. The financial management system and the information management system have a reduced percentage to Kingston Hydro as the fibre optic business utilizes this software.

Risks to Completion and Risk Mitigation:

Kingston Hydro bears a reduced amount of risk as this project is being jointly implemented with a cost sharing split with Utilities Kingston and the City of Kingston.

EVALUATION CRITERIA AND INFORMATION

Efficiency, Customer Value, Reliability

Efficiency and customer value will be achieved by ensuring that the most cost-effective solution is identified. Reliability will be maintained by managing risks with strong project management methodology.

Safety

Software selection and upgrades have little effect, if any, on Health and safety.

Cyber-security, Privacy

Cyber security and privacy will be identified early as a mandatory requirement and will be reviewed and tested during implementation and post implementation.

Co-ordination, Interoperability

The software Kingston Hydro invests in will enable us to improve Kingston Hydro’s efficiency and functionality to be able to continue to provide exceptional service to our customers.

Economic Development

This program does not influence economic development

Environmental Benefits

System requirements will include enhanced ability to provide paperless operations.

Kingston Hydro	**Project Name**: 100439 - MS9 900 CCT - Overhead Rebuild of Barrie St -from King St to north of Court St **Investment Category**: System Renewal **Start Year**: 2022	
	Proposed Budget: $130,000	
	System Access: 0%	System Renewal: 100%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

This project involves the replacement of underground cable, 8 existing wooden poles and 3 distribution transformers with 16 new wood poles and 3 distribution transformers.

These poles were identified in the annual overhead infrastructure inspection as seriously deteriorated with insufficient clearances for proper worker safety.

Additionally, insufficient clearances caused problems with lines making contact with tree limbs in high winds which caused outages.

Forecast Amount

Total $130,000.00

1. O&M Costs To Be Recovered Through Rates

O&M cost recovery is not expected for this capital project

2. Related Customer Attachments and Load

The existing underground infrastructure and pole mounted transformers affect residential and commercial customers. The existing underground circuit is a one three 5kV distribution circuit. This pole line was listed as a high priority for the potential number of customers affected by an outage if the pole line were to fail.

3. Risks to Completion and Risk Mitigation:

There is minimal risk to completion.

4. Comparative Information for Equivalent Projects:

KH drew on its costing experience from past projects to develop its budget for this project.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG)

No renewable energy elements are expected for the project.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

120/240V spun bus conductor helps avoid unplanned outages caused by contact from tree limbs. The 3 transformers will be replaced with 3 transformers, and relocated to new poles with proper clearance and configured to better distribute the load.

2. Safety

Utilizing modern construction standards and materials will increase work and public safety.

3. Cyber-security, Privacy

No cyber-security or privacy concerns are expected with the project.

4. Co-ordination, Interoperability

This express feeder ties into the work previously completed on King Street, and ties in circuits 608 and 609 to circuits at MS9.

5. Environmental Benefits

The construction was designed in such a way as to minimize the interference with the existing tree line.

6. Conservation and Demand Management

No conservation and demand management elements are expected for the project.

C. <u>CATEGORY-SPECIFIC INFORMATION AND ANALYSES</u>

1. Condition and Performance Record of Asset

The existing poles have deteriorated due to age.

2. Customer Impacts

Spun bus 120/240V conductor helps avoid unplanned outages caused by contact from tree limbs.

3. Factors Affecting Project Timing/Priority

These poles were identified in the annual overhead infrastructure inspection as seriously deteriorated with insufficient clearances for proper worker safety. This pole line was listed as a high priority for the potential number of customers affected by an outage if the pole line were to fail.

4. Consequence for System O&M Costs

The construction was designed in such a way as to minimize the interference with the existing tree line

5. Impact on Reliability and Safety Factors

The old open bus 120/240V conductor will be replaced with spun bus 120/240V conductor to avoid unplanned outages caused by contact from tree limbs. The 3 transformers will be replaced with 3 transformers, and relocated to new poles with proper clearance and configured to better distribute the load.

D. PHOTOS

Figure 1 – Existing pole line on Barrie St

Project Name: UK-KHC-Pole Replacement-CFB Kingston Hwy2-Design & Recon 100439-45 **Investment Category**: System Renewal **Start Date**: March 2022 **In Service Date**: December 2022	
Proposed Budget: $115,000	
System Access: 0%	System Renewal: 100%
System Service: 0%	General Plant: 0%

GENERAL INFORMATION

The Annual Deteriorated Overhead Infrastructure Program focuses on replacement of deteriorated poles, pole mount transformers and other deficiencies identified through annual overhead infrastructure inspections. Most of the poles on Hwy 2 from Niagra Park to Princess Mary were at or nearing end of life. There is also a pole line on CFB Kingston lands, owned by Kingston Hydro that has many poles reaching end of life.

There were short outages to residents in these areas in order to transfer loads to the new pole line.

Forecast Amount

Total **$115,000**

Actual Cost Breakdown (estimated)

Labour & Vehicles $55,500

Materials $56,700

Contracts $2,800

Total **$115,000**

Risks to Completion and Risk Mitigation:

This program generally involves the replacement of wood poles that have a high risk of failing.

Comparative Information for Equivalent Projects:

Kingston Hydro regularly reviews pole conditions. The cost estimate for this project was based on actual costs experienced in the similar projects Kingston Hydro conducted in the past.

EVALUATION CRITERIA AND INFORMATION

Efficiency, Customer Value, Reliability

This project was driven by Kingston Hydro's deteriorated pole program. This project involves the replacement of wood poles that have a high risk of failing. Two existing pole lines parallel to each other were merged to a single pole line on city right of way. The line merge utilized existing newer poles to the east of Festubert St

Safety

Renewal of these assets is necessary to avoid potential risk to public safety that could result from a failure of a wood pole.

Cyber-security, Privacy

Cyber security protection is not applicable to this project.

Co-ordination, Interoperability

No coordination or interoperability is expected with this project.

Economic Development

This project is not expected to benefit economic development.

Environmental Benefits

There are no specific clean technology or conservation benefits associated with this project.

CATEGORY-SPECIFIC INFORMATION AND ANALYSES

Condition and Performance Record of Asset

Wood poles are visually inspected at least once every three years in accordance with Ontario Energy Board requirements. A competent line person may also perform a hammer test in addition to the visual inspection depending upon the pole condition and history. Deteriorated poles identified by pole inspections are prioritized for action as follows: 1) immediate attention 2) attention within 5 years 3) reassess within 5-10 years.

1. Customer Impacts

Approximately 215 residential customers will have short duration power outages for transfers.

Factors Affecting Project Timing/Priority

Wherever possible, Kingston Hydro prefers to re-design and rebuild continuous sections of an overhead line (multiple pole spans) for efficiency and to upgrade the construction to new standards (optimized) through a re-design project.   In this project a second pole line was merged with the main pole line. The number of poles were reduced and existing poles in part of the project area were utilized.

2. Consequence for System O&M Costs

This project will not materially impact system O&M costs.

3. Impact on Reliability and Safety Factors

Renewal of these assets is necessary to avoid potential risk to public safety that could result from a failure of a wood pole as well as to provide a more robust and reliable system

Alternatives and Comparison

An alternative option would be to rebuild each of the two lines in their current location.

Kingston Hydro	**Project Name**: 2022 Regulatory Meter Replacements/Seal Updates **Investment Category**: System Access **Start Date**: Jan 2022 **In Service Date**: Dec 2022	
	Proposed Budget: $414,126	
	System Access: 100%	System Renewal: 0%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

This project involves the installation of electric meters for new services within the KHC service territory. The budget amount here is based on historical trends and forecasted additional services as a result of development within the KHC service territory. The forecast for new services also takes into account the trend emerging for multi-unit buildings to convert from bulk metering to unit metering. This project also involves meter exchanges due to defects, with the quantity budgeted based on a historical average.

Forecast Amount

Total **$414,126**

Actual Cost Breakdown

Labour & Vehicles $111,602

Materials $302,524

Contracts $0

Total **$414,126**

1. O&M Costs to Be Recovered Through Rates

No O&M costs for this project will be recovered through rates.

2. Related Customer Attachments and Load

Related customer attachments include the load customers coming onto Kingston Hydro's distribution network, and existing customers that opt to upgrade their electrical services. This project covers an estimated 300 residential GS<50 services; 20 interval type services; and one 1 Tiepoint.

3. Risks to Completion and Risk Mitigation:

Risks to completing this project are availability of equipment from meter manufacturers. We are mitigating these risks by communicating early with our vendors and suppliers about our needs.

4. Comparative Information for Equivalent Projects:

Comparable costs from previous years include: 2017 - $376,000; 2018 - $440,000; 2019 - $540,000 (340,000+200,000); 2020 - $650,000; 2021 - $205,888.91.

We are also experiencing an inflationary increases on meters, along with additional 5% surcharges due to COVID on freight shipments.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG)

Threr are no O&M costs associated with REG investment.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

This project is important as it relates to reliability of billing customers. Accurate measurement is of utmost importance and keeping up with new installs and asset management maintenance is vital to ensuring KHC customers are billed fairly and accurately for the electricity they use.

2. Safety

Meter replacements and installations will be completed to modern design standards and use good utilitiy practices

3. Cyber-security, Privacy

Cyber-security and privacy are important to account for, when dealing with electric meters and data from electric meters. We continue to monitor and improve Cyber Security to meet requirements of the OEB Mandate.

Co-ordination, Interoperability

The installation of smart meters allows for the future possibility of data analysis, and for further refinement of the the outage management system.

4. Environmental Benefits

Using Smart meters allows us to read and troubleshoot the meters remotely, reducing GHG emissions from dispatching staff and vehicles

5. Conservation and Demand Management

Access to smart meter data will allow customers to conserve energy usage.

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

1. Factors Affecting Project Timing/Priority

Supply chain. Due to the COVID 19 Pandemic we are seeing lead times for new meters 40+ weeks making it difficult to order and complete meter changes with-in the same calendar year.

2. Customer Preferences

There are customers that once utilized bulk metering and are moving towards multi-meter installations.

3. Cost Factors/Cost Control

A factor that could affect the final cost of the project could be the delay in being able to receive new meters from manufactures/suppliers, there is also the factor of increased inflation which could raise the cost of materials.

4. Other Planning Objectives Met

Upon completion of the project a review of the factors affecting the final costs of the project is completed and used to factor in the decision making for future projects.

5. Alternatives and Comparison

Alternative metering options, meeting the regulations and Kingston Hydro Conditions of Service, will be analyzed and reviewed at the time of application for each customer driven project.

6. Results of Economic Evaluation

Preparing an adequate supply of new electric meters ensures that development projects in the KHC service territory are not delayed by KHC.

7. System Impact

There are no expected impacts of this program to the system.

Project Name: 100434 Removal of Transformers containing PCBs **Investment Category**: System Access **Start Date**: January 2022 **In Service Date**: December 2022	
Proposed Budget: $87,500	
System Access: 0%	System Renewal: 100%
System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

This is an annual program for confirming, testing and/or replacing distribution transformers older than 1984 for PCB contaminants.

Forecast Amount

2022 ....$87,500.00

Risks to Completion and Risk Mitigation:

Lack of labour resources due to other ongoing projects, Weather conditions, planning power outages and notifying customers when testing/replacing transformers. Order delays with supply chain issues for pad mount transformers. These risks will be mitigated by extending the project as needed.

Comparative Information for Equivalent Projects:

Kingston Hydro installs and replaces distribution transformers on an annual basis and has the expertise and experience to complete this work.

B. EVALUATION CRITERIA AND INFORMATION

Efficiency, Customer Value, Reliability

The main driver of the project is to eliminate all distribution transformers containing PCB contaminants by the end of 2025. In Kingston Hydro distribution area, three-phase transformers generally supply industrial or commercial load centers. Single phase transformers generally supply 10 to 20 residential homes or units depending on the transformer size. Kingston Hydro owns a variety of legacy style pad-mount transformers, including very simple transformer kiosks consisting of an enclosure that contains one or three pole-mount transformer(s) and associated fusing.

Single-phase vault transformers are usually located in an electrical vault/electrical room on the customer premises and consist of three single-phase oil-filled transformers.

Safety

Installation of new dead-front pad mount transformers will reduce the risk of contact with bare live components which improves worker safety.

Cyber-security, Privacy

There are no cyber security concerns related to this project.

Co-ordination, Interoperability

This program is coordinated with customer requests and timing.

Economic Development

There is no economic benefit to this program.

Environmental Benefits

Replacing leaking transformers or transformers that are severely rusted will eliminate the risk of oil spilling and protect our environment.

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

Customer Impacts

There will be associated planned outages to take an oil sample for testing, and to replace the identified distribution transformers. KH tries to schedule vault transformer replacement after normal business hours to minimize impacts on commercial customers. These customer-focused actions do however increase incrementally the cost of undertaking the work.

Factors Affecting Project Timing/Priority

All distribution transformers containing PCB contaminants need to be removed from the Kingston Hydro distribution system by the end of 2025.

Consequence for System O&M Costs

Replacing older distribution transformers with new transformers built to current standards may decrease O&M costs in some instances however it is difficult to quantify.

Alternatives and Comparison

Most locations will require like for like replacement due to increased costs for relocation.

Kingston Hydro	**Project Name**: 100440 – New Development **Investment Category**: System Access **Start Date**: January 2022	**In Service Date**: December 2022
	Proposed Budget: $300,000	
	System Access: 100%	System Renewal: 0%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

This project represents a number of projects to be completed during the year, driven primarily by customer requests for new or upgraded services greater than 200A 120/240V residential service connections. These projects are generally unplanned or unforeseen and require capital infrastructure expansions or upgrades to accommodate the service connection requirements of each individual connection request. The scope of this project includes new commercial and industrial service connections, including primary and secondary transformations and/or extensions, requests for equipment relocation and in-fill projects sometimes including purchase and installation of various pieces of equipment, including but not limited to pole or pad-mount transformers, primary cabling, and underground distribution structures.

Forecast Amount

2022 .... $300,000.00

Risks to Completion and Risk Mitigation:

This project/program was established to address the changing priorities and service connection/development requirements over the year. Depending on the development request Kingston Hydro may need to shift the project schedule to accommodate the development connection requirements.

Comparative Information for Equivalent Projects:

Comparable investments for the 2017 to 2021 historical years are

2017 .... $288,239.04
2018 .... $351,889.94
2019 .... $306,911.76
2020 .... $667,761.50
2021 .... $289,725.93

B. EVALUATION CRITERIA AND INFORMATION

Efficiency, Customer Value, Reliability

This project is driven by customer service requests. Kingston Hydro has obligations to provide customers with access to its distribution system under regulatory requirements and obligations and Kingston Hydro’s Conditions of Service.

The Electricity Act, 1998, Part III, section 28 states:

> A distributor shall connect a building to its distribution system if,
>
> (a) the building lies along any of the lines of the distributor's distribution system; and
>
> (b) the owner, occupant or other person in charge of the building requests the connection in writing.

Therefore, this project is of high priority.

Safety

Safety is not a concern for this program

Cyber-security, Privacy

There are no cyber security concerns related to this project.

Co-ordination, Interoperability

This program is coordinated with customer requests and timing.

Economic Development

The program will enable KH to provide developers and customers with access to the Kingston Hydro Distribution Network for development and expansion of commercial and retail businesses in the Kingston Hydro service territory.

Environmental Benefits

No specific clean technology or conservation benefits were associated with this project.

C. <u>CATEGORY-SPECIFIC INFORMATION AND ANALYSES</u>

Factors Affecting Project Timing/Priority

Kingston Hydro has obligations to provide customers with access to its distribution system under regulatory requirements and obligations and Kingston Hydro's Conditions of Service, which make this project a high priority. Scheduling of this work is based on customer requirements and expectations.

Customer Preferences

Each individual project is customer initiated. Kingston Hydro will provide new services to meet the customers' expectations in terms of time and cost.

Cost Factors/Cost Control

Controllable costs will be minimized by utilizing standardized design and materials. For the indivdual projects completed Kingston Hydro reviews the factors affecting the final costs of the project is completed and used to factor in the decision making for future projects.

Other Planning Objectives Met

Where applicable, multiple design and implementation options are considered and evalutaed.

Kingston Hydro	**Project Name**: Substation MS6 Building Structural Rehabilitation and Roof Replacement **Investment Category**: System Renewal **Start Date**: May 2022 **In Service Date**: July 2022	
	Proposed Budget: $350,000	
	System Access: 0%	System Renewal: 100%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

In 2017, Utilities Kingston (UK) issued an RFQ for a Substation Structural and Building Envelope Condition Assessment. The final report was received in May 2018 and contained a recommended list of Maintenance and Capital programs for the nine facilities that were assessed. The assessment identified the masonry walls and structural steel frame at thes substation MS6 have shifted (laterally displaced) along the north and south walls, and the foundation wall is unstable. It is proposed to widen the concrete foundation walls outward and rebuild the concrete block masonry walls. Existing 4-ply tar, gravel roof is in poor condition; however the roof replaced will be required with the exterior (shear) wall construction. MS6 was built approximately in 1958. The station has an 44kV equipment yard with a chain link perimeter fence and a one storey building. The building containing the 5kV switchgear has an exterior structure steel frame (8 columns) supporting the steel beam and concrete precast slab roof system. The steel frame is in-filled with eight inch block and/or brick veneer. The building measures 19' x 60' (1,140 sq.ft.).

1. O&M Costs To Be Recovered Through Rates

O&M cost recovery is not expected for this capital project

2. Related Customer Attachments and Load

No direct customer attachments and load are expected for these projects.

3. Risks to Completion and Risk Mitigation:

MS6 could be isolated by transferring all 5kV loads to adjacent substations. The risk to completion is low.

4. Comparative Information for Equivalent Projects:

The Substation Structural and Building Envelope Condition Assessment recommended the roof replacement of Substations MS11 and MS12. The roofs were replaced in 2019.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG)

No renewable energy elements are expected for the projects.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

The Substation Structural and Building Envelope Condition Assessment completed in 2018 helped UK staff to prioritize this building structural rehabilitation and roof replacement work with other building envelope upgrades that were identified in the condition assessment. The wall is leaning inward. The wall collapse could damage the existing 5kV switchgear line-up and cause multiple 5kV feeder outages. The substation has to be backfed from adjacent substations for a year or longer if the collapse happens, impacting the system reliability.

2. Safety

The unstable foundation and leaning wall poses a worker safety concern.

3. Cyber-security, Privacy

No cyber-security or privacy concerns are expected with the projects.

4. Co-ordination, Interoperability

The entire substation MS6 will be isolated during the construction to protect worker safety and prevent water leaking to the live high-voltage equipment.

5. Environmental Benefits

A detailed designated substance report will be prepared prior to construction for worker safety and to ensure proper disposal of hazardous waste material.

6. Conservation and Demand Management

The building standards at the time of original construction did not require insulation as the building is normally not occupied and energy efficiency standards were virtually non-existent. A base insulation layer of 2” Poly-Iso insulation will be installed prior to installing the new roof membrane for this project to improve roof drainage and reduce heat loss.

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

This non-discretionary substation work was required to ensure a safe and reliable electricity supply

1. Condition and Performance Record of Asset

The assessment identified the masonry walls and structural steel frame at thes substation MS6 have shifted (laterally displaced) along the north and south walls. Typically, steel frame structures have in-place bracing or masonry (shear) walls to hold the steel structure in place. MS6 have this inset masonry wall detail, which does not provide effect restraint to the structure steel. MS6 shows signs of displacement, which give rise to concerns about the long-term stability of the building. It is proposed to remove all masonry (exterior) walls and then widen the concrete foundation walls outward. New concrete block masonry walls, including new doors and windows, can then be reconstructed in-plane with the steel columns. Brick veneer can then be installed to cover the concrete block and steel members. Roof edge will need to be reframed to extend over the masonry wall system with new parapets, then new roof membrane installed. Existing 4-ply tar, gravel roof is in poor condition; however the roof replaced will be required with the exterior (shear) wall construction.

2. Customer Impacts

The 5kV distribution of Substation MS6 normally serves 1800 customers. An outage to the 5kV distribution system would have a medium to high customer impact.

Factors Affecting Project Timing/Priority

Refer to section B.1 above.

3. Consequence for System O&M Costs

If the roof membranes on MS2 have not been replaced then water ingress at these substations would have increased and required regular site visits to divert the water away from switchgear and electrical equipment located inside the substation (e.g. tarps and/or buckets).

4. Impact on Reliability and Safety Factors

UK staff believe that same day power restoration could be achieved if the wall failed or a roof membrane failed at Substation MS6 by temporarily re-routing feeders. The impact of an unplanned outage caused by water ingress due to a faulty roof membrane is Medium (e.g. single 5kV feeder trip). However, the impact of an unplanned outage caused by wall collapse is High as it will change the 5kV system configuration for a long time.

5. Alternatives and Comparison

An alternative to replacement is deferral of the replacement. However, the deferral will pose a high risk of wall collapse, roof leaking and equipment damage.

D. PHOTOS

Fig. 1 – MS6 – view facing south

Fig. 2 – MS6 – Masonry Walls and Structural Steel Frame Shifted (Laterally Displaced)

Fig. 3 – MS6 – Cracked Masonry North Walls

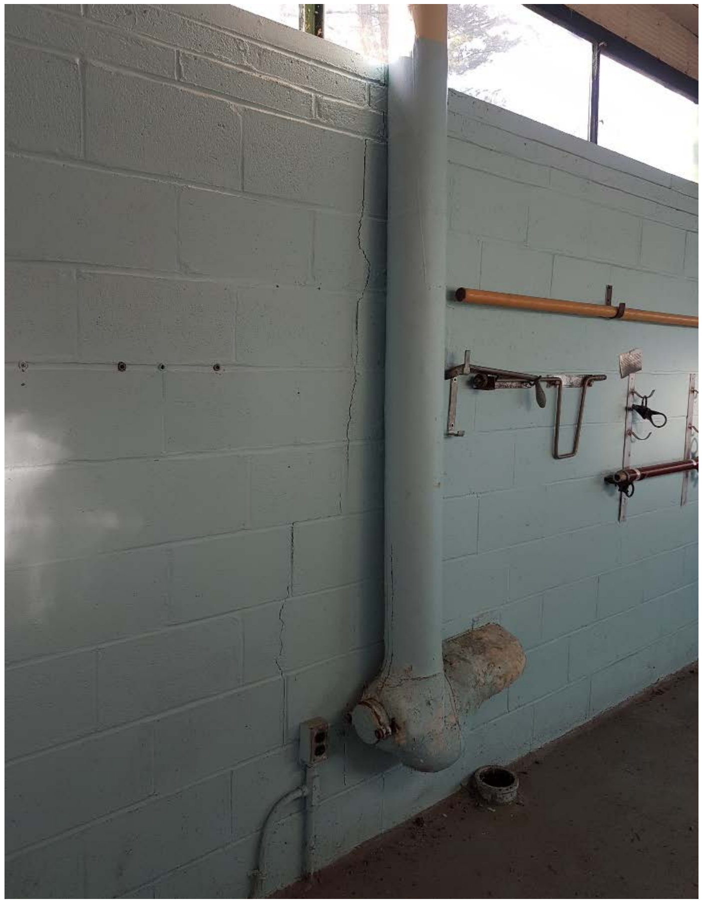


Fig. 4 – MS6 – Cracked Masonry South Walls

Fig. 5 – MS6 – Cracked Footing for Steel Column

Fig. 6 – MS6 – View of existing deteriorated lower roof

Kingston Hydro	**Project Name**: Substation MS2 Roof Replacement **Investment Category**: System Renewal **Start Date**: June 2022 **In Service Date**: September 2022	
	Proposed Budget: $80,000	
	System Access: 0%	System Renewal: 100%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

In 2017, Utilities Kingston (UK) issued an RFQ for a Substation Structural and Building Envelope Condition Assessment. The final report was received in May 2018 and contained a recommended list of Maintenance and Capital programs for the nine facilities that were assessed. The roof membrane replacement at Substation MS2 was recommended. MS2 was built approximately in 1906. It is multi-wythe brick construction and consists of a 1,800 sq.ft. high roof (west) building area and a 700 sq.ft. low roof (east) building area. All of the 44kV and 5kV high voltage equipment is located inside the two storey brick building.

1. O&M Costs To Be Recovered Through Rates

O&M cost recovery is not expected for this capital project.

2. Related Customer Attachments and Load

There are customer connected load to MS2, as noted below, those customers can be loop fed and will have minimum impact on those connected customers.

3. Risks to Completion and Risk Mitigation:

MS2 could be isolated by transferring all 5kV loads to adjacent substations. The risk to completion is low.

4. Comparative Information for Equivalent Projects:

The Substation Structural and Building Envelope Condition Assessment recommended the roof replacement of Substations MS11 and MS12. The roofs were replaced in 2019.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG)

No renewable energy elements are expected for the project.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

The Substation Structural and Building Envelope Condition Assessment completed in 2018 helped UK staff to prioritize this roof replacement work with other building envelope upgrades that were identified in the condition assessment. A 5-ply built-up roof (BUR) membrane will be installed due to the lower up front cost and lower expected life cycle cost.

2. Safety

Utilizing modern construction standards and materials will increase work and public safety .

3. Cyber-security, Privacy

No cyber-security or privacy concerns are expected with the project.

4. Co-ordination, Interoperability

The 44kV overhead incoming line and substation MS2 will be isolated during the construction to protect worker safety and prevent water leaking to the live high-voltage equipment.

5. Environmental Benefits

A detailed designated substance report will be prepared prior to construction for worker safety and to ensure proper disposal of hazardous waste material.

6. Conservation and Demand Management

The building standards at the time of original construction did not require insulation as the building is normally not occupied and energy efficiency standards were virtually non-existent. A base insulation layer of 2" Poly-Iso insulation will be installed prior to installing the new roof membrane for this project to improve roof drainage and reduce heat loss.

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

This non-discretionary substation work was required to ensure a safe and reliable electricity supply

1. Condition and Performance Record of Asset

The following descriptions appeared in the Asset Condition Assessment report issued May 2018:

4-ply tar, gravel roof should be replaced in 2020. The condition is poor.

2. Customer Impacts

The 5kV distribution of Substation MS2 normally serves 1500 customers. An outage to the 5kV distribution system would have a medium to high customer impact. Substation MS2 and MS13 are fed from the same 44kV feeder that is protected by an upstream transformer station breaker. An unplanned outage to this 44kV distribution feeder would have a high customer impact because it would trigger a loss of supply to two Kingston Hydro substations and several 44kV customers

Factors Affecting Project Timing/Priority

Refer to section B.1 above.

3. Consequence for System O&M Costs

If the roof membranes on MS2 have not been replaced then water ingress at these substations would have increased and required regular site visits to divert the water away from switchgear and electrical equipment located inside the substation (e.g. tarps and/or buckets).

4. Impact on Reliability and Safety Factors

UK staff believe that same day power restoration could be achieved if a roof membrane failed at Substation MS2 by temporarily re-routing feeders. The impact of an unplanned outage caused by water ingress due to a faulty roof membrane could range from High (e.g. 44kV feeder trip or 5kV bus trip) to Medium (e.g. single 5kV feeder trip).

5. Alternatives and Comparison

An alternative to replacement is deferral of the replacement. However, the roof replacement has been delayed for two years. Further deferral will pose a high risk of roof leaking and equipment damage.

D. PHOTOS

Fig. 1 – MS2 – view facing south

Fig. 2 – MS2 – View of existing deteriorated higher roof

Fig. 3 – MS2 – View of existing deteriorated lower roof

Kingston Hydro	**Project Name**: MS#5 Power Transformer Replacement **Investment Category**: System Renewal **Start Date**: January, 2022 **In Service Date**: December, 2022	
	Proposed Budget: $560,000	
	System Access: 0%	System Renewal: 100%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

Power transformer T1 and T3 at Municipal Substation MS#5 will be decommissioned. The transformers feed schools, business, apartment buildings, residential loads, and CFB Kingston. This project involves replacement of the end-of-life 5MVA T1 and T3 transformers with a 5/6.7MVA power transformer, new run of secondary cabling in station, and new switches and will be delineated as T2. T1 will be a 5.0/5.6MVA transformer from MS4, and will also reuse the transformer pad, provide new secondary cabling, and new switches. This work is being driven by the age and condition of the transformers, and the load growth seen at CFB Kingston.

1. O&M Costs To Be Recovered Through Rates

O&M cost recovery is not expected for this capital project.

2. Related Customer Attachments and Load

The transformer feeds schools, business, apartment buildings, residential loads, and CFB Kingston.

3. Risks to Completion and Risk Mitigation:

Power transformers have a long lead time, this risk will be mitigated by placing the transformer order early in 2022.

4. Comparative Information for Equivalent Projects:

Transformer T1 at MS#4 was replaced in 2018 and transformer T3 at MS#8 was replaced in 2011 due to poor asset condition. The cost estimate for this project was based on actual costs experienced in the similar projects Kingston Hydro conducted in the past.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG)

No renewable energy elements are expected for the project. There is other works being done at MS5 in coordination with a customer DER project outside the scope of the transformer replacement.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

This project is driven mainly by the aging assets at the end of their service life. The secondary drivers include increased maintenance requirements and high transformer losses. Annual oil test and inspection indicate continued deterioration of the electrical characteristics of the transformer. In 2012 and 2019, Kingston Hydro retained Kinectrics Inc. to perform an Asset Condition Assessment (“ACA”) of its key distribution assets. The objective of the ACA was to provide KH with a quantifiable evaluation of asset condition and probability of failure, aid in prioritizing and allocating capital resources, and facilitate the development of KH Asset Management Plan. Based on health index and the risk of failure of the T2/T3 transformers at MS#5, the ACA recommends replacement of these assets.

Power transformers are the most critical and valuable assets in the electrical distribution system and need to be addressed proactively with a high priority for replacement prior to failure. Running in an abnormal configuration is acceptable for short outage durations, prolonged use of an abnormal configuration introduces operational constraints, inflexibility and potential damage on the system.

If KH did not proceed with this work, the risk of transformer failure and the resulting large scale power outage would increase. Replacement of the end-of-life transformer with a new high performance transformer will reduce transformer losses and greatly reduce the risk of customer service interruption. Customers’ expectation of continuous electrical supply will be met in addition to improving system reliability and efficiency. Existing and new customers will benefit from the improved and reliable power supply. The new T2 transformer will be the same size and will have the same electrical parameters as the renamed T1 transformer. Therefore, two transformers are able to run in parallel to improve operational flexibility and efficiency due to increased ability to transferring load. In addition, the new larger size transformer will support load growth and new customer connection requests in the long term.

2. Safety

Replacing the old transformer with a new transformer reduces the risk of fires due to transformer failure, improving the worker safety and the public safety. The new T2 transformer will be installed on the location previously reserved for T3 transformer that will increase the separation distance between T1 and T2 transformers to meet the latest code requirements of safety clearance for outdoor liquid-insulated transformers.

3. Cyber-security, Privacy

No cyber-security or privacy concerns are expected with the project.

4. Co-ordination, Interoperability

New T2 transformer will have the same electrical parameters as re-used T1. Therefore, two transformers are able to run in parallel to improve system reliability and operational flexibility.

5. Environmental Benefits

Transformer failure may harm the environment as a result of oil spills and transformer fires. Installation of a new transformer will significantly reduce this risk.

6. Conservation and Demand Management

No conservation and demand management elements are expected for the project.

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

1. Condition and Performance Record of Asset

In order to better determine the transformers end-of-life, Kingston Hydro commissioned a furan analysis for all station transformers in 2004 and 2005. Kingston Hydro has continued to monitor the condition of the T2/T3 transformer in the interim. The annual oil quality test and oil Dissolved Gas Analysis indicate a worsening condition. Transformer T1 at MS#5 is 60 years old and far exceeds station transformer's typical useful life of 45 years. In order to determine the transformers end-of-life, Kingston Hydro commissioned a furan analysis for all station transformers in 2004 and 2005. The Degree of Polymerization (DP) results of transformers T1 were consistently less than 450 which is a better indicator of the end of the transformers' life than the absolute end-of-life indicated by a DP value of 200. The annual oil quality test also indicates insulation and oil deterioration. The degradation of the paper insulation makes the transformer susceptible to winding failure during short-circuits and overload. In 2011, annual oil test indicated Total Dissolved Combustible Gas (TDCG) and key gas, including Acetylene (C_2H_2), Hydrogen (H_2) and Ethylene (C_2H_4), far exceeded acceptable limits, indicating severe arcing and partial charge in the transformer. Kingston Hydro immediately removed the transformer from service. According to ACA, Kingston Hydro has to replace seven station transformers by 2020. In order to pace station transformer replacement projects to stabilize annual capital plan, Kingston Hydro developed a Power Transformer Replacement Program to identify, prioritize and pace transformer upgrade. In the plan, a new 5/7.5MVA transformer will be installed at MS#4 to replace T1 and T2 transformers in 2015. T1 will replace failed MS#5 T1 transformer and T2 will replace MS#17 T1 transformer which is reaching end-of-life in 2017. By reusing and relocating existing transformers, KH is able to control investment levels, maximize system performance and improve system reliability in Kingston Hydro distribution system. All of this data supports the conclusion that the transformer is in poor condition.

The degradation of the paper insulation and oil makes the transformer susceptible to winding failure during short-circuits and overload.

2. Customer Impacts

The transformer supplies schools, business, apartment buildings, residential loads, and CFB Kingston..

3. Factors Affecting Project Timing/Priority

As the most critical and valuable asset in distribution system, replacement of end-of-life transformers is a high priority.

4. Consequence for System O&M Costs

The new high performance transformer will reduce O&M cost, including: replacement of failed parts, treatment of leaking oil, and reduced inspection and oil testing frequency.

5. Impact on Reliability and Safety Factors

Replacement of the end-of-life transformer with a new high performance transformer will greatly reduce the risk of customer service interruption. Customers' expectation of continuous electrical supply will be met in addition to improving system reliability. Replacing the old transformer with a new transformer reduces the risk of fires due to transformer failure, improving the worker safety and the public safety.

6. Alternatives and Comparison

An alternative to replacement is deferral of the replacement. However, station transformers are considered for replacement prior to failure in the proactive approach in accordance with KH asset management strategy. Without a proactive replacement for this transformer KH could expect to spend over $420,000 in an emergency to replace a failed unit. If no capital budget were allocated for this replacement the result would be a large deferral of a set of other priority projects.

D. <u>PHOTOS</u>

113 T3 Transformer and T2 Transformer and T1 Transformer Pad at MS5

Kingston Hydro	**Project Name**: Ruskin Street Pole Replacement **Investment Category**: System Renewal **Start Year**: 2022	
	Proposed Budget: $75,000	
	System Access: 0%	System Renewal: 100%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

This project involves the replacement of 6 deteriorated wood poles, and 1 distribution transformers with 6 new wood poles and 1 distribution transformers in the backyards.

These poles were identified in the annual overhead infrastructure inspection as seriously deteriorated with insufficient clearances for proper worker safety.

Additionally, insufficient clearances caused problems with lines making contact with tree limbs in high winds which caused outages.

Forecast Amount

Total...$75,000.00

1. O&M Costs To Be Recovered Through Rates

O&M cost recovery is not expected for this capital project.

2. Related Customer Attachments and Load

The existing pole mounted transformers affect primarily commercial customers. The pole line contains one 5kV distribution circuit. This pole line was listed as a high priority for the potential number of customers affected by an outage if the pole line were to fail.

3. Risks to Completion and Risk Mitigation:

There is minimal risk to completion.

4. Comparative Information for Equivalent Projects:

KH drew on its costing experience from past projects to develop its budget for this project.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG)

No renewable energy elements are expected for the project.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

The 1 transformer will be replaced with 1 transformer, and relocated to new poles with better vehicle access, proper clearance and configured to better distribute the load.

2. Safety

Utilizing modern construction standards and materials will increase work and public safety.

3. Cyber-security, Privacy

No cyber-security or privacy concerns are expected with the project.

4. Co-ordination, Interoperability

No other project coordination and interoperability was expected for this project.

5. Environmental Benefits

No environmental benefits are expected for this project, ad efforts will be made to minimize environmental impact.

6. Conservation and Demand Management

No conservation and demand management elements are expected for the project.

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

1. Condition and Performance Record of Asset

The existing poles have deteriorated due to age.

2. Customer Impacts

Relocating the transformer to a pole with better vehicle accessibility will reduce the duration of unplanned outages.

3. Factors Affecting Project Timing/Priority

These poles were identified in the annual overhead infrastructure inspection as seriously deteriorated with insufficient clearances for proper worker safety. This pole line was listed as a high priority for the potential number of customers affected by an outage if the pole line were to fail.

4. Consequence for System O&M Costs

No significant consequences for system O&M costs are expected.

5. Impact on Reliability and Safety Factors

The old open bus 120/240V conductor will be replaced with spun bus 120/240V conductor to avoid unplanned outages caused by contact from tree limbs. The 1 transformer will be replaced with 1 transformer, and relocated to new poles with proper clearance and configured to better distribute the load. Relocating the transformer to a pole with better vehicle accessibility will reduce the duration of unplanned outages.

D. PHOTOS

Figure 1 – Existing pole line

Kingston Hydro	**Project Name**: Transformer Vault TV#4 Upgrade **Investment Category**: System Renewal **Start Year**: 2022	
	Proposed Budget: $ 215,000	
	System Access: 0%	System Renewal: 70%
	System Service: 30%	General Plant: 0%

A. GENERAL INFORMATION

Transformer vault TV#4 is located under the sidewalk on Bagot Street mid-block between Princess Street and Brock Street in the Downtown Kingston area. Electrically, TV#4 contains obsolete oil switchgear with four switch units, and a load break center. The switching equipment housed within this vault is inoperable when live.

In 2019, Kingston Hydro retained Kinectrics Inc. to perform an Asset Condition Assessment (ACA) of its key distribution assets (refer to Appendix 4 of the Exhibit 2, Tab 2, Schedule 1, Attachment 1, “Utilities Kingston 2012 Asset Condition Assessment”). The objective of the ACA was to provide KH with a quantifiable evaluation of asset condition and probability of failure, to aid in prioritizing and allocating capital resources, and facilitate the development of the KH Asset Management Plan. The ACA recommends the replacement of the existing oil switch.

This project involves replacement of the end of service life oil switch with gas switchgear, secondary breakers with a secondary breaker panel, a new load break center and associated cables.

Forecast Amount

Total...$ 215,000

1. O&M Costs To Be Recovered Through Rates

O&M cost recovery is not expected for this capital project.

2. Related Customer Attachments and Load

The vault supplies 4.16kV primary voltage approximately 60 businesses and residential customers located within a one block radius of the vault. This vault is routinely utilized as a tie between three separate 5kV circuits.

3. Risks to Completion and Risk Mitigation:

There is minimal risk to completion for the project. 5kV customers and secondary loads can be transferred to adjacent vaults or circuits by switching network switches. One Primary customer’s service will need to be fed from an alternative source during the equipment installations.

4. Comparative Information for Equivalent Projects:

In recent years Kingston Hydro has upgraded other transformer vaults with similar equipment in similar condition. Kingston hydro will benefit from the experience gained on these projects in the execution of this project. The cost estimate for this project is based on actual costs experienced in the similar projects Kingston Hydro conducted in the past.

Comparable transformer vault equipment upgrades;

TV3 (2020) – $231,647
- S&C Vista Switch
- 750kVA 120/208V Submersible Vault Style Transformer
- Secondary distribution breaker

TV85 (2018) - $ 449,585.13
- New precast vault structure
- S&C Vista Switch
- 750kVA 120/208V Submersible Vault Style Transformer
- Secondary distribution breaker

TV29 (2017) - $268,913
- S&C Vista Switch
- Secondary distribution breaker panel

TV37 (2016) – $100,837.32
- S&C Vista Switch

TV8 (2015) - $323,314
- New Self-Supporting Vault Roof Slabs
- S&C Vista Switch
- 750kVA 120/208V Submersible Vault Style Transformer
- Secondary distribution breaker

TV9 (2015) - $405,175
- New precast vault structure
- S&C Vista Switch
- 750kVA 120/208V Submersible Vault Style Transformer
- Secondary distribution breaker panel

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG)

No renewable energy elements are expected for the project.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

This project is driven mainly by the need to replace aging assets at the end of their service life. The second driver is low reliability caused by planned outages required by operating the oil switch. The oil switch in this vault is an obsolete switch and is unsafe to operate under load. Current safe work practice requires Kingston Hydro staff to de-energize this type of switch by opening feeder breakers at substations or operating vault gas switches further out in the distribution system before operating the oil switches, resulting in extended outages and low reliability. Kingston Hydro Reliability Performance

Analysis (refer to Exhibit 2, Tab 3, Schedule 2) indicates an average of nine these events happened in the KH distribution system per year between 2004 and 2013, affecting 2980 customers and 1142 total customer hours or 0.042 SAIDI in a year.

Kingston Hydro's current standard is to replace oil switches with S&C Vista gas switches, which are rated to operate under load, thus greatly reducing customer interruption occurrences and duration, meeting customers' expectation of continuous electrical supply. The new switchgear is equipped with fault interrupters and relay protection that clear local faults at vault transformer and primary customers rather than by utilizing station breakers, this improves protection coordination and system reliabilities. The new gas switchgear and secondary panel will reduce arc flash risk and improve worker safety. Replacement of oil switch also eliminates unnecessary switching, resulting in more efficient operations and reduced O&M costs.

2. Safety

Replacement of secondary breakers with metal enclosed breaker panels reduces arc flash risk and risk of making any physical contact with bare live conductors, improving worker safety.

3. Cyber-security, Privacy

No cyber-security or privacy concerns are expected with the project.

4. Co-ordination, Interoperability

Installation of the new gas switchgear enables KH staff to operate the switchgear when the feeder is energized improving operational flexibility and simplifying switching procedures.

New gas switchgear with digital relays makes provision for future distribution system automation and smart grid implementation

5. Environmental Benefits

Replacement of the old oil-filled switchgear will eliminate environmental risk caused by oil leaks.

6. Conservation and Demand Management

No conservation and demand management elements are expected for the project.

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

1. Condition and Performance Record of Asset

The oil switchgear in TV#4 was originally installed in the late 1960's. The ACA indicates that the oil switchgear's health index is 45.96% and it is therefore in poor condition. The ACA recommends the replacement as a high priority. Kingston Hydro operates oil-filled vault switch units in ages ranging from 30 to 54 years. Deteriorated mechanical contacts in this type of switch move slowly and are prone to arcing when operated under load. This presents a worker safety concern for Kingston Hydro. Current safe work practice requires Kingston Hydro staff to de-energize and ground the switches before operating them. Due to the presence of a damp and corrosive environment, most of the vault switchgear is corroded. Bad contact and oil leaking are detected frequently. Kingston Hydro replaced 21 switch units during the last rate application period. There are 62 units still in service. The ACA indicates the health indices of oil switches are ranging from 33.58% to 46.23%, these oil switches are in poor condition, and recommends a replacement rate of 6 units per year for the next ten years.

The secondary breakers are at end-of-life and are an older style with bare connection lugs.

2. Customer Impacts

TV#4 directly supplies approximately 60 businesses and residential customers in Downtown Kingston neighbourhood. In the event of asset failure, KH would expect a prolonged outage while repairs or an alternate feed could be completed. Refer to attached map for further details of customer impacts. Considering customer classes and locations, the value of customer impact is high.

Factors Affecting Project Timing/Priority

Poor asset condition and reduced reliability caused by planned outages required for operating the oil switch make this project a high priority relative to other transformer vaults and other projects. This project currently depends on available capital funds but could become an urgent need project should the oil switch fail.

3. Consequence for System O&M Costs

No significant consequences for system O&M costs are expected.

4. Impact on Reliability and Safety Factors

Implementation of the project will improve the system redundancy and system flexibility of the 5kV circuits in the Downtown Kingston area surrounding TV4, improving service reliability and operational efficiency, maintaining high customer satisfaction levels.

D. <u>PHOTOS</u>

Figure 1 & 2 – TV4 Legacy Oil Switch (OS4) and PILC cables

	Project Name: Transformer Vault TV#18 Upgrade **Investment Category**: System Renewal **Start Year**: 2022	
Kingston Hydro	**Proposed Budget**: $ 275,000	
	System Access: 0%	System Renewal: 70%
	System Service: 30%	General Plant: 0%

A. GENERAL INFORMATION

Transformer vault TV#18 is located under the sidewalk on Ontario Street at Brock Street in the Downtown Kingston area. Electrically, TV#18 contains obsolete oil switchgear with six switch units, a submersible transformer and four older secondary breakers. The switching equipment is inoperable when live.

In 2019, Kingston Hydro retained Kinectrics Inc. to perform an Asset Condition Assessment (ACA) of its key distribution assets (refer to Appendix 4 of the Exhibit 2, Tab 2, Schedule 1, Attachment 1, "Utilities Kingston 2012 Asset Condition Assessment"). The objective of the ACA was to provide KH with a quantifiable evaluation of asset condition and probability of failure, to aid in prioritizing and allocating capital resources, and facilitate the development of the KH Asset Management Plan. The ACA recommends the replacement of the existing oil switch.

This project involves replacement of the end of service life oil switch with gas switchgear, secondary breakers with a secondary breaker panel, a new load break center and associated cables.

Forecast Amount

Total..$ 275,000

1. O&M Costs To Be Recovered Through Rates

O&M cost recovery is not expected for this capital project.

2. Related Customer Attachments and Load

The vault supplies 4.16kV primary voltage and 120/208V secondary voltage to approximately 60 businesses and residential customers located within a two block radius and is a tie point of two 5kV circuits.

3. Risks to Completion and Risk Mitigation:

There is minimal risk to completion for the project. 5kV customers and secondary loads can be transferred to adjacent vaults or circuits by switching network switches. One Primary customer's service will need to be fed from an alternative source during the equipment installations.

4. Comparative Information for Equivalent Projects:

In recent years Kingston Hydro has upgraded other transformer vaults with similar equipment in similar condition. Kingston hydro will benefit from the experience gained on these projects in the execution of this project. The cost estimate for this project is based on actual costs experienced in the similar projects Kingston Hydro conducted in the past.

Comparable transformer vault equipment upgrades;

TV3 (2020) – $231,647

- S&C Vista Switch
- 750kVA 120/208V Submersible Vault Style Transformer
- Secondary distribution breaker

TV85 (2018) - $ 449,585.13

- New precast vault structure
- S&C Vista Switch
- 750kVA 120/208V Submersible Vault Style Transformer
- Secondary distribution breaker

TV29 (2017) - $268,913

- S&C Vista Switch
- Secondary distribution breaker panel

TV37 (2016) – $100,837.32

- S&C Vista Switch

TV8 (2015) - $323,314

- New Self-Supporting Vault Roof Slabs
- S&C Vista Switch
- 750kVA 120/208V Submersible Vault Style Transformer
- Secondary distribution breaker

TV9 (2015) - $405,175

- New precast vault structure
- S&C Vista Switch
- 750kVA 120/208V Submersible Vault Style Transformer
- Secondary distribution breaker panel

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG)

No renewable energy elements are expected for the project.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

This project is driven mainly by the need to replace aging assets at the end of their service life. The second driver is low reliability caused by planned outages required by operating the oil switch. The oil switch in this vault is an obsolete switch and is unsafe to operate under load. Current safe work practice requires Kingston Hydro staff to de-energize this type of switch by opening feeder breakers at substations or operating vault gas switches further out in the distribution system before operating the oil switches, resulting in extended outages and low reliability. Kingston Hydro Reliability Performance

Analysis (refer to Exhibit 2, Tab 3, Schedule 2) indicates an average of nine these events happened in the KH distribution system per year between 2004 and 2013, affecting 2980 customers and 1142 total customer hours or 0.042 SAIDI in a year.

Kingston Hydro's current standard is to replace oil switches with S&C Vista gas switches, which are rated to operate under load, thus greatly reducing customer interruption occurrences and duration, meeting customers' expectation of continuous electrical supply. The new switchgear is equipped with fault interrupters and relay protection that clear local faults at vault transformer and primary customers rather than by utilizing station breakers, this improves protection coordination and system reliabilities. The new gas switchgear and secondary panel will reduce arc flash risk and improve worker safety. Replacement of oil switch also eliminates unnecessary switching, resulting in more efficient operations and reduced O&M costs. Installing a new primary load break center improves the adaptability and flexibility of the 5kV.

2. Safety

Replacement of secondary breakers with metal enclosed breaker panels reduces arc flash risk and risk of making any physical contact with bare live conductors, improving worker safety.

3. Cyber-security, Privacy

No cyber-security or privacy concerns are expected with the project.

4. Co-ordination, Interoperability

Installation of the new gas switchgear enables KH staff to operate the switchgear when the feeder is energized improving operational flexibility and simplifying switching procedures.

New gas switchgear with digital relays makes provision for future distribution system automation and smart grid implementation

5. Environmental Benefits

Replacement of the old oil-filled switchgear will eliminate environmental risk caused by oil leaks.

6. Conservation and Demand Management

No conservation and demand management elements are expected for the project.

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

1. Condition and Performance Record of Asset

The oil switchgear in TV#18 was originally installed in the late 1960's. The ACA indicates that the oil switchgear's health index is 45.96% and it is therefore in poor condition. The ACA recommends the replacement as a high priority. Kingston Hydro operates oil-filled vault switch units in ages ranging from 30 to 54 years. Deteriorated mechanical contacts in this type of switch move slowly and are prone to arcing when operated under load. This presents a worker safety concern for Kingston Hydro. Current safe work practice requires Kingston Hydro staff to de-energize and ground the switches before operating them. Due to the presence of a damp and corrosive environment, most of the vault switchgear is corroded. Bad contact and oil leaking are detected frequently. Kingston Hydro replaced 21 switch units during the last rate application period. There are 62 units still in service. The ACA indicates the health indices of oil switches are ranging from 33.58% to 46.23%, these oil switches are in poor condition, and recommends a replacement rate of 6 units per year for the next ten years.

The secondary breakers are at end-of-life and are an older style with bare connection lugs.

2. Customer Impacts

TV#18 supplies approximately 60 businesses and residential customers in Downtown Kingston neighbourhood. In the event of asset failure, KH would expect an approximate 90 minute outage to secondary customers to allow for sectionalizing. The one radially fed primary customer would experience a prolonged outage while repairs or an alternate feed could be completed. Refer to attached map for further details of customer impacts. Considering customer classes and locations, the value of customer impact is high.

Factors Affecting Project Timing/Priority

Poor asset condition and reduced reliability caused by planned outages required for operating the oil switch make this project a high priority relative to other transformer vaults and other projects. This project currently depends on available capital funds but could become an urgent need project should the oil switch fail.

3. Consequence for System O&M Costs

No significant consequences for system O&M costs are expected.

4. Impact on Reliability and Safety Factors

Implementation of the project will maintain the system redundancy and system flexibility of the 5kV circuits and the area fed from TV18, improving service reliability and operational efficiency, maintaining high customer satisfaction levels.

D. <u>PHOTOS</u>

Figure 1 & 2 – TV18 existing oil switch OS18, legacy secondary tie-breaker switches and vault transformer

Kingston Hydro	**Project Name**: Annual Deteriorated Overhead Infrastructure Program **Investment Category**: System Renewal **Start Date**: January 2022 **In Service Date**: December 2022	
	Proposed Budget: $180,000	
	System Access: 0%	System Renewal: 100%
	System Service: 0%	General Plant: 0%

GENERAL INFORMATION

The Annual Deteriorated Overhead Infrastructure Program focuses on replacement of deteriorated poles, pole mount transformers and other deficiencies identified through annual overhead infrastructure inspections. The program typically consists of numerous small projects involving single pole replacement as well as replacement of short sections of overhead line, many of which are below the materiality threshold.

The annual budget for this program has many drivers including pole condition, available resources and available funds. Sometimes it is necessary to allocate capital funds to other projects with competing priorities.

Forecast Amount

Total…………………………………………………….$180,000

Actual Cost Breakdown
Labour & Vehicles……………………………….$122,000
Materials…………………………………………….$36,700
Contracts……………………………………………..$21,300

Total…………………………………………………$180,000

Risks to Completion and Risk Mitigation:

This program generally involves the replacement of wood poles that have a high risk of failing.

Comparative Information for Equivalent Projects:

Kingston Hydro regularly reviews pole conditions and switch replacements through an inspection process. The cost estimate for this project is based on previous actual costs experienced with similar projects Kingston Hydro has conducted in the past.

EVALUATION CRITERIA AND INFORMATION

Efficiency, Customer Value, Reliability

This work is required to maintain a reliable power supply as these assets have reached the end of their useful life.

Safety

Renewal of these assets is necessary to avoid potential risk to public safety that could result from a failure of a wood pole.

Cyber-security, Privacy

Cyber security protection is not applicable to this project.

Co-ordination, Interoperability

This project will be coordinated with third party telecoms identified as attachers on assets identified for replacement as applicable.

Economic Development

This project will not directly benefit economic development.

Environmental Benefits

There are no specific clean technology or conservation benefits associated with this project.

CATEGORY-SPECIFIC INFORMATION AND ANALYSES

Condition and Performance Record of Asset

Wood poles are visually inspected at least once every three years in accordance with Ontario Energy Board requirements. A competent line person also performs a hammer test, a Polux test in addition to the visual inspection depending upon the pole condition and history. Deteriorated poles identified by pole inspections are prioritized by condition of various criteria, and are graded as follows: 1) Critical 2) Major 3) Minor.

In 2019, Kingston Hydro retained Kinectrics Inc. to perform an Asset Condition Assessment (ACA) of its key distribution assets (refer to Distribution System Plan Appendix 4). The objective of the ACA was to provide KH with a quantifiable evaluation of asset condition and recommend Flag-For-Action (FFA) replacement quantities based on probability of failure for Asset Management and capital planning purposes. Kingston Hydro also gauges its risk and long term asset management strategy by comparing the average annual replacement quantity of the proposed 6 year budget (2020 Bridge Year plus 2022-2026 Forecast Years) to the 10 year average annual recommended FFA quantity. This helps to identify changing trends for future capital planning purposes as demonstrated by the following charts for poles and pole transformers.

Kingston Hydro is proposing to pace deteriorated pole replacement and pole transformer replacement so that a greater portion of available capital funds can be allocated to renewal of other assets. The average annual FFA quantity for wood poles and pole mounted transformers appears to be decreasing over time. The reliability and financial risk of a pole failure is partially mitigated through the annual pole inspection program and continuous prioritization of pole work. For example, replacement of deteriorated poles with a 44kV circuit and/or multiple 5kV circuits would typically be prioritized over a pole with a single phase primary circuit or secondary circuit due to the higer reliability and financial risk involved.

Customer Impacts

The number and type of customers impacted varies with each pole replacement project. Poles supporting 44kV circuits are given the highest priority for replacement over other poles since they have the highest electrical loads and tend to affect the greatest number of customers.

Factors Affecting Project Timing/Priority

Wherever possible, Kingston Hydro prefers to re-design and rebuild continuous sections of an overhead line (multiple pole spans) for efficiency and to upgrade the construction to new standards. For example, the number of poles and pole transformers can often be reduced (optimized) through a re-design project whereas a like-for-like replacement approach may not always be optimal. Sections of overhead line containing multiple poles that have been identified as “Critical” or “Major” are therefore prioritized for re-design and replacement. If the re-design and replacement of a continuous section of overhead line must be deferred due to limited capital funds and/or resources then the alternative is like-for-like spot replacement within 12 months for poles identified as “Critical” status and deferral of pole replacement for poles identified as “Major” until sufficient capital funds and resources are available or until the next inspection cycle (whichever comes first).

Consequence for System O&M Costs

Generally speaking, these projects do not materially impact system O&M costs.

Alternatives and Comparison

This program is reactive in nature.

Kingston Hydro	**Project Name**: 100439-74 – 13.8kV – Rigney St **Investment Category**: System Service **Start Date**: 2022	
	Proposed Budget: $115,000	
	System Access: 0%	System Renewal: 0%
	System Service: 100%	General Plant: 0%

A. GENERAL INFORMATION

This project involves construction of a new future use 13.8kV overhead circuit on new poles to be installed on Rigney Street, coming from MS 16. Kingston Hydro will look to utilizing this new circuit as a future express 13.8kV feeder to the Williamsville Area to support the proposed future development and planned intensification plans in the area.

Forecast Amount

Total..$115,000

1. O&M Costs to Be Recovered Through Rates

O&M costs will not be recovered through rates.

2. Related Customer Attachments and Load

There are no related customer attachments or load.

3. Risks to Completion and Risk Mitigation:

There is minimal risk to completion.

4. Comparative Information for Equivalent Projects:

The cost estimate for this project was based on actual costs experienced in the similar projects Kingston Hydro conducted in the past.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG:

This fund is not associated with REG facilities.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

This project was driven by recent development and proposed future development and intensification in the Williamsville area. The extension of a future use 13.8kV will increase the capacity in the Williamsville area for the future development. The new 13.8kV circuit will increase the reliability and increase the capacity available for the 5kV circuits in the area.

2. Safety

This program has no effect on health and safety.

3. Cyber-security, Privacy

Not Applicable

4. Co-ordination, Interoperability

This project was completed in coordination with the planned pole replacements on Leroy Grant Drive

5. Environmental Benefits

Not Applicable

6. Conservation and Demand Management

Not Applicable

C. CATEGORY-SPECIFIC INFORMATION AND ANALYSES

1. Condition and Performance Record of Asset

Not Applicable

2. Customer Impacts

Not Applicable

3. Factors Affecting Project Timing/Priority

The timing for this project is dictated by the proposed development applications for the Williamsville Area. This project is the first of a three stage 13.8kV extension and expansion project to be completed over the next 4 years to support the developments and future development/intensification in the Williamsville Area.

4. Consequence for System O&M Costs

Not Applicable

5. Impact on Reliability and Safety Factors

Not Applicable

6. Alternatives and Comparison

Not Applicable

Kingston Hydro	**Project Name**: Frontenac TS – MS1 Pilot Wire Upgrades **Investment Category**: System Service **Start Date**: 2022 **In Service Date**: 2022	
	Proposed Budget: $140,000	
	System Access: 0%	System Renewal: 0%
	System Service: 100%	General Plant: 0%

A. GENERAL INFORMATION

This is a multi-year project started in 2020. Protection upgrades to the M4 and M5 feeders at Hydro One Frontenac TS triggered the need to upgrade the 44kV line protections and associated tele-protections for two 44kV breakers (1M43 and 1M56) at Kingston Hydro Substation MS1. The legacy Pilot Wire tele-protection scheme over Bell copper pairs will be upgraded to a DCB tele-protection scheme over fibre. This project involves the implementation of the new DCB tele-protection scheme. The 44kV line protections are also being upgraded in 2022 and are considered a system renewal project.

1. O&M Costs To Be Recovered Through Rates

O&M cost recovery is not expected for this capital project.

2. Related Customer Attachments and Load

The Frontenac M4 and M5 feeders supply six Kingston Hydro 44kV substations and 12 customer-owned 44kV stations including two hospitals. The combined load of the Frontenac M4 and M5 feeders represents approximately half of Kingston Hydro's load.

3. Risks to Completion and Risk Mitigation:

There are minimal risks to completion. Feeder load can be transferred while work is being performed.

4. Comparative Information for Equivalent Projects:

KH drew on its costing experience from these past projects to develop its budget for this project.

5. Total Capital and OM&A Associated with Renewable Energy Generation (REG)

There are no capital or OM&A costs associated with REG for this project.

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

The new fibre connection will replace legacy copper wiring and provide a more modern and up to date communication link.

2. Cyber-security, Privacy

No cyber-security or privacy concerns are expected with the project.

3. Co-ordination, Interoperability

This project is to be coordinated with Hydro One Network Inc.'s upgrades to their Frontenac TS.

4. Environmental Benefits

No environmental benefits are expected from this project.

5. Conservation and Demand Management

No conservation and demand management elements are expected for the project.

C. <u>CATEGORY-SPECIFIC INFORMATION AND ANALYSES</u>

1. Benefits for Customers

The legacy Bell copper pairs used by the existing Pilot Wire protection scheme are obsolete and will not be maintained by Bell for much longer. The new UK fibre link will provide reliable and modern protections for Kingston Hydro customers for many years to come.

2. Regional Infrastructure Plan Requirements

No larger regional infrastructure requirements are expected to be part of this project.

3. Incorporation of Advanced Technology

The installation of new fibre and tie ins to new protective devices is expected in this project.

4. Benefits or Effects on System

A benefit to the system will be a more reliable and supported tele-protection communication link.

5. Factors Affecting Implementation Timing/Priority

Timing is dependent on coordination of Hydro One Networks Inc. work at Frontenac TS and Kingston Hydro's work at Substation MS1.

6. Alternatives and Comparison

Utilizing a radio communication device was looked at, but not chosen due to radio interference, possibility of losing direct visibility between stations, and available real estate to install towers. Replacing the copper lines was also not chosen due to the outdated element of that technology. Thus, fibre, installed by UK fibre, was the chosen choice for the project.

Kingston Hydro	**Project Name**: 100434 - New Transformers or New Connections funded by Capital Contributions **Investment Category**: System Access **Start Date**: Fall 2022	**In Service Date**: Fall 2023
	Proposed Budget: $150,000	
	System Access: 100%	System Renewal: 0%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

New Transformers or New Connections funded by Capital Contributions

Historic/Forecast Amount

Total $150,000

Comparative Information for Equivalent Projects:

The capital contributions are based on five year past average for capital contributions from new connections.

1. O&M Costs To Be Recovered Through Rates

No O&M costs for this project will be recovered through rates.

Related Customer Attachments and Load

Unplanned customer connections may require a transformer and cabling to connect to the distribution system

2. Risks to Completion and Risk Mitigation:

For each expansion that is required, to connect a general service customer greater than 50kW, an economic evaluation is calculated to determine if revenues cover the costs of the connection. If new connections generate adequate revenue, or if there are fewer connection requests than anticipated, there will not be an increase to the capital contribution fund and transformers/cabling will be funded solely from the New Connections buget item.

3. Comparative Information for Equivalent Projects:

KH regularly receives connection requests and extends circuits for new customer connections. The cost estimate for this project is based on actual costs experienced in the similar projects KH conducted in the past.

4. Total Capital and OM&A Associated with Renewable Energy Generation (REG)

There is no Renewable Energy Generation project associated with this program

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

This project is driven by a customer service requests. KH has obligations to provide customers with access to its distribution system under regulatory requirements and obligations and KH's Conditions of Service.

The Electricity Act, 1998, Part III, section 28 states:

> A distributor shall connect a building to its distribution system if,
>
> (a) the building lies along any of the lines of the distributor's distribution system; and
> (b) the owner, occupant or other person in charge of the building requests the connection in writing.

Implementation of the project will meet customer requests for new connections and property development.

2. Safety

This program has no effect on health and safety.

3. Cyber-security, Privacy

Cyber security protection was not applicable to this project.

4. Co-ordination, Interoperability

The new services will provide supports for local businesses and job creation.

5. Environmental Benefits

No specific clean technology or conservation benefits were associated with this project.

6. Conservation and Demand Management

This project has no elements relating to Conservation and Demand Management

<u>CATEGORY-SPECIFIC INFORMATION AND ANALYSES</u>

1. Factors Affecting Project Timing/Priority

The timing of this project is determined by the timing of new connections and the receipt of capital contributions.

2. Customer Preferences

Customer and third party input do not apply to this program.

3. Cost Factors/Cost Control

The one and only factor effecting this project is the results of the economic evaluations.

4. Other Planning Objectives Met

No other options or planning objectives were considered.

5. Alternatives and Comparison

There are no alternatives to this program

6. Results of Economic Evaluation

The Economic evaluation calculation determines the future revenues of proposed developments and will offset the capital costs of the expansions.

7. System Impact

New load on the 5kV system reduces available capacity for future connections.

Kingston Hydro		
	Project Name: 100440-05 - Williamsville new development 575 Princess St **Investment Category**: System Access **Start Date**: Fall 2020	**In Service Date**: Fall 2023
	Proposed Budget: $78,000	
	System Access: 100%	System Renewal: 0%
	System Service: 0%	General Plant: 0%

A. GENERAL INFORMATION

A mixed commercial and residential building will be constructed at 575 Princess St. located on Princess St . between Frontenac St and Albert Street. Kingston Hydro ("KH") will provide a 44kV service as required by the customer to this new development in 2021. As the closest existing 44kV three phase pole line runs along Concession St., a new 44kV overhead pole line will be installed on Nelson St. from Concession to York St. On York to Albert St and extending to 575 Princess St. The project will trigger existing pole line reconstruction. This is a multi year project with budgets being split over the three years.

There will be planned outages to residents in these areas in order to transfer loads to the new constructed pole line.

Historic/Forecast Amount

Total $195,000

2021 Actual Cost Breakdown

Labour & Vehicles $14,561

Materials $13,562

Contracts $16,048

Total $44,171

2022 Forecast Amount

Labour & Vehicles $48,700

Materials $27,000

Contracts $2,300

Total $78,000

2023 Forecast Amount

Labour & Vehicles	$48,000
Materials	$27,000
Contracts	$0
Total	**$75,000**

Note: the remaining portion (2023) will be funded from the main program budget (100440).

Comparative Information for Equivalent Projects:

1. O&M Costs To Be Recovered Through Rates

No O&M costs for this project will be recovered through rates.

Related Customer Attachments and Load

Customer loading in the Williamsville area is increasing due to the city's promotion over the last few years of development in the area; there may be opportunities in the near future to utilize the line expansion for growth on Princess St.

2. Risks to Completion and Risk Mitigation:

The risks to completion of this project may include delays in receiving required approvals and permits from municipal and other authorities, and the risk of the project not being fully developed as per the customers submitted plans. The risk will be mitigated through securing permits in advance and requiring an expansion deposit from the customer driving this project that will be refunded as load connects.

3. Comparative Information for Equivalent Projects:

KH regularly receives similar connection requests and extends circuits for new customer connections. The cost estimate for this project is based on actual costs experienced in the similar projects KH conducted in the past.

4. Total Capital and OM&A Associated with Renewable Energy Generation (REG)

There is no Renewable Energy Generation project associated with this program

B. EVALUATION CRITERIA AND INFORMATION

1. Efficiency, Customer Value, Reliability

This project is driven by a customer service request. KH has obligations to provide customers with access to its distribution system under regulatory requirements and obligations and KH's Conditions of Service.

The Electricity Act, 1998, Part III, section 28 states:

> A distributor shall connect a building to its distribution system if,
>
> (a) the building lies along any of the lines of the distributor's distribution system; and
> (b) the owner, occupant or other person in charge of the building requests the connection in writing.

Implementation of the project will meet customer requests for new connections and property development.

2. Safety

Some of the poles in this project are nearing end of useful life, renewal of these assets is necessary to avoid potential risk to public safety that could result from a failure of a wood pole.

Cyber-security, Privacy

Cyber security protection was not applicable to this project.

3. Co-ordination, Interoperability

The new service will provide supports for local businesses and job creation and will provide much needed additional housing for downtown Kingston area.

4. Environmental Benefits

No specific clean technology or conservation benefits were associated with this project.

5. Conservation and Demand Management

6. This project has no elements relating to Conservation and Demand Management

CATEGORY-SPECIFIC INFORMATION AND ANALYSES

1. Factors Affecting Project Timing/Priority

The developer drives the timing of the service requirement. KH will coordinate with the customer and prioritize this project to meet the required in-service date of March, 2023.

2. Customer Preferences

KH proposed the most cost effective option for the new service, meeting the customer's preferences of a reliable supply at low cost.

The customer's inputs will be accommodated in the detail design and construction. KH will coordinate with the developer to ensure that all customer needs are met.

Implementation of the project will meet customer requests for new connections and property development.

3. Cost Factors/Cost Control

Between 2021 and 2023, the 44kV three phase pole line will be extend to Princess St. KH will utilize the existing 5kV pole line location to take the opportunity to replace several end of life poles.

4. Other Planning Objectives Met

Aging asset renewal and upgrade objectives are also being met in this project. KH will replace old poles. The reconstruction of the existing pole line will improve service reliability in the area.

5. Alternatives and Comparison

KH assessed two alternative routes and determined the chosen route was the least expensive while also meeting the customer’s needs.

6. Results of Economic Evaluation

The Economic evaluation calculation determined the future revenues of the proposed development (if fully developed) will offset the capital costs of the expansion.

7. System Impact

The 44kV overhead line expansion will provide provision for future 44kV service requests in this area.

RATE BASE (EXHIBIT 2)

<u>Interrogatory 2.0-VECC -6</u>

Reference: Exhibit 2, Tab 4, DSP /Appendix 2-AA

a) For 2022 and 2023 KHC shows $300,000 in each year for "New Development" investments. Please identify the projects for these amounts and specifically whether they are related to those discussed at 5.2.1 of the DSP (page 25 of 505).
b) Which month are the projects for 2022 and 2023 expected come into service?
c) Please describe the current status/progression of the projects so as to clarify the basis of the estimated in-service dates.

<u>Response</u>

a) This is a budgetary envelope to cover distribution transformer and primary cable costs for new developments as they connect. The City's intensification plans for Williamsville and Central Kingston Growth Strategy are expected to trigger most of this new development.

b) Kingston Hydro cannot predict when capital contribution projects will come into service because there are many factors that can affect project schedule including planning approvals and construction contract award which has been impacted in recent years by the ongoing COVID-19 pandemic and associated supply chain and skilled labour shortages.

c) The annual LV and HV connections due to service requests is on track with historic trends. Please refer to the response to 2-Staff-34 for the number of annual historic LV and HV connections.

RATE BASE (EXHIBIT 2)

<u>Interrogatory 2.0-VECC -7</u>

Reference: Exhibit 2, Tab 4 DSP, page 65-

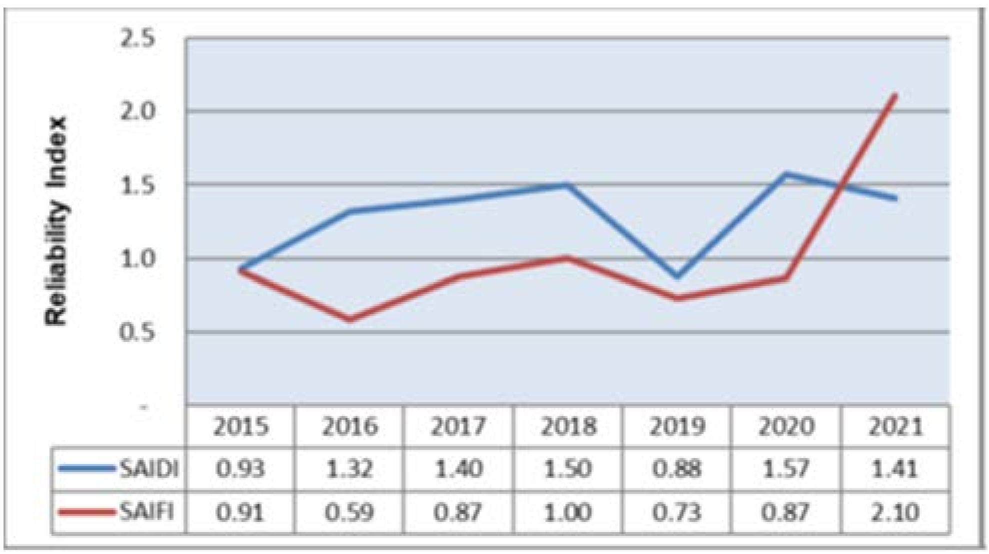


Figure 5.2-18 – 2015 to 2021 System Reliability Indices 2 Excluding Loss of Supply and Major Event Days

"• 44kV Customer-owned Equipment Failure in 2021
A 44kV cable termination was failed at a customer owned substation on March 5, 2021. The foreign interference caused a total of 10,716 customers of interruptions and 13,873 customer-hours of interruptions, or 0.38 in SAIFI and 0.50 in SAIDI. This single event contributed 35.5% of the annual SAIDI and 18.1%

of the annual SAIFI in 2021."

a) ***The above chart shows a major degradation in reliability in 2021. Is the explanation provided at page 70 of 505 of the DSP the reason for this major shift?***
b) ***What changes were made subsequent to this failure to reduce the risk of customer owned equipment causing outages to other customers?***

Response

a) Yes, the following unplanned outages described on page 70 of the DSP contributed to the change in the annual SAIFI in 2021:
   - the 44kV customer-owned cable termination failure and
   - the Unknown Trips of Multiple 44kV Feeders during a Thunderstorm.

b) After the 44kV customer-owned cable termination failure in 2021, Kingston Hydro installed visual fault indicators at the cable riser of the 44kV customer-owned equipment to aid in quickly locating future cable faults on this cable section.

RATE BASE (EXHIBIT 2)

<u>Interrogatory 2.0-VECC -8</u>

Reference: Exhibit 2, Tab 4, DSP, pages 77-

a) The Service Reliability Charts at pages 72 and 73 appear to show a significant uptick in outages due to loss of supply in 2021 (1.80 with supply loss and 1.41 without). Please explain the reasons for this outage(s).

b) KHC notes that Hydro One has made some investments, specifically at the Frontenac TS, that will likely reduce loss of supply. The Utility also notes however, that there are other investments Hydro One could make to improve Kingston's reliability, specifically with respect to relays at the Gardiner DESN1. Has KHC made a request to Hydro One to make this investment and if so what was the response.

<u>Response</u>

a) The 44kV M7 Feeder at Hydro One's Gardiner TS tripped at 3:00 am on August 8th, 2021. The Ontario Grid Control Centre (OGCC) tried to supply the M7 feeder with the M11 feeder through a M7-M11 tie switch, but the M11 tripped when trying to pick up the M7 load, causing extended outages. The loads were temporarily fed from other 44kV feeders at 8:05 am on August 8th. This outage caused a total of 10,726 customer-hour interruptions or 0.39 in the Kingston Hydro SAIDI. Kingston Hydro did not receive a formal explanation or report from Hydro One regarding the cause of this extended outage but informal reports at the time of the incident suggest they were caused by a faulty Gardiner TS protection relay and a momentary fault on the DC battery system at Gardiner TS. The cause of interruption for this outage is Loss of Supply for Kingston Hydro as the upstream Gardiner M7 feeder protection is owned and maintained by Hydro One.

b) Yes, Kingston Hydro has made many inquiries to Hydro One asking about the timing of upgrades to the legacy 44kV protections at Gardiner TS which have reached the end of their useful life. Most recently, in the absence of a clear response, Kingston Hydro raised concerns about the lack of ability to collect fault event reports and distinguish the location of faults on the Gardiner TS feeders due to the legacy 44kV protection relays at Gardiner TS and suggested SCADA fault indicators at the Kingston Hydro demarcation point would be a helpful interim solution until the legacy protection relays are upgraded. Kingston Hydro raised these concerns in emails that were sent to both Hydro One Transmission and Hydro One Distribution in January 2020 as part of the Peterborough to Kingston Regional Planning process. Hydro One Transmission was contacted because Kingston Hydro is supplied by three dedicated feeders. Hydro One Distribution was also contacted because each dedicated feeder from Gardiner TS that serves Kingston Hydro has a short section of Hydro One distribution line between Gardiner TS and Kingston Hydro demarcation point. The following response was received from the Hydro One Distribution Planner on February 3, 2020:

> *We will add an investment to our Dx plan to add communicating fault current indicators at the demarcation point on the Kingston Hydro supplies from Gardiner TS. We can also take a look and see if we can have distance to fault activated on the Gardiner TS feeder protections. This should shorten search times and give clear indication if the fault is on H1 Dx system or KH system.*

> *There is a mix of H1 Tx and Dx outages in the sheet so I think a joint discussion with all 3 parties is warranted. I think <H1 TX> are planning another discussion related to the needs assessment with all 3 parties so we can discuss the topic then.*

It's important to note that some of the legacy protection relays are electro-mechanical and have no ability to report the "distance to fault" in an event report. We also expressed concerns about the legacy 44kV protection relays in our conversations with Hydro One following the multiple relay failures at Gardiner TS in August 2021.

During the IRRP and RIP phases of the Peterborough to Kingston Regional Planning stages, the focus on Gardiner TS expanded to the replacement/upgrade of the existing transformers at Gardiner TS DESN1 to increase capacity and meet near term load growth needs. Kingston Hydro believes this additional need to invest in capacity upgrades further supports Hydro One's investment plans to upgrade the legacy 44kV protections at Gardiner TS in the near future.

RATE BASE (EXHIBIT 2)

Interrogatory 2.0-VECC -9

Reference: Exhibit 2, Tab 4, DSP, section 5.4.1.1.1

a) Please confirm that KHC forecast no capital contributions in its prior DSP estimates. If this is confirmed please explain the reason for this.
b) In this application does the category of "System Access" attract 100% of the capital contributions? If not please breakdown the capital contributions estimates by investment category for the 2023-2027 period.
c) Please explain how the capital contribution amounts were estimated for 2023 – 2027, that is show the derivation. Specifically address why it appears that contributions are a varying proportion of system access investments over the rate plan period.

Response

a) Confirmed, the prior DSP forecast did not include a forecast of capital contributions because this is customer-funded work and our primary focus has always been on managing Net Capital Expenditures funded from rates.

b) Yes, System Access attracts 100% of the capital contributions. The annual estimated amount of capital contributions for 2023-2027 is $200,000 and consists of $150,000 for capital contribution payments related to new transformers/connections (System Access) and $50,000 for capital contribution payments related to new meter installations (System Access). The 2024-2027 capital contribution forecast has not been finalized or approved by the Kingston Hydro board.

c) Please refer to response to 2-SEC-12.

RATE BASE (EXHIBIT 2)

Interrogatory 2.0-VECC -10

Reference: Exhibit 2, Tab 4, DSP, section 5.4.1.1.2 pages 204-

a) KHC system access forecast for the 2023 to 2027 period is significantly higher (almost double) the past period. Please show how the 2024 to 2027 forecast of system access was derived.

b) Please explain the difference between the amount shown for system access in table 5.4. of $1,083m and that shown in Appendix 2-AA (Capital Projects) of $1,032,500.

Response

a) This is a duplicate question. Please refer to question and response to 2.0-VECC-11 b).

b) This is a duplicate question. Please refer to question and response to 2.0-VECC-11 c).

RATE BASE (EXHIBIT 2)

<u>Interrogatory 2.0-VECC -11</u>

Reference: Exhibit 2, Tab 4, Appendix 2-AA

a) Please update Appendix 2-AA (Capital Projects) to show the spending for the first 6 months of 2021 and the current projected in-service capital investments at year end 2021.
b) KHC system access forecast for the 2023 to 2027 period is significantly higher (almost double) than the past rate period. Please show how the 2024 to 2027 forecast of system access was derived.
c) Please explain the difference between the amount shown for system access in table 5.4. of $1,083m and that shown in Appendix 2-AA (Capital Projects) of $1,032,500.

<u>Response</u>

a) An updated version of App 2-AA showing the spending for the first 6 months of 2021 is provided as an attachment to the interrogatory response. The Total Spend at year end 2021 by project is summarized in DSP Figure 5.4-17 through Figure 5.4-22 (App-2AA snapshots). There was insufficient time and resources during the interrogatory response period to provide the in-service capital investment at year end 2021 by project however, the in-service capital investment at year end 2021 by project would be the 2021 Total Spend less 2021 WIP. The following table summarizes the 2021 WIP remaining at year end 2021 by project.

Project name	Status	Sum of Total cost amount
UK-KHC-Frontenac TS-Coordination Study - Design & Inspection	WIP	62,065.46
UK-KHC-Frontenac TS-Fibre Install - Comm Equip	WIP	3,440.00
UK-KHC-Frontenac TS-Fibre Install -Services	WIP	2,195.00
UK-KHC-Frontenac TS-Fibre Install - Design & Inspection	WIP	1,361.03
UK-KHC-MS#5 Upgrade-Design&Inspec	WIP	5,993.79
UK-KHC-Elm St-Single Phase 5kV Extension-P&F	WIP	51.45
UK-KHC-484 Albert St. New Primary 500kVA-Design&Inspect	WIP	1,030.99
UK-KHC-11 Wright Cres-Service Connection-Design&Inspect	WIP	180.59
		76,318.31

b) The table below summarizes the forecast year of investment for each of the requested 2023-2027 System Access projects but does not include costs because the 2024-2027 project prioritization and costs have not been finalized or approved by the Kingston Hydro board yet.

Brief Project Description	Forecast Year
13.8kV voltage conversion	2023-2024
Bagot @ Russel to Supply Davis Tannery Phase 1	2024
Clyde Crt - New MTS - Planning and Design	2024-2025
New Development	2023-2027
New Transformers or New Connections funded by Capital Contributions	2023-2027
Regulatory Meter Replacements/Seal Updates	2023-2027
Removal of Transformers containing PCBs	2023-2025

c) The sub-total amount of $1,032,500 for System Access investments in Appendix 2-AA (DSP Figure 5.4-17) is the total amount of material 2023 System Access projects that exceed the materiality threshold of $78,000. The sub-total amount of $1.083million for System Access investments in Appendix 2-AB (DSP Figure 5.4-4) represents the total amount of all 2023 System Access projects and is slightly higher than the sub-total amount in Appendix 2-AA.

Response to Vulnerable Energy Consumers Coalition (VECC)

Interrogatory #2.0-VECC-11 (a)

Attachment 1 of 1

(Updated App2-AA)

Table 2-VECC-11 a)
Updated App2-AA showing spending for first 6 months of 2021

Projects	OEB Category	2021 YTD June 30
UK-KHC-Vehicles & Vehicle Modifications	General Plant	201,341.00
UK-KHC-IS&T Expenditures from City	General Plant	109,260.25
UK-KHC-CRM-Computer Software	General Plant	28,767.00
UK-KHC-Office Equipment-Computer Equipment-Hardware	General Plant	23,921.00
Tools & Equipment	General Plant	9,956.92
UK-KHC-Information Management-Computer	General Plant	8,978.85
FMS	General Plant	4,967.05
UK-KHC-Victoria Street-OH to UG Reconfig	System Access	65,029.28
UK-KHC-Frontenac St-Pole Line Rebuild	System Access	56,759.00
UK-KHC-Pole Replacement-Baiden and McDonald St.-Des&Insp	System Access	53,957.84
Electric Meters	System Access	48,271.75
UK-KHC-300kVA - 14 Garrett St.-Design&Inspect	System Access	42,876.16
Services-Overhead & Undergrnd	System Access	23,427.16
UK-KHC-Baiden St. -Bell Expansion and Pole Upgrades-P&F	System Access	20,443.00
UK-KHC-Transformer Replacement-301 Johnson St.-Tx	System Access	18,796.39
Electric Interval Meters	System Access	17,514.33
Elect Cap-40 Cliff Cres	System Access	14,777.27
UK-KHC-218 Green Bay Rd-Capital-Ugh Civil	System Access	13,440.23
UK-KHC-Pole Replacement-27 Wright Cres-P&F	System Access	9,394.62
UK-KHC-New Development Charges-Poles&Fixtures	System Access	8,421.36
UK-KHC-120 Lappan's Lane-Transformer Upgrade-Design&Inspec	System Access	- 5,833.16
Substn MS1 Rebuild-Stage 3	System Renewal	1,073,980.55
UK-KHC-King St. W 608-609 Cable Replacement-Design&Recon	System Renewal	375,739.54
UK-KHC-TV3 Rebuild	System Renewal	149,321.59
Deteriorated Pole Replcmnt Prj	System Renewal	147,426.30
UK-KHC-MS2-203 CCT-PILC Cable Replacement-Design&Recon	System Renewal	130,605.13
Transformer Installations	System Renewal	120,032.36
UK-KHC-EM36 Rebuild - King St W at Beverley St-Design&Inspec	System Renewal	80,542.96
UK-KHC-Weller Ave-Pole Replacement-Montreal to Baker-P&F	System Renewal	75,598.61
UK-KHC-Pole Replacement-CFB Kingston Hwy2-Design & Recon	System Renewal	53,676.94
UK-KHC-Pole Line-MacDonnell-207 CCT	System Renewal	41,176.98
UK-KHC-Pole Replacement-Bath Rd Gren to Arm	System Renewal	34,721.24
UK-KHC-Pole Replacement-Railway St-Design&Inspect	System Renewal	33,950.30
UK-KHC-Johnson Backyard Poles-Design	System Renewal	18,641.28
UK-KHC-Dundas St. - Cable Upgrade-Design&Recon	System Renewal	8,177.00
UK-KHC-Pole Replacement-540 Bagot St.	System Renewal	5,647.74
UK-KHC-MS#5 Upgrade Design-Design&Inspec	System Renewal	3,098.52
UK-KHC-SK15-Old Oak Rd-Switch Replacement-Design	System Renewal	1,281.00
UK-KHC-Johnson St. Secondary Riser Poles-Design&Inspect	System Renewal	338.91
UK-KHC-MS2 Window Replacement & MS4 Caulking-Design&Inspect	System Renewal	302.23
UK-KHC-44kV LBS Replacement-100 Portsmouth	System Renewal	94.27
Transformers - unallocated	System Renewal	- 64,539.70
UK-KHC-PCB Transformer Inspection and Testing-Design&Inspect	System Service	43,594.02
UK-KHC-Leroy Grant Dr. - Pole Line Rebuild-Design&Inspect	System Service	39,608.93
UK-KHC-Frontenac TS-Coordination Study	System Service	16,307.14
UK-KHC-Leroy Grant Dr. - JCB to MS13-Design&Inspect	System Service	4,131.28
UK-KHC-Frontenac TS-Fibre Install	System Service	3,440.00
	Total	3,171,362.42