

(F-12)

K2.3

EB-2016-0160

**IN THE MATTER OF** the *Ontario Energy Board Act 1998*, S.O. 1998, c.15, (Schedule B);

**AND IN THE MATTER OF** an application by Hydro One Networks Inc. for an order approving just and reasonable rates and other charges for electricity transmission to be effective January 1, 2017 to December 31, 2018.

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**CANADIAN MANUFACTURERS & EXPORTERS ("CME")  
COMPENDIUM FOR  
HYDRO ONE NETWORKS INC. ("HONI")  
WITNESS PANELS 1 – 3**

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Ontario Energy Board	
FILE No.	EB-2016-0160
EXHIBIT No.	K-23
DATE	
08/99	

1 **Building Owners and Managers Association (BOMA) INTERROGATORY #036**

2  
3 **Reference:**

4 Exhibit B1, Tab 2, Schedule 1, Page 9

5  
6 **Interrogatory:**

7 The consultations with customers were done not long before the application was filed (eight to  
8 ten weeks). What specific amendments were made to the application to reflect their concerns?

9  
10 **Response:**

11 The findings from customer consultations were used to inform investments included in this  
12 application. Some specific amendments are:

- 13
- 14 1) Increased overall sustainment capital program to maintain reliability;
- 15 2) Increased investments in lines area to ensure safety and maintain reliability; and
- 16 3) Accelerated air blast breaker investment at Middleport TS to maintain reliability.

17  
18 In addition, the Power Quality (PQ) program, described in Exhibit B1, Tab 3, Schedule 3, was  
19 being developed as a result of the PQ Working Group and the feedback from the customer  
20 consultation further supported this PQ work.

### Proposed Transmission Regulatory Scorecard - Hydro One Networks Inc.

Performance Outcomes	Performance Categories	Measures	Historical Years					
			2011	2012	2013	2014	2015	Trend
Customer Focus Services are provided in a manner that responds to identified customer preferences.	Service Quality	Satisfaction with Outage Planning Procedures (% Satisfied)	Note 1	78	Note 1	86	92	▲
		Customer Delivery Point (DP) Performance Standard Outliers as % of Total DPs	13.8	10.8	12.8	11.8	Note 2	▲
	Customer Satisfaction	Overall Customer Satisfaction in Corporate Survey (% Satisfied)	85	76	81	77	85	-
Operational Effectiveness Continuous improvement in productivity and cost performance is achieved; and distributors deliver on system reliability and quality objectives.	Safety	Recordable Incident Rate (# of recordable injuries/illnesses per 200,000 hours worked)	3.7	2.3	2.5	1.8	1.7	▲
		System Reliability	T-SAIFI-S (Ave. # Sustained Interruptions per Delivery Point)	0.60	0.61	0.57	0.60	0.59
	T-SAIFI-M (Ave. # Momentary Interruptions per Delivery Point)		0.60	0.65	0.69	0.48	0.50	▲
	T-SAIDI (Ave. Minutes of Interruptions per Delivery Point)		127.9	71.5	66.0	36.6	44.3	▲
	System Unavailability (%)		0.50	0.48	0.37	0.48	0.66	▼
	Unsupplied Energy (minutes)		21.6	14.0	20.9	12.2	11.8	▲
	Asset Management	In-Service Capital Additions (% of OEB approved plan)	95	75	90	106	85	▲
		CapEx as % of Budget	78	81	73	90	106	▲
	Cost Control	Total OM&A and Capital per Gross Fixed Asset Value (%)	9.8	8.6	7.6	8.4	9.0	▲
		Sustainment Capital per Gross Fixed Asset Value (%)	2.6	2.8	3.3	4.2	4.6	Note 3
OM&A per Gross Fixed Asset Value (%)	3.4	3.0	2.7	2.7	2.9	▲		
Public Policy Responsiveness Transmitters deliver on obligations mandated by government. (e.g. in legislation and in regulatory requirements imposed further to Ministerial directives to the Board)	Connection of Renewable Generation	% on time completion of renewables connection impact assessments	100	100	100	100	100	-
	Market Regulatory Compliance	NERC/NPCC Reliability Standards Compliance						
		- Number of High Impact Violations (Note 4)	N/A	N/A	N/A	20	2	
- Number of Medium/Low Impact Violations (Note 4)	N/A	N/A	N/A	5	10			
Regional Infrastructure	Regional Infrastructure Planning progress - % Deliverables met	N/A	N/A	N/A	100	100		
Financial Performance Financial viability is maintained; and savings from operational effectiveness are sustainable.	Financial Ratios	Liquidity: Current Ratio (Current Assets/Current Liabilities)	0.24	0.29	0.80	0.69	0.13	
		Leverage: Total Debt (includes short-term & long-term debt) to Equity Ratio	1.27	1.22	1.10	1.16	1.39	
		Profitability: Regulatory						
		Return on Equity	Deemed (included in rates) (%)	9.66	9.42	8.93	9.36	9.30
Achieved (%)	10.95	12.41	13.22	13.12	10.93			

Note 1: Customer Satisfaction survey not done in 2011 and 2013.

Note 2: Results will be available in July 2016.

Note 3: In 2014 strategic decision made to increase sustainment capital.

Note 4: Results from 2011 to 2013 are excluded due to a lack of consistent data compared to 2014 and 2015.

**Legend:**

- ▲ up
- ▼ down
- flat

**Table 1: Hydro One’s Values and Business Objectives**

Customer Focus	Customer Satisfaction	<ul style="list-style-type: none"> <li>Improve current levels of customer satisfaction</li> </ul>
	Customer Focus	<ul style="list-style-type: none"> <li>Engage with our customers consistently and proactively</li> <li>Ensure our investment plan reflects our customers' needs and desired outcomes</li> </ul>
Operational Effectiveness	Cost Control	<ul style="list-style-type: none"> <li>Actively control and lower costs through OM&amp;A and capital efficiencies</li> </ul>
	Safety	<ul style="list-style-type: none"> <li>Drive towards achieving an injury-free workplace</li> </ul>
	Employee Engagement	<ul style="list-style-type: none"> <li>Achieve and maintain employee engagement</li> </ul>
Public Policy Responsiveness	System Reliability	<ul style="list-style-type: none"> <li>Maintain top quartile reliability relative to transmission peers</li> </ul>
	Public Policy Responsiveness	<ul style="list-style-type: none"> <li>Ensure compliance with all codes, standards, and regulations</li> <li>Partner in the economic success of Ontario</li> </ul>
Environment	Environment	<ul style="list-style-type: none"> <li>Sustainably manage our environmental footprint</li> </ul>
	Financial Performance	<ul style="list-style-type: none"> <li>Achieve the ROE allowed by the OEB</li> </ul>

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Hydro One submits that the forecasted expenditures and associated timing described in this Application are necessary if these objectives are to be achieved.

**2.2 Customer Engagement and Needs Assessment**

Hydro One's goal is to engage with customers consistently and proactively to better understand the customer and enhance the company’s ability to provide services that meet their needs and improve customers’ overall satisfaction with the service they receive. One critical element of achieving this goal is the development of an investment plan that is outcome-focused and designed to meet customers' needs and preferences.

In preparing this Application, Hydro One has engaged in an intense and focused level of customer engagement, which is detailed in Exhibit B1, Tab 2, Schedule 2. The company

Witness: Oded Hubert



# SUMMARY OF SYSTEM PERFORMANCE

**Hydro One's transmission reliability has remained flat.**

**The transmission system faces increasing challenges due to asset condition.**

**Equipment performance is the largest controllable factor, contributing 42% of system interruption<sup>1</sup> minutes.** Assets continue to age (e.g., 20% of conductors now beyond *expected service life*<sup>2</sup> of 70 years).

**Evidence suggests that underlying reliability risk is increasing:**

- Equipment outages<sup>3</sup> caused by failure or necessary repairs/replacements increased ~300% from 2011 – 2015.
- Increased duration of placing customers, normally served by a multi-circuit system<sup>4</sup> on single supply, increasing interruption risk by ~400%.

**Condition assessments have identified critical replacement needs, for example:**

- 2,300 cct-km of conductors identified for priority replacement due to being at or near end of useful life<sup>5</sup>.
- 9,100 steel towers at heightened failure risk due to depletion of their corrosion protection layer.

**Hydro One continues to take action to mitigate reliability risk by:**

- Managing equipment performance through robust, condition-based asset replacement programs.
- Reducing customer exposure to single-supply through improved planning and work processes.

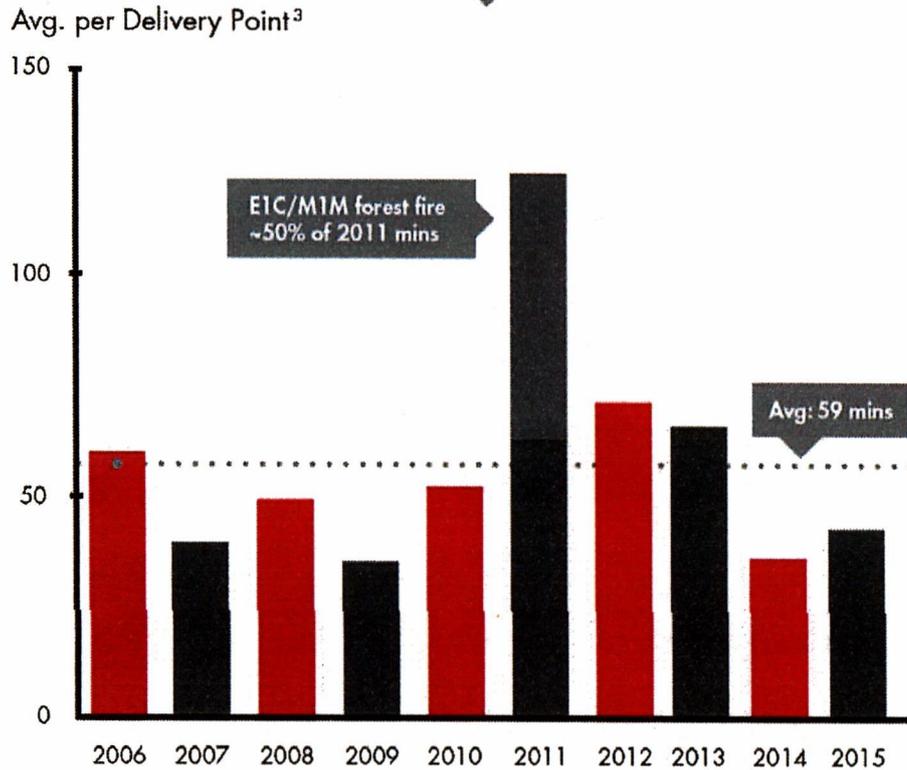
1. Outages on the transmission system that interrupt the supply of energy to transmission customers.
2. The average time in years that an asset can be expected to operate under normal system conditions.
3. The removal of facilities from service, unavailability for connection of facilities, temporary de-rating, restriction of use or reduction in the performance of facilities for any reason, including to permit the inspection, testing, maintenance or repair of facilities.
4. Delivery points served by multiple transmission circuits, creating system redundancy; tend to be located in the southern areas of the province.
5. As asset-specific determination based on an asset's condition, criticality, performance, demographics, utilization and economics.

6

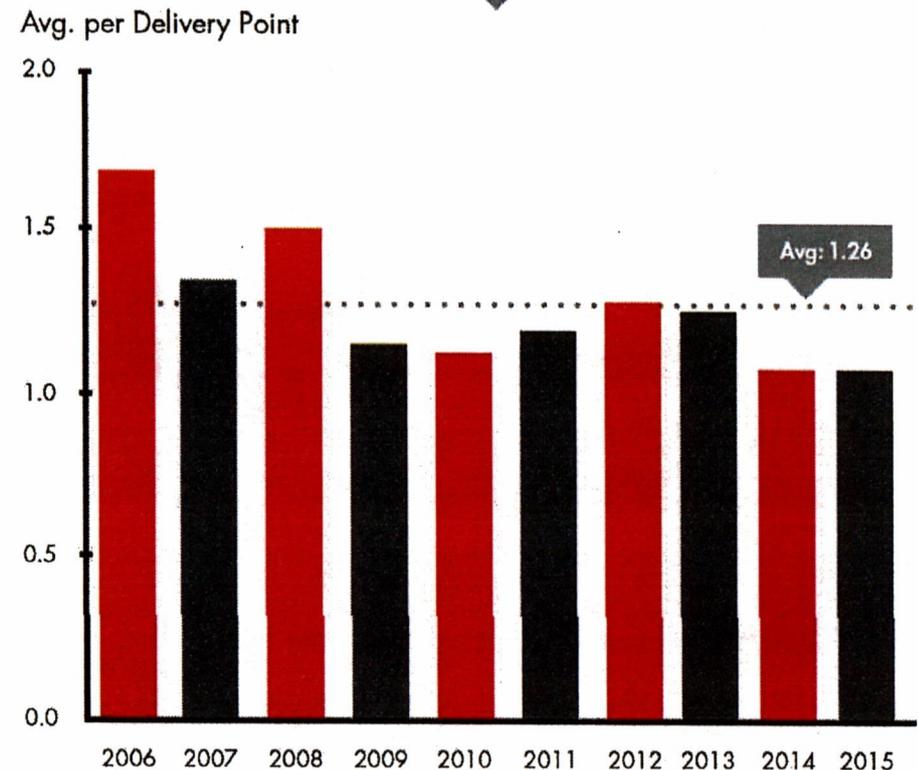
# OVERALL TRANSMISSION RELIABILITY HAS REMAINED FLAT



### DURATION OF INTERRUPTIONS (SAIDI)<sup>1</sup> 2006 – 2015



### FREQUENCY OF INTERRUPTIONS (SAIFI)<sup>2</sup> 2006 – 2015



Note: Includes both sustained and momentary interruptions. Excludes planned interruptions and interruptions due to customer activity. Excludes 2013 GTA flood (extreme Force Majeure event - a natural consequence of external forces that are beyond reasonable control).

1. System Average Interruption Duration Index

2. System Average Interruption Frequency Index

3. Interface between the Hydro One transmission system and its load customers. Delivery points consist of: (a) all Hydro One owned step-down transformer stations' low-voltage buses, and (b) stations owned by end-use transmission customers, including LDCs and other transmitters operating at 115kV or higher.

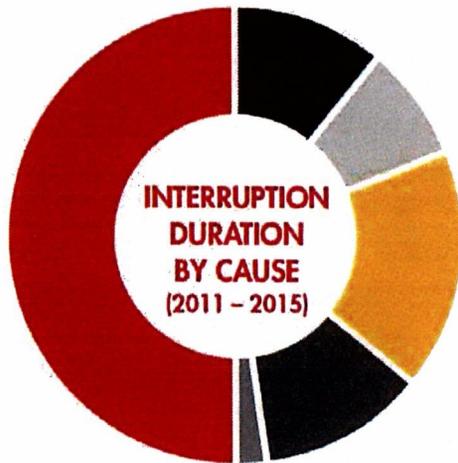
# EQUIPMENT PERFORMANCE AND DRIVERS VARY ACROSS MULTI-CIRCUIT AND SINGLE-CIRCUIT SYSTEMS (2011-2015)

Equipment failure is the single largest driver of customer interruption minutes across both systems.

## MULTI-CIRCUIT SYSTEM (SAIDI)

KEY FACTS:

- ~70% of delivery points • ~85% of total load
- Located primarily in Southern Ontario



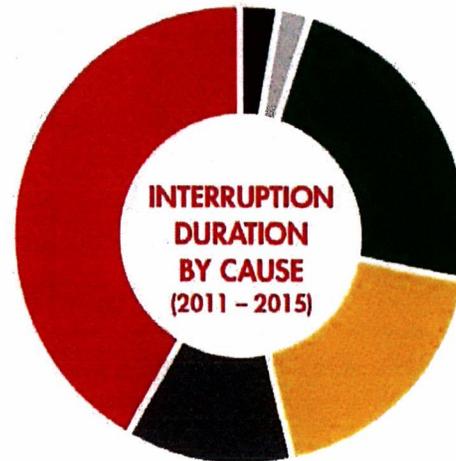
Average interruption duration per delivery point: **10 mins**

Duration of interruptions limited by redundancy in the multi-circuit network

## SINGLE-CIRCUIT SYSTEM (SAIDI)<sup>1</sup>

KEY FACTS:

- ~30% of delivery points • ~15% of total load
- Located primarily in Northern Ontario



Average interruption duration per delivery point: **211 mins**

Lack of redundancy drives increased duration of interruptions

Note: Excludes planned interruptions and interruptions due to customer activity. Excludes Force Majeure events.

1. Delivery points served by sole transmission circuit, leading to limited redundancy; tend to be located in the northern areas of the province.

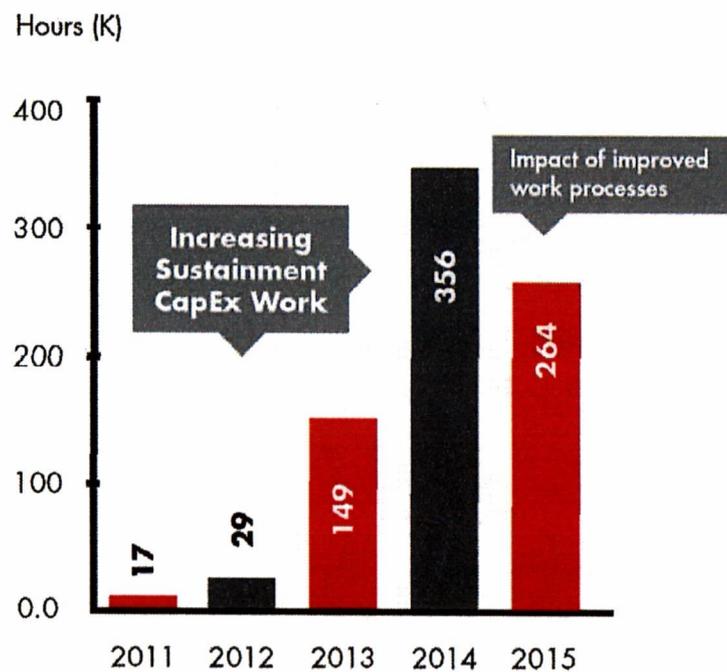
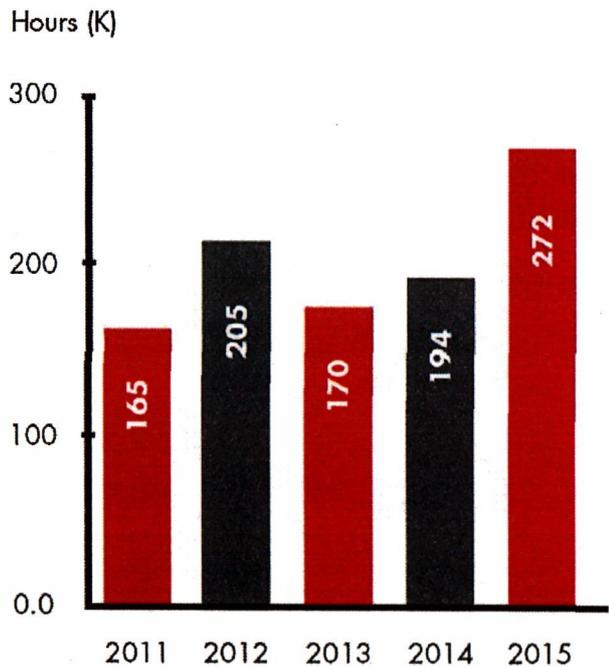


# ASSET CONDITION IS INCREASING OUTAGES ACROSS THE SYSTEM

## 1 UNPLANNED OUTAGE HOURS DUE TO EQUIPMENT FAILURE<sup>1</sup> (system-wide)

## 2 PLANNED OUTAGE HOURS FOR EQUIPMENT REPAIR/REPLACEMENT<sup>2</sup> (system-wide)

**Implications of outages:**  
**Single-circuit system:** Increased duration of interruptions  
**Multi-circuit system:** Greater time on single supply → increased interruption risk



1. Includes direct outages caused by power equipment or protection equipment failure  
2. Includes total duration of planned outages designated as for repair or replacement across all equipment types

# INVESTMENT SCENARIOS

**Illustrative scenarios have been developed** for various levels of sustainment expenditures.

These in turn, **result in different rate impacts and reliability risks.**

These scenarios focus on the Sustainment Capital portion of our Investment Plan and are meant to represent a spectrum of potential investments.

**We do not have a recommended scenario, nor are we asking you to choose from the scenarios presented.**

The asset solutions identified are flexible. The inclusion and pacing of investments in the plan may vary from what is presented in the scenarios.

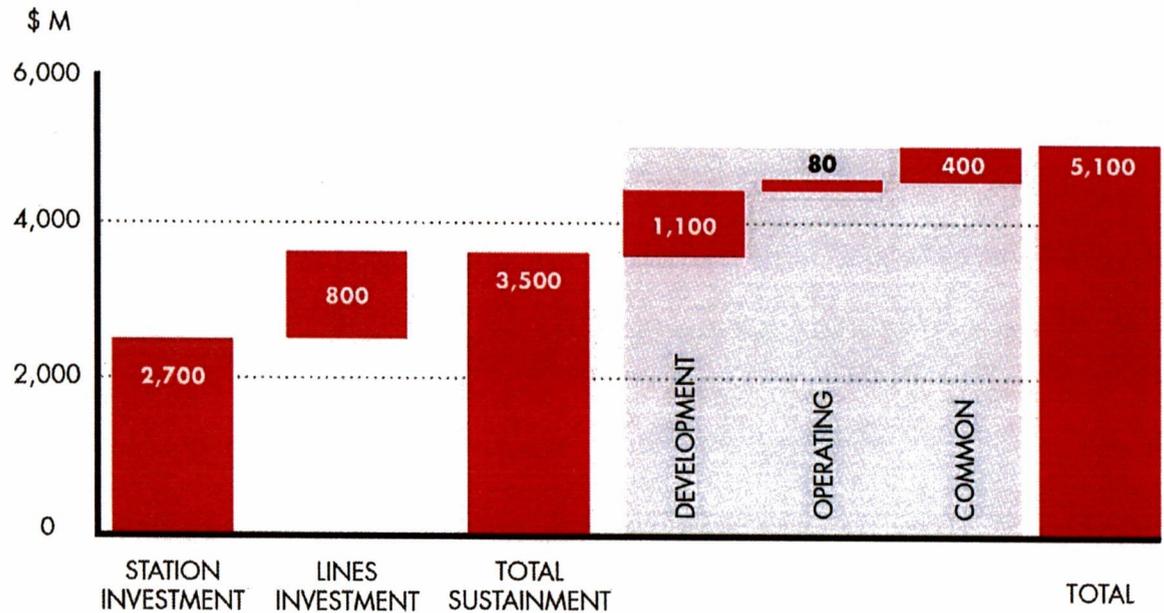
Through this conversation, we would like to better understand your business needs and preferences to inform our 5-year Investment Plan.

# SCENARIO ONE

**SCENARIO 1**  
~\$5,100M (2016 – 2020)

## KEY ELEMENTS OF SCENARIO 1

- Coordinated replacement of multiple elements at stations to reduce outages
- Investment to replace high risk air-blast circuit breakers
- Replacement of aging transformer population
- Does not fully address increasing risk due to line asset aging/conditions



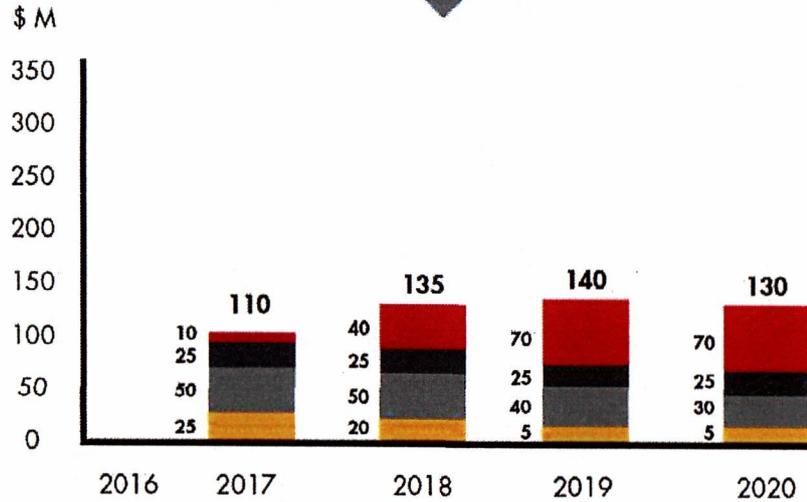
Overall risk profile:  
Reliability risk expected to increase



# SCENARIOS TWO AND THREE

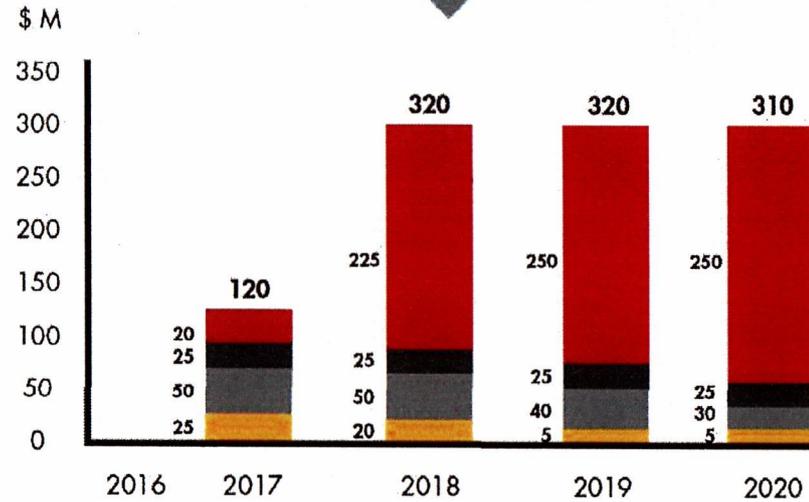


**SCENARIO 2**  
~\$520M in incremental  
CapEx from 2016 – 2020



■ Line Refurbishment     ■ Steel Tower Life Extension  
■ Insulator Replacement     ■ Station Work

**SCENARIO 3**  
~\$1.1B in incremental  
CapEx from 2016 – 2020



■ Line Refurbishment     ■ Steel Tower Life Extension  
■ Insulator Replacement     ■ Station Work

- Scenario 1 and additional station work, insulator replacement, and steel tower life extension program
- Projected replacement of 1,200 cct-km of conductors, including all copper conductors at end of useful life

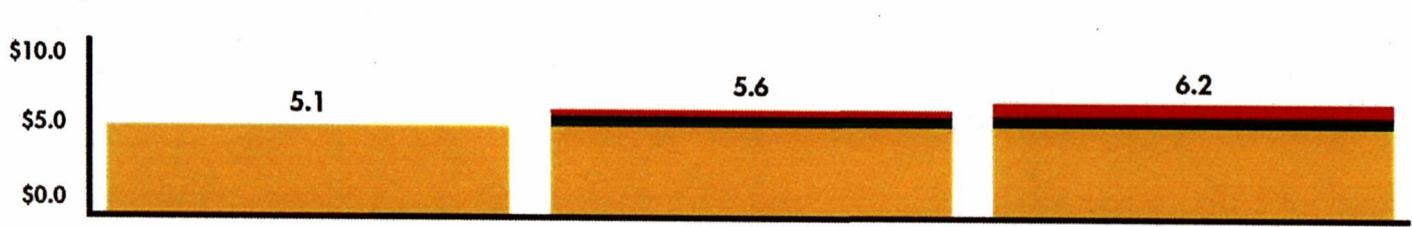
- Scenario 1 and additional station work, insulator replacement, and steel tower life extension program
- Projected replacement of 2,300 cct-km of conductors, including all copper conductors at end of useful life

Overall risk profile:  
Current reliability risk expected to remain unchanged

Overall risk profile:  
Reliability risk expected to decrease

# OVERVIEW OF THREE POTENTIAL SCENARIOS

2016 – 2020 Transmission System Net CapEx (\$B)



- Conductor Refurbishment
- Steel Tower Life Extension
- Scenario 1 Investments
- Insulator Replacement
- Additional Station Work

		SCENARIO 1	SCENARIO 2	SCENARIO 3
<b>Capital Spend</b>	Sustainment (\$B)	3.5	4.0	4.6
	Development (\$B)	1.1	1.1	1.1
	Other (\$B)	0.5	0.5	0.5
<b>Expected Outcomes</b>	Frequency and duration of interruptions	▲ Expected increase in line-related interruptions	▶ Some increase in lines risk offset by limiting unplanned outages and improved station performance	▼ Reduce risk from lines and continue to limit exposure to unplanned outages
	Reliability risk <sup>1</sup>	▲ Risk is expected to increase	▶ Current risk expected to remain essentially unchanged	▼ Risk is expected to decrease
<b>Rates</b>	Transmission rate impact (Compound Annual Growth Rate for 2017 – 2020) <sup>2</sup>	▲ ~5.8%	▲ ~6.3%	▲ ~6.8%

1. Reliability risk is a probabilistic calculation based on asset demographics and the historical relationship between its age and its failure or replacement.  
 2. Excludes impacts of potential changes in load forecast and any potential change to operations and maintenance spending.

1 (“Northstar”) conducts the Transmission Customer surveys. Northstar ensures that the  
2 sample size and methodology are appropriate so that findings are representative. The  
3 trending of results identifies opportunities to improve transmission customer satisfaction.

4

5 **4.1 Customer Surveys**

6

7 **4.1.1 Large Transmission Customer Survey**

8 This survey is performed annually. The objectives of the Large Transmission Customer  
9 survey are to measure the level of customer satisfaction, and to monitor Hydro One’s  
10 performance in four key areas: Price, Customer Service, Product Quality / Reliability  
11 and Relationship. The surveys measure customers’ perception of the company (whether  
12 they have interacted with Hydro One recently or not), with a specific focus on how well  
13 the company meets their expectations and delivers on critical success factors.

14

15 All interviews were conducted either online or by computer-assisted telephone  
16 interviewing, depending on the customers’ preferred method of communication. In 2015,  
17 the survey had a response rate of 64%. Table 1 outlines the surveyed customer segments  
18 and survey sample size.

19

20

**Table 1: Surveyed Customer Segments**

Year	End Users	LDCs	Generators
2015	34	50	32

21

\*Note: All LDCs were included in the study

1 For example, there are 506 circuit-km of 75 year old lines making up about 1.7% of the  
2 population with an annual probability of failure of 1.94% given that these conductors survived  
3 previously to 74 years. Therefore the probability of failure of these 75 year old, 506 circuit-km  
4 is 0.0194 x 0.017. This calculation is performed for each age group over the entire demographic  
5 distribution and summed to produce the overall probability of failure.

6  
7 This process is conducted for the present assets and after the planned replacements identified in  
8 this filing, representing a 1.056% and 1.031% probability of failure respectively. The ratio of  
9 these probabilities determines the relative risk as it appears in Table 1.

10  
11  $1.031\%/1.056\% - 1 = -2\%$ .

12  
13 As presented for lines, each asset type's demographic profile was multiplied by their age-specific  
14 hazard rates to obtain a risk profile for the assets as a function of their age. This was summed up  
15 as in the example for lines and these values are presented in Figure 1 below under 'supporting  
16 data'. Future demographic asset distributions were used for the 'Proposed Investment' and 'Do  
17 Nothing' scenarios. For the 'proposed investment', the future demographics takes into account  
18 the aging of assets that are not replaced as well as those that are removed due to replacement. For  
19 the 'Do Nothing' scenario the presently installed assets are aged to the end of 2018.

Supporting Data				Calculations for Table 1				% of Interruption Duration *
Asset Type	Proposed Investment for 2017/18		"Do Nothing" After 2016	Relative Change in Risk from Jan 1, 2017 to Dec 31, 2018 as per proposed investment		Relative Change in Risk from Jan 1, 2017 to Dec 31, 2018 without investment		
	Jan. 1, 2017	End of Rate Filing Period	Jan. 2019					
Lines	1.056%	1.031%	1.17%	1.03 / 1.06 - 1 =	-2%	1.17 / 1.06 - 1 =	11%	69%
Transformers	1.694%	1.535%	1.92%	1.54 / 1.69 - 1 =	-9%	1.92 / 1.69 - 1 =	14%	9%
Breakers	2.610%	2.633%	3.05%	2.63 / 2.61 - 1 =	1%	3.05 / 2.61 - 1 =	17%	6%
				(-2% x 69%) + (-9% x 9%) + (1% x 6%) =	-2%	(-2% x 69%) + (-9% x 9%) + (1% x 6%) =	10%	

Figure 1

21 The totals in the bottom row as filed and presented in Table 1 utilize the SAIDI interruption data  
22 to weigh the overall probabilities of failure of each asset type as shown above. Figure 1

Witness: Mike Penstone

1 demonstrates the calculation of the total risk by weighing the relative risk of the asset type by  
2 the SAIDI interruption data and then summed up over all the assets.

3  
4 b) As stated, the columns in Table 1 presenting the asset-specific relative risks are based on the  
5 computed overall probabilities of failure. It does not include outage interruption data (SAIDI)  
6 and is based on historical replacement rates. Note that in the case of multiple supply delivery  
7 points, an equipment failure will not result in SAIDI, CAIDI implications but will increase  
8 the risk of reliability while under the single supply condition.

9  
10 c) The reliability risk is a function of asset demographics and hazard curves, which are non-  
11 linear. As such, the relationship between capital investment level and relative change in  
12 reliability risk is also non-linear. However, there is a positive correlation, a higher level of  
13 investment leads to more improvement in reliability risk.

14  
15 d) Yes, Hydro One evaluated alternative investment scenarios, which were discussed as part of  
16 the customer engagement included in Exhibit B1, Tab 2, Schedule 2, Attachment 2,  
17 Transmission Customer Engagement: Investing for The Future, Page 23. Three indicative  
18 investment scenarios over a 5 year planning period were discussed. Respective reliability  
19 risk associated with Scenario 1, 2 and 3 are increased by 9%, increased by 2% and reduced  
20 by 10%.

21  
22 e) Yes. Hydro One has prioritized its proposed investments at the corporate level. The  
23 prioritized project list takes the form of the optimized portfolio of investments filed in this  
24 application. In the event of a reduced approved level of capital investment, Hydro One will  
25 reduce its work program using the optimization criteria (Exhibit B1, Tab 2, Schedule 7).

26  
27 The expected outcome is an increase in reliability risks and potential future deterioration in  
28 actual reliability performance. In this scenario, a load serving transformer in poor condition  
29 is ranked the lowest and may not get replaced, effectively placing it under run to failure option,  
30 which is highly impactful to reliability.

1 analysis to deferring the kind of expenditures you are now  
2 asking, and you said no.

3 So I was curious. In the last two applications, when  
4 you talked about an aging asset base, you didn't calculate  
5 the risk or the cost to ratepayers of deferring that to  
6 now? So now it's all coming home to roost at once;  
7 correct?

8 MR. PENSTONE: So, in previous applications, we did  
9 not have a risk model.

10 MR. YAUCH: But you knew it was aging and you said --  
11 I went through the last application, and repeatedly you  
12 talk about an aging asset base has to be fixed. But you  
13 decided not to do it then, and now you can't avoid it  
14 anymore.

15 MR. PENSTONE: In the past application, we identified  
16 that we had aging assets and, in particular, aging station  
17 assets. Consequently, we have made investments, and as a  
18 result of those investments, the relative contribution to  
19 the reliability risk by station assets has gone down;  
20 right? So we are seeing an impact of the station  
21 investments.

22 What has become evident to us, in the process of  
23 developing this investment plan, is the contribution of  
24 lines towards unreliability. And I would refer you to the  
25 presentation, the customer consultation presentation. If  
26 you give me a minute, I will give you the exact reference.

27 So the reference the reference is B-1-2-2-2, and if  
28 you could turn it to page 13 -- I'm sorry. I think you are

***Hydro One Board of Directors***

***Approval – Martindale  
Transformer Station:  
Autotransformer  
Replacement and Station  
Upgrade Project***

***August 12, 2016***

## Martindale Transformer Station: Autotransformer Replacement and Station Upgrade

### Summary of Recommendation:

We are requesting approval for \$75.8 million to replace end-of-life autotransformers and complete other upgrades at Martindale Transformer Station on the existing property consistent with current Hydro One design standards and Northeast Power Coordinating Council requirements. The station has deteriorated assets and conditions that are negatively impacting the reliability of supply to local distribution companies, generators and large industrial customers in the City of Greater Sudbury and surrounding area.

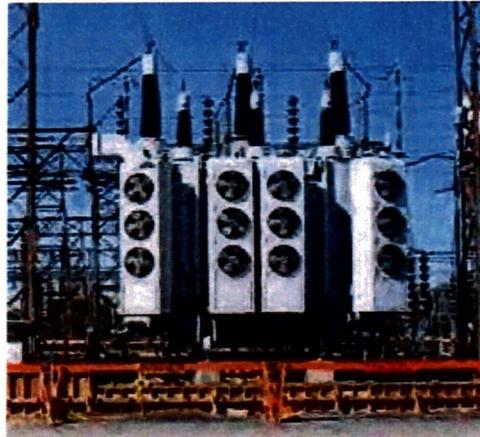
### Investment Details:

In-service: December 13, 2021

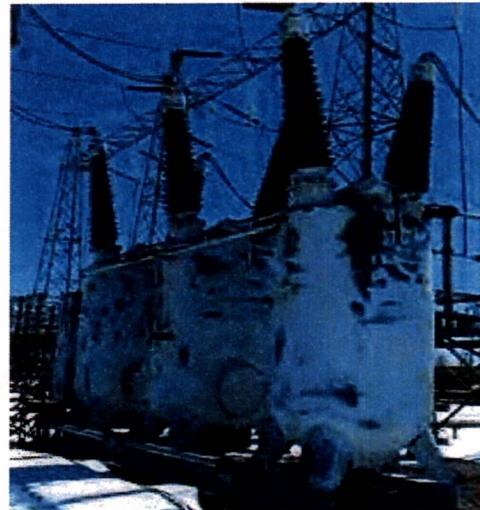
Martindale Transformer Station went into service in 1935. It is a 230 kV transformer station and major hub for East - West power flow on the 115kV transmission system in Northern Ontario. The station also supplies approximately 100MW to the City of Greater Sudbury, including the City's Wahnapiatae Water Treatment Plant and connects large industrial mining customers to the transmission system, including Glencore Canada Corporation and Vale Canada Limited.

This project will replace equipment at Martindale Transformer Station that is at end-of-life due to poor condition and performance, limited capacity, and obsolescence, and that poses a safety risk to field personnel due to electrical safety clearance issues. Since 2008, there have been a total of 32 cooling or oil level/temperature related issues on the T21 and T23 autotransformers and a total of 623 corrective and emergency work orders associated with all the equipment that is identified for replacement by this investment. These facilities will be replaced and upgraded to meet current Hydro One design standards and Northeast Power Coordinating Council requirements, including:

- (i) two 230-115 kV, 75/100/125 MVA autotransformers (T21 and T23) that are at end of life, in poor condition, limited capacity and require noise mitigation;



T21 autotransformer - 60 years old, end of life unit with no self cooling rating



64 year old, end of life 230kV oil circuit breaker

- (ii) five 230kV Canadian Westinghouse GW oil circuit breakers that do not meet the required interrupting time for high voltage circuit breakers;
- (iii) three 230 kV bus sections that are inadequate for withstanding the existing short circuit levels at the station;
- (iv) four 115 kV line disconnect switches and two breaker disconnect switches;
- (v) replacement of the 1960's vintage design 44kV switchyard equipped with eleven oil circuit breakers and four feeder tie switches that pose safety risks to field maintenance personnel due to electrical safety clearance issues;
- (vi) upgrades to the DC Station service, protections, controls and telecom facilities to meet Northeast Power Coordinating Council requirements including A and B duplication and physical separation of protection systems;
- (vii) upgrade spill containment system and install new noise barrier to comply with Ministry of the Environment and Climate Change requirements.



**Aerial of Martindale TS with locations of new facilities**

Hydro One has committed to the Ministry of the Environment and Climate Change to meet station noise compliance requirements and address noise complaints by installing a noise barrier for T25 and T26 transformers and replacing T21 and T23 autotransformers with quieter units. Furthermore, spill containment, drainage and oil/water separator facilities currently do not meet Ministry of the Environment and Climate Change requirements and are considered to pose the sixth greatest spill risk of the 291 Hydro One stations (other investments are ongoing or being planned to address the other high spill risk stations).

Other asset replacement strategies are also incorporated as part of this project to enable operational efficiencies. These other strategies include the replacement of end of life station insulators and high voltage instrument transformers as well as upgrades to station yard lighting, AC and DC station service systems and the station ground grid.

**Benefits:**

The investment will provide the following benefits:

- a) improve transmission reliability performance by eliminating poor performing equipment and increase capacity by 15%;

- b) reduce annual emergency and corrective maintenance orders at the station by 54% (70 orders) and reduce the associated costs by 41% (~\$100k/year) through the elimination of end of life equipment.
- c) eliminate electrical safety clearance issues in the 44kV switchyard;
- d) comply with Ministry of the Environment and Climate Change requirements for an Environmental Compliance Approval by mitigating noise and spill risk at the station;
- e) comply with Northeast Power Coordinating Council requirements including A and B duplication and physical separation of protections systems.

**Estimated Costs & In-service:**

This is a multi-year project, with partial in-service additions annually from 2017 to 2021.

The cost breakdown is as follows:

Category	Cost (\$M)
Project Management	2.5
Engineering	5.7
Procurement	22.7
Construction	26.2
Commissioning	3.4
Contingency	4.3
Interest	0.9
Overhead	10.1
<b>Total</b>	<b>75.8</b>

Funds of \$3.5 million were previously approved to carry out engineering, estimating and procurement of long lead time materials. The necessary engineering has been completed to achieve an estimate accuracy of +/-10%. The contingency is based solely on construction and commissioning to cover any deviation from the original design during execution.

This investment is included in the approved 2016 Budget and is included in the 2017-2022 business plan with total funding of \$69.4M. The additional funding required will be redirected from other projects to enable overall capital expenditures to remain within the total approved envelope.

The incremental costs of 6.4 M\$ were identified following a quality assurance review of the original estimate. The review identified that the scale of the civil work had been underestimated and shortcomings existed in the staging plan for the equipment outages required to execute the project.

The quality assurance review combined with more extensive outage planning and project scoping are actions that have been recently implemented as a result of assessments past projects.

## Other Alternatives Considered

### *Status Quo or Do nothing Alternative*

The status quo option is rejected because it does not address the poor condition of multiple end of life assets, including the capacity limiting autotransformers T21 and T23, the safety concerns associated with the 44kV switchyard electrical clearances, the negative impact on the transmission capacity and reliability, and does not address the non-compliance with Northeast Power Coordinating Council and Ministry of the Environment and Climate Change requirements.

## Regulatory Considerations

Capital expenditures of \$67.4 million for this project are included in the current Transmission Rate Application (EB-2016-0160) for 2017 and 2018 currently before the Ontario Energy Board for approval. This rate application assumed that all capital expenditures would be placed in-service at the end of 2020. The partial in-service strategy will create a \$39 million variance from the rate base submitted to the Ontario Energy Board. The impact of this variance will result in other project's funding being reduced or reprioritized to ensure the 2017 and 2018 in-serviced capital aligns with allowable capital recovered through the revenue requirement.

Hydro One considers the risk of non-recovery of this investment, including the in-service and total cost variance, to be low because this investment will improve the quality and reliability of Hydro One's transmission system supplied by this station and will reduce future annual maintenance costs compared to current levels. The variances will be disclosed and defended at future transmission rate filing to the Ontario Energy Board at the appropriate time.

## Risks and Mitigation

### *First Nations and Metis Relations*

The work to be completed will take place within the existing station footprint and a Class Environmental Assessment is not required. However, Hydro One will notify the surrounding First Nations and Metis communities to maintain its ongoing positive relationship. Current risk is assessed to be low.

**UNDERTAKING – J1.1**

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**Undertaking**

What is the percentage of transmission revenues paid by LDCs?

**Response**

Based on the 2017 and 2018 forecast charge determinants for LDC transmission customers, LDCs contribute about 92% of Hydro One’s transmission revenue.