RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-117

Reference: Exhibit 2A, Tab 1, Schedule 2, OEB Appendix 2-BA

a) Please provide appendix 2-BA for 2019 actuals. Please ensure to reconcile any differences between closing 2019 balances and opening 2020 balances, as provided in reference 2.

RESPONSE:

Please refer to Appendix A to this response for 2019 actuals. The difference between closing 2019 balances and opening 2020 balances is related to the disallowance from rate base of $4 million associated with the Enterprise Resource Planning ("ERP") Phase 1 project.[1]

[1] EB-2018-0165, OEB Decision and Order (December 19, 2019) at page 69.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-118

References: Exhibit 2A, Tab 4, Schedule 2, Appendix A - OEB Appendix 2-D Overhead Costs_Redacted
Exhibit 2A, Tab 4, Schedule 2

a) Please provide a variance analysis of OEB-approved overhead costs in Toronto Hydro's last CIR and actuals as provided in reference 1 for the years 2018-2023. If any of the variances result in a +10% difference, please explain in detail.

RESPONSE:

In preparing its response, Toronto Hydro identified a data entry error in populating data in OEB Appendix 2-D (Exhibit 2A, Tab 4, Schedule 2). The corrected OEB Appendix 2-D is appended to this interrogatory response, and has been updated to include: 2023 actuals, and an updated 2024 bridge year forecast reflecting the impact of the Cloud and Locates DVAs as set out in the DVA Continuity appended to interrogatory 9-Staff-349. Toronto Hydro confirms that this error was isolated to OEB Appendix 2-D.

In its Decision, the OEB approved the 2020 Test Year for Overhead Costs.[1] The 2021-2023 forecast in Table 1 was determined by escalating the test year by I-X, where "I" is the OEB approved inflation for the respective years and "X" is the 0.6 percent stretch factor. Table 1 compares this forecast with the actual capitalized OM&A for 2018-2023.

Table 1: Total Capitalized OM&A Funded/Actuals ($ Millions)

	2018	2019	2020	2021	2022	2023
Total Capitalized OM&A Funded	(115.2)	(124.7)	(122.3)	(124.2)	(127.6)	(131.5)
Total Capitalized OM&A Actuals	(115.2)	(125.2)	(122.3)	(112.7)	(124.9)	(137.8)
Variance (%)	**0%**	**0%**	**0%**	**-9%**	**-2%**	**5%**

[1] EB-2018-0165, Exhibit U, Tab 2, Schedule 3, Appendix A – OEB Appendix 2-D (April 30, 2019).

Toronto Hydro did not experience any material variance greater than +/- 10% for total capitalized OM&A between OEB-approved overhead costs in Toronto Hydro's last CIR and actuals. However, variance analysis of the three subcomponents of the OM&A is summarized below:

1. Labour Capitalization

Table 2: Labour Capitalization Funded/Actuals ($ Millions)

	2018	2019	2020	2021	2022	2023
Labour Capitalization Funded	(101.4)	(109.8)	(106.1)	(107.7)	(110.7)	(114.1)
Labour Capitalization Actuals	(101.4)	(109.4)	(106.1)	(95.2)	(105.3)	(115.2)
Variance	**0%**	**0%**	**0%**	**-12%**	**-5%**	**1%**

In 2021, capitalized labour was 12 percent lower than funded. This is attributed to the lower number of internal resources allocating their time to capital projects as a result of lower staffing levels due to challenges beyond Toronto Hydro's control such as COVID-19 and other external factors; as well as resources balancing for capital work execution.

2. Vehicle Capitalization

Table 3: Vehicle Capitalization Funded/Actuals ($ Millions)

	2018	2019	2020	2021	2022	2023
Vehicle Capitalization Funded	(4.2)	(3.9)	(3.8)	(3.9)	(4.0)	(4.1)
Vehicle Capitalization Actuals	(4.2)	(3.6)	(3.8)	(5.5)	(5.5)	(4.7)
Variance (%)	**0%**	**-7%**	**0%**	**42%**	**39%**	**15%**

As described in Exhibit 2A, Tab 4, Schedule 2 in Section 1.3 at page 3, Toronto Hydro updated its approach for the calculation of available hours to deduct leaves and time not spent working on specific operating or capital jobs from total working hours. This resulted in the variances observed in 2021-2023.

3. Material Handling On-cost

Table 4: Material Handing On-Cost Funded/Actuals ($ Millions)

	2018	2019	2020	2021	2022	2023
Material Handling On-cost Funded	(9.6)	(11.0)	(12.4)	(12.6)	(12.9)	(13.3)
Material Handling On-cost Actuals	(9.6)	(12.3)	(12.4)	(12.0)	(14.1)	(17.9)
Variance (%)	**0%**	**12%**	**0%**	**-5%**	**9%**	**34%**

In 2019 and 2023, capitalized material on-costs increases are attributed to higher material throughput and material handling costs. These increases were 12 percent ($1.2 million) and 34 percent ($4.6 million), respectively to support the material requirement for the capital program.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-119

References: **Exhibit 2A, Tab 2, Schedule 1, Appendix C - OEB Appendix 2-BB - Useful Life Comparison**
Exhibit 9, Tab 1, Schedule 1, Appendix A - Calculation of Useful Life Change Impacts

QUESTION (A):

a) Please provide the $ amount change in depreciation expense for 2023 and 2024 associated with the asset useful lives that changed when Toronto Hydro applied Concentric's depreciation methodology.

RESPONSE (A):

Please see Table 1 below.

Table 1: Depreciation and Amortization Expense ($ Millions)

	2023 Bridge	2024 Bridge
Depreciation and Amortization Expense (without UL changes)	276.1	291.6
Depreciation and Amortization Expense (with UL change)	229.0	237.2
Difference	**(47.1)**	**(54.4)**

QUESTION (B)

b) Please provide a variance analysis of historical depreciation expense to approved depreciation expense for 2018-2023 by asset class. If any variances are greater than +10%, please provide a detailed explanation.

RESPONSE (B):

Please refer to Appendix A to this response for a comparison of historical depreciation expense[1] to approved depreciation expense.[2]

[1] Exhibit 2A, Tab 1, Schedule 2, OEB Appendix 2-BA
[2] EB-2018-0165, Draft Rate Order (February 12, 2020), Schedule 2, pages 1-5; and Exhibit U, Tab 2, Schedule 1, Appendix B, (April 30, 2019)

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-120

Reference: Exhibit 2B, Section E4, Appendix B – OEB Appendix 2-AA – Program Summary

$	2025	2026	2027	2028	2029
AFUDC	6.3	7.0	8.7	10.3	12.0

a) Please confirm the interest rate applied to the eligible capital amounts.

RESPONSE:

The interest rate applied to eligible capital amounts is 4.02 percent.

Toronto Hydro notes that the interest rate in Exhibit 5, Tab 1, Schedule 2, Appendix 2-OA is 4.04 percent. The misalignment of the rates is attributed to the timing of when the capital plan was finalized, which used a preliminary forecast of the interest rate at the time. Upon finalization of the interest rate, owing to the immaterial impact to the 2025-2029 capital expenditures and revenue requirement, no further changes were made. The impact is approximately $0.2 million less in AFUDC costs over the 2025-2029 period ($0.04 million per year), which has an immaterial impact to revenue requirement.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-121

References: **Exhibit 2B, Section A, PDF Page 2 of 356**
Alectra Utilities 2020-24 Distribution System Plan, Exhibit 4, Tab 1, Schedule 1, Pages 17, 186, 211, PDF Pages 37, 205, 231 of 1007
Hydro Ottawa Distribution Revenue Requirement & Rate Application, Exhibit 4, Tab 1, Schedule 8, Page 4, PDF Page 88
Hydro Ottawa Distribution Revenue Requirement & Rate Application, Exhibit 1, Tab 3, Schedule 3, Attachment A, Page 22, PDF Page 1408

Preamble**:**

Please see the table below that shows a subset of utility parameters per 1,000 customer basis for Toronto Hydro and several of its peers.

Utility	# of Customers	Service Area sq. km	# of Employees	# of Terminal Stations	# of Municipal Substations	# of Poles	Circuit kms Overhead Wires	Circuit kms Underground Wires	# of Distribution Transformers
Toronto Hydro	790,000	631.1	1,245	37	139	183,620	15,393	13,765	61,300
# per 1,000 customers		0.80	1.58	0.047	0.18	232	19.5	17.4	77.6
Alectra	950,000	1924	1600	14	155	130,000	16400	22,000	125,000
# per 1,000 customers		2.03	1.68	0.015	0.16	137	17.3	23.2	131.6
Ottawa	340,000	1,116	720	18	88	49,247	5609		45414
# per 1,000 customers		3.28	2.12	0.053	0.26	145	16.5	-	133.6
Enwin	88,000	120	198	11	50	20,293	2,703	1965	6713
# per 1,000 customers		1.36	2.25	0.125	0.57	231	30.7	22.3	76.3
Brantford	39,300	74	60	3		10,021	254	229	5,063
# per 1,000 customers		1.88	1.53	0.076	-	255	6.5	5.8	128.8
Synergy	56,000	441	129	3	7	23,391	993	277	7673
# per 1,000 customers		7.88	2.30	0.054	0.13	418	17.7	4.9	137.0
Hydro One (Distribution)	1,400,000	961,142	9,300		1000	1,600,000	113,000	10000	522,000
# per 1,000 customers		686.53	6.64	-	0.71	1,143	80.7	7.1	372.9

QUESTION (A):

a) Please review and update this table with corrected Toronto Hydro information if necessary.

RESPONSE (A):

Please see Tables 1 to 3 below.

Table 1: Utility Parameters for Toronto Hydro and its Peers

	# of Customers	Peak Load *(MW)*	Service Area *(sqkm)*	# of FTE	OH Primary *(km)*	UG Primary *(km)*	Poles	Distribution Transformers
Alectra Utilities Corporation	1,076,537	5,407	1,924	1,466	7,192	14,492	130,909	124,955
Brantford Utilities	111,044	519	636	183	1,275	853	31,721	13,595
ENWIN Utilities Ltd.	91,128	465	121	169	682	480	20,299	7,723
Hydro One Networks Inc.	1,440,085	6,821	961,143	4,927	114,165	10,576	1,600,000	522,000
Hydro Ottawa Limited	358,901	1,280	1,116	616	2,763	3,463	50,000	47,400
Synergy North Corporation	57,088	172	441	128	993	277	22,362	7,670
Toronto Hydro-Electric System Limited	790,699	4,276	630	1,245	4,052	6,611	183,620	61,300

Table 2: Utility Parameters for Toronto Hydro and its Peers per 1000 Customers

	# of Customers	Service Area *(sqkm)*	# of FTE	OH Primary *(km)*	UG Primary *(km)*	Poles	Distribution Transformers
Alectra Utilities Corporation	1,076,537	1.79	1.36	6.68	13.46	121.60	116.07
Brantford Utilities	111,044	5.73	1.65	11.48	7.68	285.66	122.43
ENWIN Utilities Ltd.	91,128	1.33	1.85	7.48	5.27	222.75	84.75
Hydro One Networks Inc.	1,440,085	667.42	3.42	79.28	7.34	1,111.05	362.48
Hydro Ottawa Limited	358,901	3.11	1.72	7.70	9.65	139.31	132.07
Synergy North Corporation	57,088	7.72	2.24	17.39	4.85	391.71	134.35
Toronto Hydro-Electric System Limited	790,699	0.80	1.57	5.12	8.36	232.22	77.53

Table 3: Utility Parameters for Toronto Hydro and its Peers per MW

	Peak Load *(MW)*	Service Area *(sqkm)*	# of FTE	OH Primary *(km)*	UG Primary *(km)*	Poles	Distribution Transformers
Alectra Utilities Corporation	5,407	0.36	0.27	1.33	2.68	24.21	23.11
Brantford Utilities	519	1.23	0.35	2.46	1.64	61.16	26.21
ENWIN Utilities Ltd.	465	0.26	0.36	1.47	1.03	43.66	16.61
Hydro One Networks Inc.	6,821	140.90	0.72	16.74	1.55	234.56	76.52
Hydro Ottawa Limited	1,280	0.87	0.48	2.16	2.71	39.07	37.04
Synergy North Corporation	172	2.57	0.75	5.78	1.61	130.24	44.67
Toronto Hydro-Electric System Limited	4,276	0.15	0.29	0.95	1.55	42.94	14.33

QUESTION (B)

b) Please discuss the ability of utilities serving more densely populated service areas to achieve more optimal utilization of assets relative to utilities serving less densely populated service areas.

RESPONSE (B):

The discussion on the relative costs of serving more densely versus less densely populated service areas, specifically within the context of the City of Toronto, is thoroughly examined in the Econometric Benchmarking Study of Toronto Hydro's Total Cost and Reliability Metrics, Exhibit 1B, Tab 3, Schedule 3, Appendix A. Further insights into urban-specific challenges are outlined in the Productivity section, Exhibit 1B, Tab 3, Schedule 3 at pages 2-9.

When evaluating asset utilization across utilities serving areas of varying population densities, it's crucial to consider factors that influence operational efficiency and asset deployment. Utilities in densely populated areas, such as Toronto Hydro, encounter unique challenges in optimizing asset utilization. These challenges include serving a diverse mix of customer classes, accommodating higher customer loads, meeting elevated reliability standards, and managing the complexities of urban infrastructure demands.

Toronto's downtown core serves many unique customers that require elevated reliability and service continuity, e.g., buildings that house major economic and governmental institutions, hospitals and emergency rooms, universities and research facilities, etc. To meet these reliability requirements Toronto Hydro operates one of the largest secondary networks in North America. Secondary networks, due to their complexity and redundancy, require more infrastructure per unit of load, but they significantly improve reliability and quality of service in highly dense areas where outages have serious consequences.

Customers in densely populated areas typically exhibit higher peak loads and consumption compared to those in less densely populated areas. Toronto Hydro, for instance, records the highest peak load and consumption per customer among the utilities identified in the preamble, with the load being 17% higher than average. Urban customer density areas also require higher reliability, power quality and flexibility to support the critical nature of loads and more rigorous maintenance practices. Urban and densely populated areas benefit from redundant system designs, allowing load to be served by multiple feeders and enhancing service levels, which is achieved at the expense of increased infrastructure per customer and load. Higher reliability requirements lead to lower asset utilization factors.

In addition, the expectation of higher growth rates in urban areas also necessitates addressing future space constraints within utility planning. Toronto's downtown core, for example, saw a significant population increase of about 16% over five years, from 2016 to 2021, as noted in Exhibit 1B, Tab 3, Schedule 3, pp. 2-3. Increased population density heightens challenges related to rights of way and congestion with other utility providers, influencing the required size and scale of assets and built-in additional capacity.

The following bullets provide additional thoughts on the nuances required in comparing utilization rates ranging from rural zones to metro downtown core areas:

- In rural areas, service is typically provided through overhead lines with a radial design and smaller-sized distribution transformers feeding individual farms or residences. Consequently, utilities encounter longer lines and a higher number of distribution transformers per customer.
- Suburban areas are served by 3-phase overhead and underground feeders, likely featuring larger conductors and higher capacity distribution transformers to accommodate increased loads. On average, each transformer serves a greater number of homes and small business customers. Enhanced reliability requirements necessitate additional circuits and switches within the system. Although utilities may install a higher asset count per customer, these assets are of higher capacity, facilitating load accommodation and enabling switching capabilities.
- Urban settings predominantly utilize underground 3-phase lines with large conductors, encased in concrete ducts and run through cable chambers. Transformation equipment, often situated in underground vaults, is sized for higher customer loads. Utilities will ensure that there is enough spare capacity available on the feeders to reroute power in case of a failure in one part of the network. In urban environments, utilities might observe a lower transformer count per customer or per unit of load, although circuit length and pole counts

may increase due to larger loads and heightened reliability demands. Many transformers must have a higher capacity compared to suburban and rural settings to manage larger loads. The grid also incorporates additional civil infrastructure, including vaults, chambers, and ducts, alongside a high number of protection and load transfer equipment. It's notable that customers may own equipment at supply points, resulting in fewer distribution transformers per customer and per unit of load.

- The downtown core is almost exclusively served by underground infrastructure, with many customers connected to a secondary network. Transformers are of a significantly larger size to serve residential and commercial towers and high-rise buildings. The high loads, interconnected feeders, and the use of dual and secondary networks lead to lengthier primary and secondary underground circuits. Feeders and equipment are housed in multi-duct banks, vaults, and chambers. The system extensively employs network protectors and switches to ensure resilient and highly reliable service delivery to critical loads. Utilities typically install more expensive, high-capacity, and complex underground equipment, along with additional lines, to ensure sufficient redundancy in the system for load switching within a sophisticated network design. However, this typically results in a lower asset count per customer or per unit of load compared to other customer density settings.

In conclusion, utilities serving more densely populated areas need to account for factors negatively impacting asset utilization: higher customer loads, increased reliability standards, and needs to accommodate potential demand growth within scarce land.

QUESTION (C):

c) Please compare and contrast Toronto Hydro’s customer density and asset utilization relative to its Ontario peers.

RESPONSE (C):

The econometric study, detailed in Exhibit 1B, Tab 3, Schedule 3, Appendix A, investigates the impact of serving a densely populated service territory using the urban core variable. The study found that

Toronto Hydro's costs, when accounted for the urban core variable, were 28% below the expected benchmark for the period from 2020 to 2022. In general, the lower costs reflect a better utilization of available resources and infrastructure by Toronto Hydro when compared to its peers.

Part b) of the question discussed the challenges related to direct comparison of the asset utilization in the highly densely populated area, such as Toronto Hydro service territory with urban and downtown core settings, to its less densely populated Ontario peers.

Generally, within the service territory of Toronto Hydro, when compared to its peers in Ontario, the utility would anticipate:

- A lower count of distribution transformers per service, albeit with higher capacity;
- Longer underground circuits per customer and per unit of load when including secondary circuits (secondary network area);
- A number of poles and length of overhead infrastructure similar to that of other urban-based utilities, with the exception of those serving rural areas;
- Significantly more extensive and complex underground infrastructure, featuring multi-duct banks, vaults, and cable chambers;
- Higher counts of switching and protection equipment;
- Unique infrastructure, such as underground stations and vaults situated well below the surface.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-122

Reference(s): Exhibit 2B, Section A, Page 6
RRR Data, 2022

Preamble:

Figure 1 in Reference 1 indicates unknown causes of outage make ups 7% of outage causes from 2018 - 2022.

From the RRR data filed by Toronto Hydro, the contribution of unknown outage cause is increasing with time.

	2015	2016	2017	2018	2019	2020	2021	2022
SAIFI - Unknown	0.21	0.32	0.30	0.29	0.31	0.54	0.39	0.49

QUESTION (A):

a) How did Toronto Hydro restore the outages where the cause was unknown?

RESPONSE (A):

Please refer to Toronto Hydro's response to interrogatory 2B-EP-27.

QUESTION (B):

b) Please explain the increase in unknown outages and what Toronto Hydro is doing to improve this measure.

RESPONSE (B):

Please refer to Toronto Hydro's response to interrogatory 2B-EP-27.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-123

Reference: Exhibit 2B, Section A, Page 15

Preamble:

Toronto Hydro states: "Toronto Hydro now incorporates climate data projections into its equipment specifications and station load forecasting."

QUESTION (A):

a) Does Toronto Hydro update the depreciation rates of assets to reflect climate hardening activities it has undertaken? If yes, please provide examples. If no, please explain why not.

RESPONSE (A):

Response from Concentric:

Concentric considered all factors when selecting average service life and Iowa curve recommendations, including forces of retirement such as weather-related events and third-party contacts/strikes, as estimated based on peer utilities, the professional judgement of Concentric personnel, and discussions with operations and management staff from Toronto Hydro. In discussions with Toronto Hydro staff, Concentric was informed of the types of assets currently being retired and the materials and types of assets being installed. Attention was paid to circumstances where assets being removed are being replaced with significantly different assets, and the rationale for the change. While the depreciation study did not consider system hardening as a separate factor in the selection of average service lives, the changes in asset types and expected lives of assets installed in more recent years was considered. It should be noted that system hardening is occurring throughout the North American electric industry. As such, in addition to system hardening being part of discussions with operations and maintenance staff, it is reflected in the asset lives selected by peer utilities, which form the basis of the peer review.

Response from Toronto Hydro:

As described in Exhibit 2A, Tab 2, Schedule 1, Section 3.1, Toronto Hydro has incorporated the recommendations of Concentric Advisors, ULC ("Concentric") in its depreciation rates effective January 1, 2023.

QUESTION (B):

b) Does Toronto Hydro update the useful lives of assets to reflect climate hardening activities it has undertaken? If yes, please provide examples. If no, please explain why not.

RESPONSE (B):

Toronto Hydro did not specifically consider climate hardening activities to update useful lives; however, Toronto Hydro routinely considers updates to its useful lives as new information becomes available, including the information produced by Concentric as part of the Depreciation Study, which includes peer utility and operation experience that integrates climate hardening considerations as per response to part (a).

QUESTION (C):

c) Please explain how Toronto Hydro determined asset hardening needed to be done to preserve asset life and provide examples of analyses.

RESPONSE (C):

In June 2015, Toronto Hydro completed a vulnerability assessment following Engineers Canada's Public Infrastructure Engineering Vulnerability Committee ("PIEVC") protocol. The assessment identified areas of vulnerability to Toronto Hydro's infrastructure as a result of climate change. Toronto Hydro utilized climate data projections for temperature, rainfall, and freezing rain in its equipment specifications. For example, revision to submersible transformer specification to require stainless steel construction, revision to network transformer specification to require thicker walls and increased paint specifications for corrosion mitigation, and revision to padmount, poletop, and vault transformers specification to handle overload conditions. In 2022, this study was updated, please refer to Exhibit 2B, Section D2, Appendix A.

Further to this study, Toronto Hydro monitors changes to industry codes, standards, and regulations for alignment on asset hardening requirements. For example, in February 2023 the Canadian Standards Association (or CSA Group) updated CSA C22.3 No. 1:20, Overhead Systems and CSA C22.3 No. 7:20, Underground systems, with new requirements for Climate Change Adaptation. Toronto Hydro strives to meet and surpass these new requirements. For more information see Exhibit 2B, Section D2.1.2 Climate and Weather at page 10.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-124

References: Exhibit 2B, Section A, Page 2
Exhibit 2B, Section E6.1, Page 6
Exhibit 1B, Tab 5, Schedule 1, Appendix A

Preamble:

Toronto Hydro's recent customer engagement demonstrated that residential customers' first priority is controlling rates, their second priority is maintaining reliability, and their third priority is investing in new technologies that reduce rates or reduce their exposure to long duration outages due to extreme weather. Toronto Hydro's capital expenditures are targeting improved SAIDI, which excludes the MEDs that residential customers consider a priority.

QUESTION (A):

a) Please describe how Toronto Hydro planned to achieve the first priority of lowest possible rates and the second priority of maintaining reliability in light of its targeted SAIDI improvement.

RESPONSE (A):

To clarify, customers' first priority was found to be the delivery of electricity at reasonable distribution rates, not the "lowest possible" rates. See Exhibit 1B, Tab 5, Schedule 1, page 5.

As mentioned in Exhibit 1B, Tab 5, Schedule 1, Customer Engagement at page 8, "Phase 2 solicited detailed customer feedback on the $5.9 billion draft plan and the associated price impacts, providing the utility additional insight about customers' preferences relative to the investment plan priorities, options and outcomes. This feedback: (i) confirmed that Toronto Hydro found a suitable balance between price and other key outcomes of its 2025-2029 investment plan, (ii) supported the refinement and finalization of the plan, and (iii) informed the development of the 2025-2029 custom scorecard presented in Exhibit 1B, Tab 3, Schedule 1."

Toronto Hydro's 2025-2029 Distribution System Plan ("DSP") was tailored to meet customers' needs and preferences, including prioritizing investments for reliability. As mentioned in Exhibit 1B, Tab 3, Schedule 1 at page 9, "Toronto Hydro intends to improve Outage Duration performance as measured by the custom SAIDI metric compared to historical performance. This objective aligns with customer needs and priorities based on the Phase 1 Customer Engagement survey results which revealed that when it comes to reliability performance all customers (except Key Accounts) prioritize reducing the overall length of outages."

As mentioned in Exhibit 1B, Tab 3, Schedule 1 at page 16, "Toronto Hydro's projection indicates that the investment plan is roughly sufficient to maintain Outage Frequency as measured by the custom SAIFI Defective Equipment metric over the 2025-2029 period, with some risk of deterioration relative to the five-year historical baseline (2018-2022). The target to maintain (rather than improve) Outage Frequency recognizes that customers in all classes (except Key Accounts) prioritize outage duration over frequency, and expect the utility to balance reliability performance with price and other key outcomes."

Regarding the exclusion of MEDs from the SAIDI performance metric, please see response 1B-Staff-90, part (b).

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-125

Reference: Exhibit 2B, Section B, page. 2

Preamble:

Toronto Hydro indicates that as part of proactive customer engagement, large customers and developers with upcoming projects are engaged to understand their needs and timelines and these engagements enable Toronto Hydro to incorporate anticipated connections into its Peak Demand Forecast with a higher degree of confidence.

QUESTION:

a) Given the emergence of new electrification trends such as commercial electric vehicle charging, building electrification etc., please confirm if Toronto Hydro has evolved its proactive customer engagement processes to engage a broader range of customers.
    i. If yes, please explain how Toronto Hydro has evolved its proactive customer engagement processes to engage prospective customers that are interested in connecting loads for electrification trends such as commercial electric vehicle chargers, building electrification etc.

RESPONSE:

Yes, Toronto Hydro continually evolves its proactive customer engagement practices as customer needs and new environmental factors such as electrification emerge. Through the Key Accounts segment's operational and senior leader customer engagements, Toronto Hydro ascertains future electrification and decarbonization plans from Key Account customers and supports customers to develop strategies to achieve their future decarbonization goals. This information is shared with internal stakeholders such as System Planning. Please also refer to the evidence on ongoing customer engagement,[1] the Key Accounts segment of the Customer Operations program,[2] and the Customer Relationship Management segment of the Customer Care program.[3]

[1] Exhibit 1B, Tab 5, Schedule 1, p. 13-23.
[2] Exhibit 4, Tab 2, Schedule 8, p. 22-25.
[3] Exhibit 4, Tab 2, Schedule 14, p. 34-43.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-126

Reference: Exhibit 2B, Section C, Pages 5-6

QUESTION (A):

a) Please confirm that the existing outage management system underreported scheduled outages.

   i. If not confirmed, please reconcile with the stated text "Increased number of scheduled outages reported".

   ii. Would the same underreporting issues apply to unscheduled outages?

RESPONSE (A):

Confirmed.

In addition to the impact on scheduled outages, the new Oracle Utility Analytics solution captures an increased number of unscheduled outages affecting a smaller number of customers. However, these additional outages have an insignificant impact on overall SAIDI and SAIFI performance.

QUESTION (B):

b) Please explain how Toronto Hydro is ensuring that historical underreporting of outages does not drive increased reliability spending that is unnecessary to maintain actual reliability.

RESPONSE (B):

Historical underreporting of outages has had no bearing on the 2025-2029 expenditure plan. The reporting issue is primarily a factor for Scheduled Outages.

QUESTION (C):

c) Has the historic increase in sectionalization enabled Toronto Hydro to reduce the impact (customer minutes out) of scheduled outages? Please explain.

RESPONSE (C):

In general, increased ability to sectionalize provides more options to minimize the customer impact of scheduled outages. Scheduled outages are confined to as narrow an area as possible to allow crews to work safely. This is achieved by utilizing permanent switches where available, and by installing temporary switches where permanent switches are not available. Because temporary switches are installed when permanent switches are not present, the impact of increased sectionalization on customer minutes out due to scheduled outages is marginal.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-127

Reference: Exhibit 2B, Section C, p. 5, 12

Preamble:

Toronto Hydro notes that the "recent rise in reliability impacts was caused by a range of factors. The predominant cause for the increase in SAIFI was unknown impacts, which consist of outages that have no apparent cause."

QUESTION (A):

a) Will Toronto Hydro's upgrade from the existing Outage Management System to Oracle's Network Management System facilitate improved identification of these "unknown impacts"?

RESPONSE (A):

Unknown outages, typically brief due to temporary faults, are hard to diagnose precisely. Despite enhanced identification, tracking, and reporting from Oracle's Network Management System ("NMS") and Utility Analytics ("OUA'), these tools cannot identify the root causes of such outages. For more details, please refer to Toronto Hydro's responses to 2B-EP-27.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-128

Reference: Exhibit 2B, Section C, Page 22

Preamble:

With respect to Figure 22 in Reference 1.

QUESTION (A):

a) Do Toronto Hydro's overhead conductor system failures primarily comprise splice and termination failures?

   i. If yes, please quantify the percentage of conductor failures that are due to conductor splice and termination failures.

   ii. If no, please explain where conductor splice and termination failures are tracked,

   iii. If no, please explain what typical overhead conductor failures are.

RESPONSE (A):

In general, interruptions stemming from 'overhead conductors' (shown in Figure 22) are a mix of both conductor and connection failures (including line clamps, splices, and terminations). Conductor failures could be related to issues like metal fatigue, or physical damage, while connection failures may be associated with problems in splices, terminations, or other points where the conductor is connected.

i. The majority of these failures can be attributed to connection failures rather than conductor failures. Toronto Hydro does not track overhead conductor failures with sufficient granularity to determine the percentage of failures that are due to termination or splices.

QUESTION (B):

b) What percentage of conductor system failures represent actual conductors failing between conductor splices and/or terminations. If Toronto Hydro does not have accurate numbers, please provide an estimate.

RESPONSE (B):

Due to limited data granularity, along with inherent difficulty in ascertaining the exact location of mid-span conductor failure from an interruption reporting perspective, Toronto Hydro is unable to provide an accurate percentage breakdown of actual conductors failing between splices and/or terminations. Toronto Hydro estimates that the majority of interruptions related to overhead conductors are driven by connection failures (line clamps, splices, and terminations). Please refer to the response to part (c) for more information on how Toronto Hydro is mitigating conductor, cable, and accessory failures.

QUESTION (C):

c) What is Toronto Hydro's standard practice to mitigate conductor splice and termination failures?

    iv. Please provide the average cost of replacing only a conductor splice, the average cost of replacing only a termination, and the average cost of following Toronto Hydro's standard practice.

RESPONSE (C):

Toronto Hydro employs robust asset lifecycle optimization policies and practices to minimize failures and maximize the value derived from individual assets throughout their lifecycles, as outlined in Exhibit 2B, Section D3.1. By conducting overhead line patrols and infrared scans of overhead primary lines as described in Exhibit 4, Tab 2, Schedule 1, Toronto Hydro can proactively detect evident signs of conductor splice and termination defects before they result in failures. These signs may include cracked or deteriorated connections, damaged or exposed insulation, or thermal anomalies. Toronto Hydro also mitigates failures by adhering to the latest construction standards, complying with *Ontario Regulation 22/04*,[1] conducting field audits, and implementing asset management investment plans to replace overhead infrastructure that is at higher risk of failure.

iv. Toronto Hydro replaces terminations and conductor splices reactively following a failure, or as part of a larger capital project. Due to limited data granularity and the bundling of this type of work with other work, Toronto Hydro is unable to provide the average cost of replacing only a conductor splice or termination. In general, replacing assets reactively is more expensive than replacing them as part of a planned project.

[1] O. Reg. 22/04: Electrical Distribution Safety, under Electricity Act, 1998, S.O. 1998, c. 15, Schedule. A.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-129

References: **Exhibit 2B, Section D1, Page 12**
Exhibit 2A, Tab 2, Schedule 1, Appendix D, Rate Base
Exhibit 2B, Section D3, Appendix A, Page 2
Exhibit 2B, Section E6.6, Page 22

<u>Preamble:</u>

With regards to the above references, please answer the following questions:

QUESTION (A):

a) Please define useful life in terms of the causes of retirement that useful life includes and does not include.

RESPONSE (A):

As discussed in Toronto Hydro's response to interrogatory 2B-Staff-131, Toronto Hydro's useful lives for asset management purposes were originally adopted on the basis of the mean useful life from a study conducted by Kinectrics for Toronto Hydro on asset useful lives. These were reviewed as part of the Depreciation Study completed by Concentric Inc. Toronto Hydro made adjustments to align its useful lives to Concentric's findings, where appropriate, resulting in changes to useful lives for a subset of asset types. Please see part (b) below for Concentric's response regarding causes of retirement. For a more detailed discussion regarding the determination of depreciation life versus useful life (i.e. failure curves), please see Toronto Hydro's response to interrogatory 2B-Staff-131.

QUESTION (B):

b) Please compare and contrast the causes of asset retirement as they pertain to useful life and depreciation life.

RESPONSE (B):

Response provided by Concentric:

The depreciable life of assets is based upon a detailed retirement rate analysis which includes all historical retirements through the period available to Concentric, an analysis of Canadian peer electric utilities, discussions with Toronto Hydro operations and management personnel, and the professional experience of Concentric. The depreciable life is inclusive of factors such as retirements due to the age of assets, economic forces of retirement, changes in legislation, and other retirements beyond the control of Toronto Hydro.

Response provided by Toronto Hydro:

For a detailed discussion regarding depreciation life versus failure curves, please see Toronto Hydro's response to interrogatory 2B-Staff-131.

QUESTION (C):

c) Please explain why depreciation life is always (except in exceptional circumstances) less than useful life.

RESPONSE (C):

Please see Toronto Hydro's response to interrogatory 2B-Staff-131.

QUESTION (D):

d) For asset classes with useful life estimates, please provide a table showing the useful life and depreciation life of those asset classes, and for those with equal depreciation life and useful life, please explain why they are equal.

   i. Please explain how Toronto Hydro updates its useful life expectations when actual failure rates deviate from expected failure rates (e.g., power transformers Reference 4).

RESPONSE (D):

Please see Table 1 below identifying major asset classes with useful life estimates and the depreciation life of those asset classes.

Table 1: Comparison of asset useful life and depreciation life expectations.

Major Asset Classes	Asset Useful Life	Dep. Life	Reason if Equal
Overhead Primary Conductor	60	60	Minor adjustment to Useful life in review of Concentric Study
Overhead Secondary Conductor	60	60	Minor adjustment to Useful life in review of Concentric Study
Overhead Switch	30	30	Change driven by input from Concentric Study based on the impact of increasing technologies impacting useful life of asset class and input from operational and management staff.
Overhead Transformer	35	35	Toronto Hydro's useful life was originally set at 35 years based on 2009 Kinectrics Study[1]
Poles (Wood Poles)	45	45	Toronto Hydro's useful life is based on 2009 Kinectrics Study
UG Primary Cable - Concrete, Conduit	50	50	Toronto Hydro's useful life is based on 2009 Kinectrics Study
UG Primary Cable - DB Jacketed	40	20	
UG Primary Cable - DB Unjacketed	20	20	Minor adjustment to useful life in review of Concentric Study
UG Primary Cable - PILC	65	65	Change driven by input from Concentric Study, peer Canadian utilities generally had service life in the range of 30-60 years, and historical retirement data also indicated shorter life expectation.

[1] Toronto Hydro Electric System Useful Life of Assets, Kinectrics (August 28, 2009)

Major Asset Classes	Asset Useful Life	Dep. Life	Reason if Equal
UG Secondary Cable - DB	23	23	Toronto Hydro's useful life is based on 2009 Kinectrics Study, no change due to Concentric Study
UG Secondary Cable - Conduit	60	60	Change driven by input from Concentric Study based on discussions with operational staff and a comparison with peer utilities.
Underground Switch	40	40	Change driven by input from Concentric Study, impacting only air-insulated pad-mounted switches (resulting in an increase in useful life).
Underground Transformers	30	30	Change driven by input from Concentric Study based on discussions with operational and management staff.
Underground Network Units	35	35	Change driven by input from Concentric Study, increase in useful life based on operational and management experience.
Stations - Switchgear Enclosures	50	50	Toronto Hydro's useful life is based on 2009 Kinectrics Study, no change due to Concentric Study
Stations - DC Batteries	10	10	Toronto Hydro's useful life is based on 2009 Kinectrics Study, no change due to Concentric Study
Stations - Power Transformers	45	45	Toronto Hydro's useful life is based on 2009 Kinectrics Study, minor change (1 year) based on input from Concentric Study.
Circuit Breakers	45	45	Minor changes driven by input from Concentric Study impacting two subtypes (Airblast and Air Magnetic) only. Aligns useful life estimates with remaining breaker types.
Civil - Network Vaults	60	60	Toronto Hydro's useful life is based on 2009 Kinectrics Study, no change due to Concentric Study

Major Asset Classes	Asset Useful Life	Dep. Life	Reason if Equal
Civil - Network Vaults - Roof	25	25	Toronto Hydro's useful life is based on 2009 Kinectrics Study, no change due to Concentric Study
Civil - Cable Chambers	65	65	Toronto Hydro's useful life is based on 2009 Kinectrics Study, no change due to Concentric Study
Civil - Cable Chambers - Roof	25	25	Toronto Hydro's useful life is based on 2009 Kinectrics Study, no change due to Concentric Study
Civil- Underground Vaults	60	60	Toronto Hydro's useful life is based on 2009 Kinectrics Study, no change due to Concentric Study
Meters	15	15	Toronto Hydro's useful life is based on 2009 Kinectrics Study, no change due to Concentric Study
Automatic Transfer Switch (ATS) & Reverse Power Breaker (RPB)	40	40	Toronto Hydro's useful life is based on 2009 Kinectrics Study, no change due to Concentric Study

i. Please see Toronto Hydro's response to interrogatory 2B-Staff-131, part (a).

QUESTION (E):

e) For each of the assets listed in Table 1: Material Refinements to ACA Asset Models, please explain why updates to the Depreciation Study by Concentric triggered revisions to the useful life values used by the asset managers at Toronto Hydro.

ii. For each of the assets listed in Table 1, what information did Concentric have about Toronto Hydro's assets that Toronto Hydro did not have?

iii. Did Toronto Hydro hire Concentric for its expertise in determining asset depreciation lives, or its expertise in assessing asset condition and the resulting useful life?

RESPONSE (E):

Please see Toronto Hydro's response to interrogatory 2B-Staff-131 part (a), for details regarding Toronto Hydro's updates to useful lives and the broader use of this information in asset management.

ii. Concentric leveraged their extensive professional experience in conducting service life studies along with information from peer utilities in North America in addition to asset and financial data that was available from Toronto Hydro.

iii. Toronto Hydro hired Concentric for its expertise in estimating the service life of assets for the purpose of depreciation. Toronto Hydro's engineers have sufficient expertise and first-hand knowledge of the system to determine the appropriate timing for asset replacements. As discussed in Toronto Hydro's response to interrogatory 2B-Staff-131 part (a), service life estimates and useful life of assets are inter-related and as such the results of the Depreciation Study are an important consideration in reviewing useful life estimates.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-130

References: **Exhibit 2B, Section D1, Page 12**
Exhibit 2B, Section D5, Page 15-16

QUESTION (A):

a) When leveraging risk-based decision making to ensure System Renewal investments are sufficient to maintain historical reliability, please explain how SCADA operated switch investments in self-healing grids changes the consequence of asset failures and the resulting risk calculations?

RESPONSE (A):

SCADA operated switch investments and related investments in self-healing grid capabilities are expected to reduce the consequence of asset failure in specific circumstances due to increased operational flexibility and automated switching operations for faster restoration of customers in unaffected parts of a feeder during an outage event.

While the reduction in consequence of failure through the implementation of self-healing grids will result in an overall reduction of risk, Toronto Hydro does not expect to have self-healing functionality implemented and operational until 2030. Therefore, the change in risk profile due to self-healing capabilities in the horseshoe system is not expected within this rate period.

Toronto Hydro recognizes that the installation of SCADA switches on horseshoe feeders does provide an immediate reliability benefit due to remote switching capabilities and increased operational flexibility (although not the more significant improvement expected through automated self-healing capabilities). These benefits are considered in Toronto Hydro's plans to maintain reliability and are integrated into the projections that underpin its performance incentives for SAIFI and SAIDI as detailed in Exhibit 1B, Tab 3, Schedule 1.

QUESTION (B):

b) When leveraging risk-based decision making please confirm that when 2100 or 1400 customer group line segments are sectionalized into 700 customer group segments the consequence of individual asset failure decreases relative to the pre-sectionalized configuration.

   i. If confirmed, please explain what change would need to occur to the probability of asset failure to maintain a constant overall risk profile when consequence of failure is reduced?

   ii. If not confirmed, please explain what happens to the consequence of asset failure post-sectionalization?

   iii. In either case, please explain the process Toronto Hydro uses to adjust the acceptable probability of failure (or useful life or acceptable asset condition) to maintain a constant overall risk profile when consequence of asset failure changes.

RESPONSE (B):

Confirmed, when group line segments are sectionalized into 700 customer group segments, the consequence of individual asset failure decreases relative to the pre-sectionalized configuration.

i. If the consequence of failure is reduced through enhancement, the probability of failure would need to increase (i.e. the asset would need to be older, in worse condition, or otherwise more likely to fail) for the risk value to remain the same.

ii. Please see response to (i) above.

iii. Probability and consequence are assessed independently and combined to assess risk within Toronto Hydro’s planning processes. A reduction in the consequence of failure on a particular feeder may cause Toronto Hydro to opt to maintain assets longer and accept a higher probability of failure in favour of making investments on a part of the system that carries greater risks.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-131

References: Exhibit 2B, Section D1, Page 17
Exhibit 2B, Section D2, Pages 20, 43
Exhibit 2B, Section D3, Page 29

Preamble:

Given the large percentage of Toronto Hydro assets that are beyond their useful lives and given Toronto Hydro's historically improving SAIDI and SAIFI metrics, it is possible that Toronto Hydro has incorrectly estimated the useful lives of some of its asset classes.

QUESTION (A):

a) Please describe the process that Toronto Hydro uses to update its useful life expectations based on actual asset performance.

RESPONSE (A):

Toronto Hydro does not agree with the premise outlined in the preamble of this question with respect to the relationship between the referenced useful life metrics and SAIDI and SAIFI performance. Regardless of where the useful life values are set, the application of prudent asset management principles would dictate that a utility should always be operating a substantial percentage of assets beyond useful life. Toronto Hydro does not replace individual assets simply because the age of the asset has exceeded the useful life value. As discussed in detail in Toronto Hydro's response to interrogatory 2B-SEC-44, the utility makes replacement decisions on the basis of probability of failure, consequence of failure, and various system design considerations, as part of a programmatic asset management approach tailored to the specific realities of Toronto Hydro's dense urban environment. The specific drivers of historical reliability improvements are discussed in Exhibit 2B, Section E2.2.1.

To update its useful life expectations, Toronto Hydro relies on the judgement and expertise of its own engineering and operational experts, with support from industry-standard studies completed by leading experts. The utility's asset useful lives for asset management purposes were originally adopted on the basis of the mean useful life from a study conducted by Kinectrics for Toronto Hydro on asset useful lives, to which Toronto Hydro subject matter experts contributed. These were reviewed as part of the Depreciation Study completed by Concentric Inc., filed in Exhibit 2A, Tab 2, Schedule 1, Appendix D. Toronto Hydro made adjustments to its useful lives where appropriate, based on Concentric's results, which themselves were informed by Toronto Hydro subject matter experts.

Depreciation Life vs. Failure Curves

In 2B-Staff-129, OEB Staff requests a discussion regarding the differences between useful life values determined for depreciation purposes versus those developed for asset management purposes, and postulates that depreciation life values are almost always less than useful life values used in asset management. Toronto Hydro assumes that OEB Staff is referring to the difference between average service lives determined on the basis of a broader set of retirement causes (for depreciation purposes) as compared to average service lives calculated on the basis of what Toronto Hydro would call "failure curves," i.e. probability of failure curves created on the basis of the utility's failure data (as opposed to retirement data).

Toronto Hydro agrees with the view that, in theory, a useful life value based purely on failure data would, in many (but not all) cases, be equal to or greater than the depreciation useful life. However, the extent to which this would in fact be the case across all asset classes, and the magnitude by which the depreciation and useful life values would actually vary from one another in each instance, would be dependent on the specific asset type and the utility's asset management practices.

Assessing the actual differences between depreciation life and useful life on an objective basis requires developing asset failure curves. The development of failure curves using a utility's own failure data continues to be an area of development and exploration for many distribution utilities like Toronto Hydro. While the statistical approaches to developing the useful life of an asset class are fairly established (and not dissimilar from developing the survival curves used for depreciation), the volume of data and quality of data required to produce a failure curve remains a barrier. Specifically, this requires many years of appropriately structured and labeled failure data that can be tied directly to underlying assets and their attributes at the time of failure. For most utilities, blended asset failure datasets of this nature are, at best, limited to around 10 years of history (as compared to useful life of distribution assets themselves, which are typically around the 30-50-year range). Furthermore, the quality of this data over the available period varies significantly, especially as utilities have progressed from early implementations of data and work management systems to more mature and advanced digital tools in recent years. The reality is that the systems which capture outage data and corrective action data were historically designed with the primary goal of optimizing the efficiency of field operations and were not intended to provide the very high level of data quality and granularity necessary to develop predictive failure curves with ease. As Toronto Hydro gains experience with the more advanced Oracle Utility Analytics ("OUA") interruption tracking system, the utility expects the level of data quality regarding asset failures to improve.

Application of Useful Lives in Asset Management at Toronto Hydro

Toronto Hydro's existing useful life values are appropriate for use in asset management. By leveraging the Kinectrics and Concentric studies, Toronto Hydro ensures alignment of useful life assumptions with broader industry knowledge for major asset classes for the purpose of driving asset management decisions. On this point, it is important to underscore exactly how useful life values factor into the utility's asset management decisions.

- **Assets Past Useful Life:** As noted earlier in this response, Toronto Hydro does not replace assets simply because they have exceeded their useful life values. While the utility does make reference to the percentage of Assets Past Useful Life ("APUL") throughout the Distribution System Plan, this measure is offered as a simplified, directional indicator of changes in asset demographics over long periods of time, and does not directly inform the selection of assets by system planners. To the limited extent that APUL has been used to frame investment pacing decisions for 2025-2029, it is with regard to particular spikes in asset need that are expected over the longer-term (e.g., network units in 2030-2034).

Note that age and APUL are distinct measures. In some cases, Toronto Hydro's evidence highlights issues with the age demographics of certain asset classes (for example, stations power transformers and direct-buried cables). In these examples, the population of concern is not the general population of assets past useful life, but a subset of assets operating well beyond useful life (for example, stations power transformers operating beyond a target maximum age of 65 years).

- **Asset Condition Assessment ("ACA"):** Asset useful life is an input into the ACA methodology, along with inspection information and other asset characteristics to determine the overall condition of the asset. In this context, the useful life is used as a calibration factor within the model to represent a central point in time where the utility can expect to begin to see increased deterioration. When assets with ACA models are being targeted for replacement as part of discrete capital projects, these decisions are made on the basis of the health score. Importantly, the asset useful life on its own will not increase the asset health score of an asset beyond the HI3 band. There must be a verifiable condition present to push the asset into HI4 and HI5.

Toronto Hydro encourages all parties to review the detailed program-level evidence regarding asset needs and investment pacing decisions in Exhibit 2B, Section E6. Additional information regarding expected changes in asset demographics over the 2025-2029 period with investment is provided in Toronto Hydro's response to interrogatory 2B-SEC-44.

QUESTION (B):

b) For all asset classes with ACA data provide the following data in an MS Excel worksheet:

i. Useful life used in this filing.

ii. Useful life used in the previous distribution system plan.

i. For any useful lives that were updated, please explain the primary driver of the update.

iii. Assets Past Useful Life (APUL) percentage for this filing

iv. APUL percentage in 2017

v. Forecast APUL percentage in 2029

vi. Presence or absence of a probability of failure curve, and the year in which Toronto Hydro plans to either update the curve or create it for the first time.

i. For all the probability of failure curves, please indicate if the curves are based on Toronto Hydro specific data or 3rd party data.

RESPONSE (B):

Please see Toronto Hydro's response attached, 2B-Staff-131 App A ACA Demographics and Corresponding Useful Lives.

QUESTION (C):

c) Please explain why Toronto Hydro has selected asset age as its "comprehensive indicator of failure risk across the system" rather than performing an actual risk assessment based on actual asset condition (currently Toronto Hydro's proxy for probability of failure) and consequence of failure.

RESPONSE (C):

"Comprehensive" in this context refers to the fact that Toronto Hydro does not have a condition model for all of its major asset classes, and therefore the APUL metric is more inclusive of the utility's broader asset base.

"[…] indicator of failure risk" is meant to convey the simple fact that, in the broadest sense, age is correlated with probability of failure, and to the extent that the probability of failure is changing over time across the utility's asset base, this a directional indicator of potential changes in the level of investment required to manage asset risk.

Please refer to Toronto Hydro's response to interrogatory 2B-AMPCO-18 for details regarding the current status of Toronto Hydro's implementation of the Probability of Failure and Consequence of Failure components of the Condition Based Risk Management framework.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-132

References: **Exhibit 2B, Section D2, Page 10**
Exhibit 2B, Section E6.5, Page 37

QUESTION (A):

a) Please confirm that the historically achieved reduction in risk and the recommendation by the consultant to not relax Toronto Hydro's existing adaptation measures means that those adaptation measures meet or exceed Toronto Hydro's requirements.
   i. If confirmed, please explain why a new budget line item of $85.9 for "Overhead Infrastructure Resiliency" is being introduced in this test period.
   ii. If not confirmed, please explain what adaptation measures are in excess of the recommended adaptation measures and why.

RESPONSE (A):

Toronto Hydro confirms that the adaptation measures described in Exhibit 2B, Section D2, page 10 meet Toronto Hydro's requirements in respect of equipment specifications and design practices. Where equipment has been replaced or installed since the adaptation measures were established, it is to the new requirements.

The Overhead Infrastructure Resilience segment is an example of where these adaptation measures are being deployed. This segment is a reintroduction and expansion of work done through the Overhead Infrastructure Relocation Program in Toronto Hydro's 2015-2019 DSP to improve the resiliency of the overhead system through targeted relocations and undergrounding of overhead assets that are at risk of adverse weather, as well as, tree contacts, animal contact, foreign interference and/or in areas that are difficult to access. Targeted assets also include obsolete designs, which are no longer aligned with Toronto Hydro's current planning and work practices, but which are not currently addressed through other capital programs. For details of the needs driving this segment, please see Exhibit 2B, Section E6.5, page 26-33 and 37-38.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-133

Reference: Exhibit 2B, Section D2, Page 25

<u>Preamble:</u>

Regarding "Obsolete and deteriorating overhead accessories" and example of catastrophic failure of a porcelain insulator.

QUESTION (A):

a) Please explain how the risk of failure is high when the reason given relates solely to the typical probability of failure (i.e. the probability of electric tracking) and not typical consequence of failure.
   i. What is the typical failure mode of an insulator.
   ii. What is the typical consequence of an insulator failure.

RESPONSE (A):

i) Typical failure modes of an insulator include:
   a. Electrical tracking due to contamination build up - porcelain insulators are more susceptible to contamination build up than polymeric type insulators due to the material properties;
   b. Cracking and shattering of the insulator due to age, contamination, and even sudden temperature changes – this only applies to porcelain insulators.

ii) Typical consequence of an insulator failure include:
   a. Electrical tracking, leading to flashovers, pole fires, and outages;
   b. Cracking and shattering (for porcelain insulators only), releasing porcelain shards which can cause damage to nearby equipment, public property, and put the general public at risk.

It is the combination of the higher probability of failure with the potential to fail in a catastrophic manner as described in Exhibit 2B, Section D2 at page 25, that leads to the high risk of failure for porcelain insulators.

QUESTION (B):

b) Of all the failures in the past 5 years, what percentage resulted in a catastrophic failure that caused property damage or human injury, and what percentage did not?
   i. Please explain why a single incident of property damage is the consequence used to justify the insulator replacement program.
   ii. Please provide the risk comparison between the typical insulator failure risk (i.e. typical failure probability and typical consequence of failure) versus the risk of property damage failure (i.e. single/exceptional occurrence and property damage consequence) as measured on Toronto Hydro's risk matrix.

RESPONSE (B):

Toronto Hydro does not have detailed records specifically related to porcelain insulator failure. The information collected within Toronto Hydro's interruption tracking system does not have sufficient granularity to distinguish catastrophic and normal failure modes for this asset type.

i) Please note that Toronto Hydro is not proposing a dedicated insulator replacement program for the 2025-2029 period. Toronto Hydro will typically replace these obsolete insulators upon failure, during overhead rebuilds, or in tandem with reactive or corrective work performed on related assets such as poles or overhead conductors. As discussed in Exhibit 4, Tab 2, Schedule 1, Toronto Hydro maintains porcelain insulators by regularly washing high priority locations to reduce contamination and minimize failure risk due to tracking.

ii) As per response above, Toronto Hydro does not have the granularity within its information systems to perform a comparative risk analysis. For a broader discussion on how Toronto Hydro assesses the risk of asset failures, please see Toronto Hydro's response to interrogatory 2B-SEC-44.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-134

References: **Exhibit 2B, Section D2, Table 2, Page 27**
Exhibit 2B, Section D2, Table 3, Page 33
Exhibit 2B, Section D2, Table 4, Pages 40, 41
Exhibit 2B, Section D2, Table 5, Pages 46, 47
Exhibit 2B, Section D2, Table 6, Page 49
Exhibit 2B, Section D3, Appendix B, Page 19

QUESTION (A):

a) Please update Table 2 through Table 6 indicated in the references above to show the following columns with equivalencies determined by Toronto Hydro's risk matrix:
   i. Typical Failure Mode(s)
   ii. Probability of the Typical Failure Mode
   iii. Consequence of the Typical Failure Mode
   iv. Exceptional Failure Mode(s) (or Catastrophic Failure Mode(s))
   v. Probability of the Exceptional Failure Mode (or Catastrophic Failure Mode)
   vi. Consequence of the Exceptional Failure Mode
   vii. Locations of the Typical and Exceptional Failure Modes on Toronto Hydro's risk matrix.

Please note if Toronto Hydro does not have the probabilities of the typical and exceptional failure modes, then please provide an estimate of those values or an estimate of the relative probabilities of those values (e.g., the typical mode is 100 times more likely than the exceptional).

RESPONSE (A):

The tables referenced by the question provide common root causes of failure by asset class. Toronto Hydro does not compute average probabilities or average consequences for the various root causes of failure. The utility's approach for calculating Probability of Failure ("PoF") for risk quantification purposes is largely grounded in its application of the Condition Based Risk Management ("CBRM") framework. As discussed in Exhibit 2B, Section D3, Appendix C, at page 14:

> *THESL have defined three failure modes depending on the asset deterioration stage and corresponding remedial action as listed in Table 6. These failure modes have been applied in the ACA methodology for the derivation of probability of failure and consequence of failure values. The three failure modes align with both THESL's established practices and the principles of the CNAIM methodology and are considered to be appropriate for the evaluation of asset PoF and CoF.*

The three failure modes are Incipient, Degraded, and Outage (Catastrophic). These failure modes are differentiated by the type of action that they trigger. For example, significant corrosion on a padmount transformer will trigger reactive replacement, which by definition is a "Degraded" failure mode. Incipient and Degraded failure data is assembled primarily by leveraging corrective work order data (i.e., asset repairs and reactive replacements), where as Outage failure data is assembled primarily from outage event and emergency response records. Toronto Hydro determined the PoF for these failure modes by leveraging its records of historic failure in the manner described in Exhibit 2B, Section D3, Appendix B, page 15. Ultimately, Toronto Hydro will apply the composite probability of failure for these failure modes, which tracks with the specific health score for an asset, in its risk-based value framework. For reference, Table 1 below provides the range of PoF values for each Health Index band for each asset class where existing data is currently sufficient to calculate PoF.

1 **Table 1: PoF Ranges by Health Index Band**

Assets	PoF Ranges				
	HI1	HI2	HI3	HI4	HI5
SCADAMATE Switches	0.9%	0.9% to 1.82%	1.9% to 2.78%	2.89% to 4.79%	4.95% to 8.97%
Wood Poles	0.03%	0.03% to 0.07%	0.07% to 0.1%	0.11% to 0.17%	0.18% to 0.33%
Network Transformers	1.06%	1.06% to 2.16%	2.26% to 3.29%	3.43% to 5.67%	5.86% to 10.64%
Submersible Transformers	1.5%	1.5% to 3.05%	3.19% to 4.65%	4.84% to 8.01%	8.28% to 15.03%
Vault Transformers	0.34%	0.34% to 0.69%	0.72% to 1.05%	1.09% to 1.81%	1.87% to 3.4%
Padmount Transformers	0.63%	0.63% to 1.27%	1.33% to 1.94%	2.01% to 3.33%	3.45% to 6.25%
SF6 Insulated Padmount Switch	2.26%	2.26% to 4.58%	4.79% to 6.99%	7.27% to 12.04%	12.45% to 22.58%
Air Insulated Padmount Switch	3.56%	3.56% to 7.22%	7.55% to 11.02%	11.46% to 18.98%	19.62% to 35.59%
SF6 Insulated Submersible Switch	0.88%	0.88% to 1.79%	1.87% to 2.73%	2.84% to 4.71%	4.87% to 8.83%
Air Insulated Submersible Switch	0.44%	0.44% to 0.89%	0.93% to 1.36%	1.42% to 2.34%	2.42% to 4.39%
Station Power Transformers	2.73%	2.73% to 5.53%	5.79% to 8.45%	8.79% to 14.55%	15.04% to 27.28%
AirBlast Circuit Breaker	0.5%	0.5% to 1.01%	1.05% to 1.54%	1.6% to 2.65%	2.74% to 4.96%
Air Magnetic Circuit Breaker	0.24%	0.24% to 0.48%	0.51% to 0.74%	0.77% to 1.27%	1.32% to 2.39%
Oil Circuit Breaker	0.99%	0.99% to 2.02%	2.11% to 3.08%	3.2% to 5.31%	5.48% to 9.95%
Oil KSO Circuit Breaker	1.45%	1.45% to 2.94%	3.08% to 4.49%	4.67% to 7.74%	8.% to 14.5%
SF6 Circuit Breaker	1.89%	1.89% to 3.84%	4.01% to 5.86%	6.1% to 10.09%	10.43% to 18.92%
Vacuum Circuit Breaker	0.71%	0.71% to 1.44%	1.5% to 2.19%	2.28% to 3.78%	3.91% to 7.09%

Please see response to 2B-AMPCO-18 part (a) regarding the current status of Toronto Hydro's ongoing work to develop the Consequence of Failure component of the CBRM framework.

Please see Exhibit 2B, Section D3.2.1.3 regarding how Toronto Hydro intends to combine Probability of Failure and Consequence of Failure into a quantified risk value within the Engineering Asset Investment Planning ("EAIP") tool.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-135

Reference: Exhibit 2B, Section D2, Page 42

QUESTION (A):

a) Toronto Hydro notes that it owns "approximately 139 MSs". What is the exact number of MSs owned by Toronto Hydro?

   i. If an actual number is not available, please explain why not.

RESPONSE (A):

At the time of filing, the actual number of MSs owned was 139. The term "approximately" was used as Toronto Hydro was in the process of decommissioning one MS.

QUESTION (B):

b) If there is a decommissioning plan, please provide the number of stations operational at the time of responding to IRs, and the plan for decommissioning over the forecast period.

RESPONSE (B):

Yes, Toronto Hydro has a decommissioning plan. At this time, there are 138 MSs in-service. Please see the table below summarizing the utility's decommissioning plan for the 2025-2029.

Table 1: Number of Municipal Stations to be Decommissioned over 2025-2029

	2025	2026	2027	2028	2029
Municipal Stations	3	5	1	2	6

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-136

Reference: Exhibit 2B, Section D2, Page 11

QUESTION (A):

a) Does Toronto Hydro routinely compare the costs of rehabilitation and replacement to extend the operating life of assets found to be in poor condition?
If so, please provide some representative costs for asset classes conducive to rehabilitation.

RESPONSE (A):

No. Toronto Hydro does not routinely compare the costs of rehabilitation and replacement for assets operating in poor condition during its capital planning process. In general, many assets that are in poor condition will be:

- older assets which are built to an older standard and it would not be prudent to be refurbishing non-standard equipment, and/or
- not repairable to a state that is safe to crews and the public, and/or
- costly to repair.

Some examples include:

- Transformers and switches which will often have corrosion that requires the full replacement of the enclosure/tank (Costly Repair)
- Civil structures like vaults which have major structural deficiencies that cannot be safely patched/repaired (Unsafe Repair) (See Exhibit 2B Section E6.4 Page 12)
- Rotting wood poles which cannot be repaired (Unsafe repair)

Furthermore, Toronto Hydro's Corrective Maintenance Program (Exhibit 4 Tab 2 Schedule 4) will undertake actions to address deficiencies that will extend the operating life of the assets.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-137

Reference: Exhibit 2B, Section D2, Page 18

QUESTION (A):

a) Are priority deficiencies only evaluated for assets found to be in HI5 condition, or are they evaluated for a broader range of asset conditions? Please explain.

RESPONSE (A):

The assigned priorities (P1-P4) are dependent on various factors such as the severity of the issue (e.g. leaking transformer), location (e.g. main trunk versus lateral/sub-lateral), number of customers potentially affected, etc. Toronto Hydro also takes into consideration environmental, safety, and reliability impacts. The priorities are assigned based on inspection results and deficiencies identified by our crews or others on any of our assets and are not limited to assets found to be in HI5 condition.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-138

References: Exhibit 2B, Section D2, Page 23

QUESTION (A):

a) Please indicate the assessed health index ratings that would trigger pole replacement.

RESPONSE (A):

There is no health score that automatically triggers asset replacement. Please see response to part (b) for more information.

QUESTION (B):

b) How does Toronto Hydro prioritize pole replacements given that it replaces poles that have different health indices?

RESPONSE (B):

As discussed in Exhibit 2B, Section E6.5 at pages 16 to 21, Toronto Hydro prioritizes replacing poles that are in HI4 and HI5 condition, with a focus on parts of the system where the consequence of failure is high and where historical performance has been poor. Other factors that drive pole replacement within the System Renewal programs include the application of construction and design standards at the project planning and design stage, voltage conversion requirements, efficiencies that can be achieved by grouping assets into area rebuilds, the presence of obsolete equipment (e.g., box construction), and on-the-ground field conditions and design factors.

QUESTION (C):

c) How does Toronto Hydro determine the appropriate economic trade-off between the value to customers of the foregone lost service life due to replacing poles and pole top transformers before they fail against the risks associated with running these assets to failure?

RESPONSE (C):

The goal of minimizing an asset's total lifecycle cost while ensuring safe and reliable asset performance is embedded in Toronto Hydro's Reliability Centered Maintenance practices, its risk-based asset replacement and project planning approaches, and its iterative, outcomes-oriented Investment Planning & Portfolio Reporting process, all of which are described in Exhibit 2B, Section D3. Generally, when it comes to system renewal work, planners are expected to justify their proposed capital projects on the basis of value-for-money, i.e., whether the project is scoped to address sufficient failure risk and contribute meaningfully to system performance objectives. These principles are applied during a planner's desktop analysis when, for example, deciding which assets to address, and whether to address those assets through a spot replacement approach versus a broader area rebuild approach. Engineering managers are tasked with reviewing planner scopes and challenging assumptions to ensure asset lifecycle planning principles are applied consistently and that, ultimately, assets which are serviceable are not being replaced prematurely.

During the lead-up to its 2020 CIR, the utility moved toward its current approach of emphasizing measurable customer-focused outcomes and targets (as opposed to opaque cost-benefit metrics). This approach is built upon (i) industry-leading customer engagement, (ii) an iterative capital planning process that produced verifiable trade-offs within top-down financial constraints, and (iii) parametric five-year program estimates built upon a combination of historical unit and project costs, leading indicators such as asset condition demographics, and historical and forecast performance trends.

Beginning in 2021, Toronto Hydro – with encouragement from the OEB's Decision in the utility's 2020 CIR[1] – began the process of implementing an industry-leading Engineering Asset Investment Planning ("EAIP") tool (ultimately, Copperleaf C55). As part of this project, the utility has set-out to

[1] EB-2018-0165, Decision and Order (December 19, 2019) at pages 90-94.

develop an industry-leading Value Framework that leverages the asset-by-asset outputs of its Condition-Based Risk Management framework to assign a consistent, objective measure of value to individual projects developed by system planners. These value measures will be leveraged within the EAIP tool to run value-maximizing optimizations on the utility's execution work program, and will provide planners with an additional tool for assessing and demonstrating the economic value of their projects, consistent with the principles of asset lifecycle management. (Toronto Hydro expects this tool to be fully implemented and embedded in planning processes in time for its next major capital planning cycle in 2025.)

With respect to the overhead assets referenced in this question, note that Toronto Hydro generally does not prioritize pole top transformers for proactive replacement, except where the units are at risk of containing PCBs and as part of larger proactive area rebuild projects when there are economies of scale. For a general discussion of overhead asset replacement prioritization practices, please refer to Exhibit 2B, Section D3, Table 2.

QUESTION (D):

d) Please provide the benefit-cost analysis that Toronto Hydro used to evaluate its proposed proactive wood pole and pole top transformer replacement programs.

RESPONSE (D):

Per the discussion provided in response to part (c), Toronto Hydro does not reduce its five-year System Renewal investment programs down to a single benefit-cost analysis metric. The utility's 2025-2029 expenditure plan for the Overhead System Renewal program was developed based on various considerations including asset condition demographics, reliability performance trends, voltage conversion needs, and environmental and safety risks. The forecast benefits of this program with respect to reliability outcomes are captured within the SAIDI/SAIFI forecasts found in Exhibit 1B, Tab 3, Schedule 1, along with an overall benefit-cost analysis of Toronto Hydro's proposed reliability investments as a whole.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-139

Reference: Exhibit 2B, Section D3 p.6

QUESTION (A):

a) What has changed such that Toronto Hydro is adding concrete and steel poles to its dedicated pole inspection program in 2025?

RESPONSE (A):

Please refer to Toronto Hydro’s response to 2B-PWU-10.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-140

Reference: Exhibit 2B, Section D3, Appendix B

<u>Preamble:</u>

Appendix B provides the ACA Summary for 2017, 2022 and the Forecast for 2029 year end if no investments are made.

QUESTION (A):

a) For both tabs in Appendix B, please provide Forecasts for 2029 YE under the following scenarios.
   i. If the proposed capital and maintenance plans are implemented
   ii. If Toronto Hydro's capital program was reduced by 25%
   iii. If Toronto Hydro's capital program amounts for 2025 was approved, and Toronto Hydro was to operate under a Price Cap IR regulatory framework for the forecast period.

RESPONSE (A):

For part (i), please refer to Toronto Hydro's response to interrogatory 2B-SEC-44. For (ii) and (iii), please refer to interrogatory 1B-SEC-21.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-141

References: Exhibit 2B, Section D3, Appendix A, Pages 4, 6

QUESTION (A):

a) How many SF6 switches broken down by category (e.g., insulated padmount) are planned to be replaced in the planning period?

RESPONSE (A):

Toronto Hydro has forecasted to replace 116 padmount switches based on the preliminary selection of areas targeted as per the drivers mentioned in Section E6.2.3.3. For these Horseshoe system assets, Toronto Hydro does not yet have the discrete project details for projects in later years of the plan, which would be necessary to break these switches down further into sub-categories. The utility will be prioritizing higher-risk air-insulated switches. With respect to the Downtown underground system, Toronto Hydro plans to replace four URD submersible SF6 switches in the 2025-2029 period.

QUESTION (B):

b) Please explain why it was prudent to have 1 Hi4 and 16 Hi5 SF6 insulated padmount switches in 2022.
   i. Please explain why it is now necessary to replace switches that have effectively the same health rating in 2029 as they did in 2022?

RESPONSE (B):

The 17 SF6 insulated padmount switch units in HI4/5 in 2022 were addressed for repair or replacement through corrective maintenance and reactive capital programs in 2023. The next inspection cycle of these units in 2024 will result in updates to their Health Scores as per the action taken. Please see Exhibit 2B, Section E6.2.3 for a detailed discussion regarding the need for investment in padmount switches and the focus on air-insulated switches. Please refer to 2B-SEC-44 for a comprehensive discussion regarding expected changes in asset demographics over the 2025-2029 period.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-142

References: Exhibit 2B, Section D3, Page 6
Exhibit 2B, Section D3, Pages 12, 13

Preamble:

With regards to Toronto Hydro's asset replacement programs for poles.

QUESTION (A) AND (B):

a) Similar to submersible transformers, please explain why Toronto Hydro chose to inspect all poles on an 8-year cycle, rather than only inspecting those poles approaching or past their useful lives (or previously identified as being in poor condition) more frequently?
b) Why does Toronto Hydro not inspect poles on a cycle time that is tied to actual asset condition (or age if condition is not known)?

RESPONSE (A) AND (B):

Please refer to Toronto Hydro's response to interrogatory 2B-PWU-10.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-143

References: Exhibit 2B, Section D3, Pages 15, 16

QUESTION (A):

a) Please provide the list of asset classes that are considered critical spares.

RESPONSE (A):

The following asset classes have equipment listed as critical spares:

- Overhead transformers
- Overhead distribution poles
- Overhead primary conductors
- Overhead secondary conductors
- Overhead switches
- Overhead insulators
- Padmounted transformers
- Submersible transformers
- CRD transformers
- Building vault transformers
- Padmounted switches
- Underground cables
- Network transformers
- Stations bus disconnect switches
- Stations DC batteries and chargers

QUESTION (B):

b) For each of the critical spares asset classes please describe the long-term asset retirement strategies in terms of the expected natural failure rate, planned retirement rate, risk profile over time, and role that critical spares play in achieving that strategy.

RESPONSE (B):

Toronto Hydro is unable to provide the information requested. In the utility's experience, the multi-decade, asset-class-specific plans requested by OEB Staff are of limited value (and unnecessary) in determining effective and actionable asset investment strategies and business plans for Toronto Hydro's service territory and system. Over the last 20 years, the utility has developed an asset management and program delivery approach that is performance-based, programmatic, integrated and flexible. Toronto Hydro's programmatic System Renewal evidence found in Section E6 provides detailed justifications for the level of investment required to achieve the outcome objectives associated with the Distribution System Plan. Please see Toronto Hydro's response to 2B-SEC-44 for further discussion regarding the key considerations driving the asset management strategies for a majority of asset classes.

Toronto Hydro maintains critical spares for a large set of key assets across its system. The utility uses critical spares to allow the utility to repair or replace an asset under outage or emergency conditions in a timely manner, ultimately impacting Toronto Hydro's ability to minimize the duration of outages to its customers. The availability of critical spares is reflected in Toronto Hydro's historical interruption statistics and thus informs Toronto Hydro's risk analysis via the reliability projection methodology.

QUESTION (C):

c) Please explain why a "wall" or "wave" within a 10 to 15-year period is the optimal window within which to manage asset demographics for long lived assets.

RESPONSE (C):

As stewards of the system, Toronto Hydro must take into account rate impacts, supply chain risks, and execution limitations when dealing with asset "walls" or "waves". To clarify, Toronto Hydro does not aim to manage an asset class within a 10 to 15-year window for long-lived assets. Rather, if it becomes aware of a large proportion of assets within an asset class reaching end-of-life (i.e. a "wall" or "wave" of assets reaching end of life) within the next 10 to 15 years, it will attempt to smooth out the renewal over a longer time period to minimize inefficiencies of having to replace a large amount of assets in a short period of time. This approach allows the utility to manage execution challenges and reduce rate volatility for its customers.

QUESTION (D):

d) Please explain why asset management strategies such as Critical Spares cannot also extend the replacement lifespan over which a subset of assets can be replaced.

RESPONSE (D):

Critical spares serve as vital lifelines for Toronto Hydro, ensuring a consistent level of service continuity when faced with asset failures. The availability of critical spares is already reflected in Toronto Hydro's historical outage statistics and by extension its assumptions regarding the future consequence of failure for key assets. A greater reliance on critical spares to extend replacement lifespans would in effect mean running a greater share of assets to failure, which would result in reliability performance deterioration and greater inefficiencies related to reactive (as opposed to planned) replacement.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-144

References: **Exhibit 2B, Section D3, Page 24**
Exhibit 2B, Section D5, Page 20
Exhibit 2B, Section D5, Page 38
Exhibit 2B / Section D5 / p. 69

Question (A):

a) Please explain from a risk perspective why Advance Metering Infrastructure (AMI) meters cannot be run to fail (i.e. replaced reactively) and provide the business case justifying asset retirement before failure.

RESPONSE (A):

Toronto Hydro anticipates that replacing AMI meters reactively by employing a run to fail approach would pose significant operational, customer and regulatory compliance risks and forestall the achievement of expected benefits from the installation of newer meters compared to mass meter replacement, as discussed below and in program evidence.[1]

Reactive meter replacement involves replacing individual meters after they have become defective (e.g. due to loss of communication or a blown fuse). Reactive replacement always involves a degree of billing accuracy risk, due to the lag between meter failure and the execution of replacement in the field. When meters fail, customer consumption data is lost on the failed meter, and depending on the number of failed meters at any one time requiring reactive replacement, customer consumption data may not be captured for extended periods of time. Where replacement is not or cannot be completed in a timely manner, it can result in delayed billing and/or the need to estimate

[1] Exhibit 2B, Section E5.4, subsection E5.4.3.3 “Failure Risk”, at p. 9-10.

customer consumption and demand, which in turn may adversely affect billing accuracy.[2]

The age of Toronto Hydro's metering assets exacerbates the risks discussed above, and the extensive number of first-generation meters in the system results in a high exposure risk should mass failure of a component begin to occur. As a larger subset of the meter population ages and approaches end of life ("EOL"), the probability of meter failures increases,[3] which further drives the need for reactive meter replacement. By 2025, approximately 70 percent of Toronto Hydro's residential and small commercial meters will have surpassed their EOL, increasing the likelihood of meter failures and hindering Toronto Hydro's ability to meet the OEB-prescribed billing accuracy target of 98%.[4] In this context, relying on reactive replacements to achieve AMI 2.0 would place significant constraints on Toronto Hydro's resources and reduce efficiencies compared to mitigating these risks through a large-scale deployment.

Toronto Hydro's AMI 2.0 initiative is also driven by metering technology obsolescence. As noted in the Metering program evidence, a significant portion of Toronto Hydro's residential and small commercial meters were installed between 2006 and 2008.[5] Due to rapid advancements in technology, these first-generation smart meters have become outdated and obsolete.[6] Meter manufacturers continuously update their product with new features, abilities, communication upgrades, and storage capacity improvements. In the past 18 years, Toronto Hydro has utilized Honeywell Elster as its AMI provider. During that period, meters have gone through five generations and two communication network upgrades. The key functionalities that Toronto Hydro plans to adopt through the AMI 2.0 initiative, as part of its Grid Modernization strategy, can only be realized with the installation of fifth generation meters in the utility's system. Obsolete meters will become

[2] Exhibit 2B, Section E6.7, subsection E6.7.3.2 "Reactive Capital", at p. 13.
[3] Exhibit 2B, Section E5.4. subsection E5.4.3.3 "Failure Risk", at p. 9-10.
[4] Exhibit 2B, Section E5.4, Table 2, at p. 2.
[5] *Supra* footnote 3.
[6] Exhibit 2B, Section E5.4, subsection E5.4.3.4 "Business Operations Efficiency & Reliability" at p. 10-13.

inhibitors to fully utilizing new features and capabilities, the benefits of which are listed in 2B-Staff-194. Therefore, replacing the entire fleet of meters is the optimal solution that leads to operational improvements and facilitates the integration of key Grid Modernization initiatives, including voltage monitoring, distributed energy resource integration, electric vehicle load forecasting, and more efficient outage detection and response.

QUESTION (B):

b) Please provide the asset age demographics (by age, asset count and asset condition) for residential and small commercial AMI meters currently in service.

RESPONSE (B):

Table 1: Residential & Small Commercial AMI Meter Asset Age Demographics

Meter Age *	Number of Residential and Small Commercial AMI meters
19	38
18	5,566
17	177,604
16	176,685
15	125,208
14	37,001
13	30,404
12	11,281
11	3,580
10	3,118
9	17,538
8	16,147
7	25,410
6	39,649
5	31,177
4	16,967
3	38,033
2	12,119
1	23,463
0	6,651

Table 1 - Note: * Data used from 2023 Year End

Toronto Hydro operates its meters on a pass or fail basis and does not use an asset health index band for this type of asset. Meters that are suitable for service have a working display, are able to accurately measure consumption, and have a working communication module. None of these functions can be partially working or have any other intermediate health status that can be measured.

QUESTION (C):

c) Based on useful life and actual failure data to date, what is the expected natural failure rate for AMI meters in each year of the planning period?

RESPONSE (C):

Please refer Table 7 on page 13 of Exhibit 2B, Section E6.7, subsection E6.7.3.2, which indicates the natural failure rate for all meters, including AMI meters.

QUESTION (D):

d) Please provide the planned retirement pacing (in dollars and number of units) by year for AMI meters as per the above plan to replace $248.1M worth of AMI meters during the planning period.

RESPONSE (D):

Toronto Hydro notes that the AMI 2.0 initiative will only cover residential and small commercial and industrial meter replacements, for which the 2025-2029 cost is estimated at $201.6 million of the $248.1 million Program cost, as indicated in Table 6 in Exhibit 2B, Section E5.4, at page 17.

For the number of meters to be replaced under the AMI 2.0 initiative, please refer to the below table:

Table 2: Number of Meters to be Replaced under AMI 2.0 Initiative

	2025	2026	2027	2028	2029	Total
Residential and Small C&I Meter Replacement	157,893	173,710	179,708	68,985	0	**580,296**

QUESTION (E):

e) What is the value of AMI 2.0 meters that are planned to be replaced in advance of their natural failure rate in each year of the planning period.

RESPONSE (E):

The table below shows the derecognition value of AMI meters that Toronto Hydro plans to replace in advance of their natural failure rate (before end of life) in each year of the 2025-2029 rate period over the course of the AMI 2.0 program.

Table 3: Derecognition Value of AMI Meters Planned for Replacement

$ (Millions)	2025	2026	2027	2028	2029
AMI Meter Derecognition Values	$3.33	$3.09	$2.89	$0.98	$0.00

QUESTION (F):

f) Please explain why AMI 2.0 needs to be done in advance of DER penetration increases rather than selectively around areas where DER penetration may cause voltage concerns.

RESPONSE (F):

To successfully enable key AMI 2.0 functionalities such as feeder voltage monitoring due to increasing DER penetration, Toronto Hydro must make wholesale changes to an area and convert the area onto the AMI 2.0 communication network. While newer AMI 2.0 meters are capable of communication on the existing network, older obsolete meters cannot communicate on the new network. If Toronto Hydro were to perform spot replacements of meters to enable a single use case, the utility would lose communication with all other meters in the area, resulting in significant impacts to customer billing and utility operations. In order to successfully transition to AMI 2.0 technology and associated functionalities, a critical mass of meters at a system level must be implemented to ensure successful billing. For further details on penetration requirements at a system level to achieve the benefits of AMI 2.0, please refer to Toronto Hydro’s response to 2B-Staff-194.

QUESTION (G):

g) What level of AMI 2.0 penetration is required on a feeder to provide adequate voltage violation and overloading monitoring?

   i. Why cannot a comparatively few AMI 2.0 meters scattered amongst existing AMI meters provide adequate feeder monitoring?

RESPONSE (G):

Please refer to the response to subpart (f).

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-145

Reference: Exhibit 2B, Section D3, Page 40

<u>Preamble:</u>

In section D3, Toronto Hydro notes that it "considers a broad range of risks that the corporation faces through the Enterprise Risk Management ("ERM") process. Toronto Hydro's ERM framework has been designed to manage risks at the corporate level and considers the risks facing individual asset classes and risks relevant to investment programs."

QUESTION (A):

a) Please provide the ERM risk results in tabular format for each of the past 5 years and yearly projections for the test period.

RESPONSE (A):

To clarify, the ERM process is a corporate risk framework, not an asset risk framework. It does not comprehensively deal with granular asset risks in a manner that lends itself to the tabulation of results. Rather, as discussed further in Exhibit 2B, Section D3 at page 41, lines 10-18, the ERM helps to identify and manage corporate risks that emerge from the asset base, such as non-energy mitigating cable chamber lids.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-146

Reference: Exhibit 2B, Section D3, Appendix B, Page 8

<u>Preamble:</u>

Regarding the asset health methodology of Toronto Hydro's wood pole assets.

QUESTION (A):

a) Please provide the basis for selecting a useful life of 45 years.

RESPONSE (A):

The useful life of 45 years was adopted on the basis of the mean useful life from a study conducted by Kinectrics for Toronto Hydro on asset useful lives. This was reviewed as part of the Depreciation Study completed by Concentric Inc., filed in Exhibit 2A, Tab 2, Schedule 1, Appendix D, and was maintained at 45 years. The value recommended from Concentric Inc. has been informed by review of Toronto Hydro's data, consultations with Toronto Hydro operational, engineering, and management staff and assessment of service lives utilized by peer Canadian electric distribution utilities.

QUESTION (B):

b) Please confirm that Normal Expected Lives as used in the Reference is the same as "useful life" as used by Toronto Hydro in this filing.
   i. If not confirmed, please explain the differences between Normal Expected Lives and useful life.

RESPONSE (B):

Confirmed.

QUESTION (C):

c) Please explain why Toronto Hydro has not re-calibrated the useful life (or Normal Expected Life) of wood poles despite evidence that the useful life (or Normal Expected Life) is too low, thus resulting in elevated health scores.

RESPONSE (C):

Toronto Hydro's useful life for wood poles was set on the basis described in response to part (a), and the utility believes this useful life is reasonable based on current information. The utility does not, at present, have a valid statistical basis on which to set the useful life differently, and from a governance and consistency perspective, is unwilling to make arbitrary changes to core modelling assumptions. Potential changes of this nature require thorough study, exploration and iteration by data analysts and engineers. Toronto Hydro, recognizing early-on the unique issues with the wood pole model, has implemented a number of changes to improve and temper the behaviour of the model. This is explained in detail in the referenced report. For further discussion regarding the behaviour of the wood pole model, please refer to 2B-Staff-226, part (b). For a discussion regarding the application of wood pole condition results in Toronto Hydro's 2025-2029 investment plan, refer to 2B-SEC-44. Finally, for a broader discussion regarding useful lives, please see response to 2B-Staff-131, part (a).

QUESTION (D):

d) What percentage of Wood Poles have health score collars applied to the final health score determination?
   i. Does this percentage imply a problem with the underlying health score formulation?
   ii. If no, at what percentage would a problem with the underlying health score formulation likely exist, and why?

RESPONSE (D):

As explained by EA Technology on page 9 of the referenced report:

> "Just over 2% of the asset population have health score values set through condition collars, mainly due to moderate pole separation (cracks and pole top feathering). This shows a considered approach to the setting of condition collars to identify assets with issues requiring intervention.
>
> The CNAIM methodology includes an additional (reliability) modifier to reflect any issues or observations that are not reflected in the observed and measured condition modifiers. THESL have used this methodology feature in the wood pole model and applied a collar of 7.25 to assets that have been confirmed to be in a poor condition by inspectors in the field. This is considered to be an appropriate use of the reliability modifier mechanism to directly impact asset health where information is available."

The purpose of collars in the methodology is to ensure that an asset's health score represents the correct level to reflect the condition when the Condition Input Factors are not strong enough to achieve the correct anticipated level of health score. While a high rate of collar applications would warrant further examination, there is no specific value at which the application rate would inherently represent a problem with the underlying health score formulation.[1]

[1] To illustrate this point: if 100 wood poles were condemned by a field inspector, but the condition methodology without a collar was assigning a score of less than 7.25 to 90 of those poles, then 90% of the 100 poles would require application of a collar to ensure a minimum health score of 7.25. This would be an appropriate result.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-147

Reference: Exhibit 2B, Section D3, Page 15

Preamble:

Toronto Hydro states, "Where appropriate, Toronto Hydro undertakes targeted refurbishments in the field to maximize the serviceable life of existing assets. For example, as mentioned above, the utility will rebuild a deteriorated vault roof, extending the useful life of the entire vault."

Has Toronto Hydro considered utilizing pole stubs to extend the life of wood poles that have ground line rot but are otherwise in good condition? If not, please explain why not. If yes, what were the results?

RESPONSE:

Toronto Hydro does not utilize pole stubs to extend the life of wood poles as the additional costs or risks associated with this approach outweigh any possible benefits from cost savings. These include:

1. Due to the nature of the environmental loading (as per CSA C22.3 No1-20: Overhead Systems) acting on overhead pole lines, and the physical properties of hydro poles, the maximum stress on the pole occurs close to the groundline of the pole. A location-specific customized structural design would be required for each location depending on the type of pole stubbing method selected, and the overhead framing configuration on the pole.
2. Primary, secondary, and communication risers would not be able to be maintained on these poles due to the mechanical means by which pole stubbing is installed.
3. Climbing access needs to be maintained on poles and access would be limited by pole stubbing installations.
4. Industry standard pole loading software is not capable of modelling these kinds of reinforcement methods.

5. Poles are considered a piece of major distribution equipment as defined by Electrical Safety Authority ("ESA") in their "Technical Guideline for Section 6. Approval of electrical equipment". A pole with rot identified near the ground line of the pole may indicate that there is also deterioration of the pole beneath the ground line resulting in a poorly performing pole foundation.
6. Pole stubbing may not be compatible with foundation requirements for the type of existing pole foundation: direct buried, direct buried with concrete reinforcing, poor soil, sloped terrain, proximity to foundations or retaining walls, reinforced sidewalk bays, or legacy foundation installations.
7. In relation to hydro poles, the *Accessibility for Ontarians with Disabilities Act, 2005*[1] ("AODA") requires minimum distances to be maintained around poles in areas accessible by members of the public. Pole stubbing activities would require additional footprint around existing pole locations, and this may not be possible for existing pole locations due to space restrictions.

[1] *Accessibility for Ontarians with Disabilities Act*, 2005, S.O. 2005, c. 11.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-148

Reference: Exhibit 2B, Section D3, page. 45

<u>Preamble:</u>

Toronto Hydro uses peak demand forecasting to identify capacity constraints at substations and undertake planning to accommodate the forecasted growth.

QUESTION (A):

a) Please provide a table listing all Toronto Hydro's stations and show the forecast capacity constraints in each station for each of the next 20 years for the summer and winter peaks.

RESPONSE (A):

Please see the Excel file attached as an appendix to this IR showing the stations with forecasted capacity constraints in the next 20 years in Summer and Winter.

QUESTION (B):

b) Please provide a table of the restricted feeders and the substations they are located within, and the capacity deficit for each restricted feeder for each of the next 20 years.

RESPONSE (B):

Compared to stations buses, feeder loading is much more dynamic in nature, as load can swing from feeder to feeder frequently due to various capital and customer work, customer supply schemes and contingency situations from both planned and unplanned work. To ensure that customers can connect to the grid in a timely and efficient manner, Toronto Hydro proactively manages feeder capacity constraints through the Load Demand program. As defined in Exhibit 2B, Section E5.3, feeders that are identified as highly loaded based on standard planning practices are considered for relief. Feeders are not considered restricted from accepting load, as required expansion or enhancement work will be conducted to accommodate any customer load. Due to the dynamic nature of managing capacity constraints at the feeder level, the process of identifying feeder load level transfers and other investments to address restricted feeder capacity is a continuous one and Toronto Hydro does not forecast capacity deficits for feeders in the manner requested (i.e. over a 20-year period). With this context in mind, Exhibit 2B Section E5.3 pages 14-15 identifies the current plan for relief of highly loaded feeders in both the Horseshoe and Downtown systems.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-149

Reference: Exhibit 2B, Section D3, Page 45

<u>Preamble:</u>

Toronto Hydro considered three new specific drivers in the development of the System Peak Demand Forecast: (i) hyperscale data centres, (ii) electrification of transportation, and (iii) Municipal Energy Plans.

QUESTION (A):

a) Please provide an overview and justification for why these three specific drivers were considered.

RESPONSE (A):

The noted drivers were selected as the most impactful and discrete near and medium-term growth drivers that the utility must consider in identifying the minimum investments necessary in the 2025-2029 rate period to ensure that the system is ready and able to serve customers in the next decade. These needs are specifically:

i. Data Centers are large point loads that frequently can result station overloading.
ii. Electrification of Transportation is expected significant to impact system-wide load growth, especially transit corridors.
iii. Municipal Energy Plans: Toronto Hydro must prepare the distribution system for the City's plans. Large loads reported by City or City Consultants, require capacity planning.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-150

References: Exhibit 2B, Section D3, Page. 53

<u>Preamble:</u>

Toronto Hydro indicated that "The various risk analyses presented in Section D3.2 and Section D3.3 drive the overall investment required to manage the distribution system."

QUESTION:

a) Please provide a table showing the pre-investment and post-investment risks and the costs of mitigation for each of the risk analyses presented in section D3.2 and D3.3.

RESPONSE:

- **Quantified Risk-based Analysis:** As detailed in D3.2.1.3, Toronto Hydro is currently in the process of developing and implementing a custom value framework as part of its Engineering Asset Investment Planning ("EAIP") system, which will allow the utility to establish quantified value (inclusive of risk mitigation benefits) associated with asset failure. For details regarding the progress and completion expectations for the EAIP tool, please see 2B-AMPCO-20.
- **Reliability Projections:** Exhibit 1B, Tab 3, Schedule 1, Pages 8 to 21 provide both the current and forecasted reliability performance for Outage Duration and Outage Frequency (with comparisons to an "IRM"-level of funding), along with key programs within the expenditure plan that contribute to these measures.[1] For long-term planning, reliability projections are useful in understanding the risk that reliability performance could deteriorate under different investment scenarios.

[1] Note that these reliability projections have been updated in response to 2B-SEC-42, part (c).

- **Worst Performing Feeder:** Worst Performing Feeder measures (e.g., FESI) are highly volatile measures of granular, feeder-level performance and cannot be forecasted with current modelling capabilities. Worst Performing Feeder measures are leveraged to monitor the ongoing performance of the system and identify problem areas at risk of especially poor reliability performance.
- **Enterprise Risk Management:** Enterprise Risk Management is an embedded, qualitative aspect of business planning and the Investment Planning & Portfolio Reporting process. Please see response to 2B-Staff-145 regarding the interplay between the corporate ERM and the Asset Management System. Where applicable, for each asset management-related risk monitored within the ERM system (e.g., PCBs, box construction), Toronto Hydro has developed a 2025-2029 investment plan that is calibrated to prevent risk from escalating beyond acceptable tolerances.
- **Priority Deficiencies:** As discussed in Exhibit 2B, Section E3.2, Toronto Hydro applies a prioritization framework to identify urgent repairs and corrective actions. The utility does not forecast priority deficiencies by risk category as part of long-term investment planning. Underlying trends in priority deficiencies are considered when developing long-term expenditure plan levels in programs, including Reactive Capital (Exhibit 2B, Section 6.7) and Corrective Maintenance (Exhibit 4, Tab 2, Schedule 4).
- **Legacy Assets:** Please see Toronto Hydro's response of 2B-AMPCO-26 for a comparison of forecasted 2024 and 2029 results for key legacy assets. The reduction of legacy assets is driven by capital program investments within the System Renewal category.
- **Generation and Load Capacity Risk Assessments:** Please refer to Toronto Hydro's detailed evidence provided in Exhibit 2B, Sections D4, E3, E5.3, E5.5, and E7.4 for detailed discussions regarding the utility's peak demand and distributed generation forecasts, the risks associated with these increases in demand, and the expected impact that the planned investments will have on mitigating these risks.

Please see Toronto Hydro's response to 2B-SEC-44 for a comprehensive discussion on how asset health, performance, criticality, executability, and other asset management considerations together inform the pacing of Toronto Hydro's renewal investments in the 2025-2029 Distribution System Plan.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-151

References: Exhibit 2B, Section D3, Appendix A

QUESTION (A):

a) Why is a minimum H of 4 the appropriate choice for calculating Probability of Failure (PoF).

RESPONSE (A):

Toronto Hydro referred to Ofgem's CNAIM framework in implementing its own Condition Based Risk Management framework ("CBRM") in 2017. Inherent to the methodology, assets with a health score of 0.5 are in new or like new condition, while a health score of 5.5 represents the point at which the first significant signs of deterioration would be expected. By setting a minimum asset health score ("H") of 4 in the calculation of probability of failure ("PoF"), the same PoF is given to all assets before reaching the point where significant signs of deterioration are expected.

QUESTION (B):

b) Does setting a minimum H score constrain PoF so that it is not suitably close to 0 for assets in the best condition?

RESPONSE (B):

Setting a minimum H score in the PoF calculation is a provision for constant PoF for the lowest health scores. The PoF associated with H scores less than this limit relate to installation issues or random events instead of condition and are calibrated using asset failure data (i.e., through constants k, c in the formular). The minimum H score is a transition from constant PoF to a controlled exponential relationship.

QUESTION (C):

c) For wood poles and power transformers asset classes, please provide a table showing the range of PoF for each health score and health index.

RESPONSE (C):

Please see Table 1 below.

Table 1: Wood Pole and Power Transformer PoF Ranges

HI Band	Lower Limit of Health Score	Upper Limit of Health Score	PoF Range – Wood Poles	PoF Range – Station Power Transformers
HI1	≥ 0.5	< 4	0.03%	2.73%
HI2	≥ 4	< 5.5	0.03% to 0.07%	2.73% to 5.53%
HI3	≥ 5.5	< 6.5	0.07% to 0.10%	5.79% to 8.45%
HI4	≥ 6.5	< 8	0.11% to 0.17%	8.79% to 14.55%
HI5	≥ 8	≤ 10	0.18% to 0.33%	15.04% to 27.28%

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-152

Reference: Exhibit 2B, Section D3, Appendix A

Preamble:

In Table 2, Health Index bands and definitions, Toronto Hydro sets ranges for each HI band.

QUESTION (A):

a) Please explain how the health score ranges are mapped onto the different health indices.

RESPONSE (A):

Health Score ranges are mapped onto the different health indices as a way of representing the key stages of an asset's lifecycle. Toronto Hydro adapted Ofgem's Common Network Asset Indices Methodology ("CNAIM") approach in implementing its Condition Based Risk Management framework ("CBRM") in 2017. The following mapping is inherent to the methodology:

- An asset with a health score of 0.5 has new or like new condition. A health score that is less than 4.0 has the same Probability of Failure ("PoF") as an asset that is new.
- Assets with a health score of 4.0 will begin to have a PoF related to its health score. A health score of 5.5 represents the point at which first significant signs of deterioration would be expected. This is where the PoF of the asset is approximately double that of a new asset.
- A health score of 10 represents the worst current condition of an asset, where the PoF is 10 times that of a new asset. A health score of 15 represents the worst future condition of an asset.

Figure 1 below, taken from CNAIM, illustrates where the health index bands lie on a typical asset health / PoF curve.

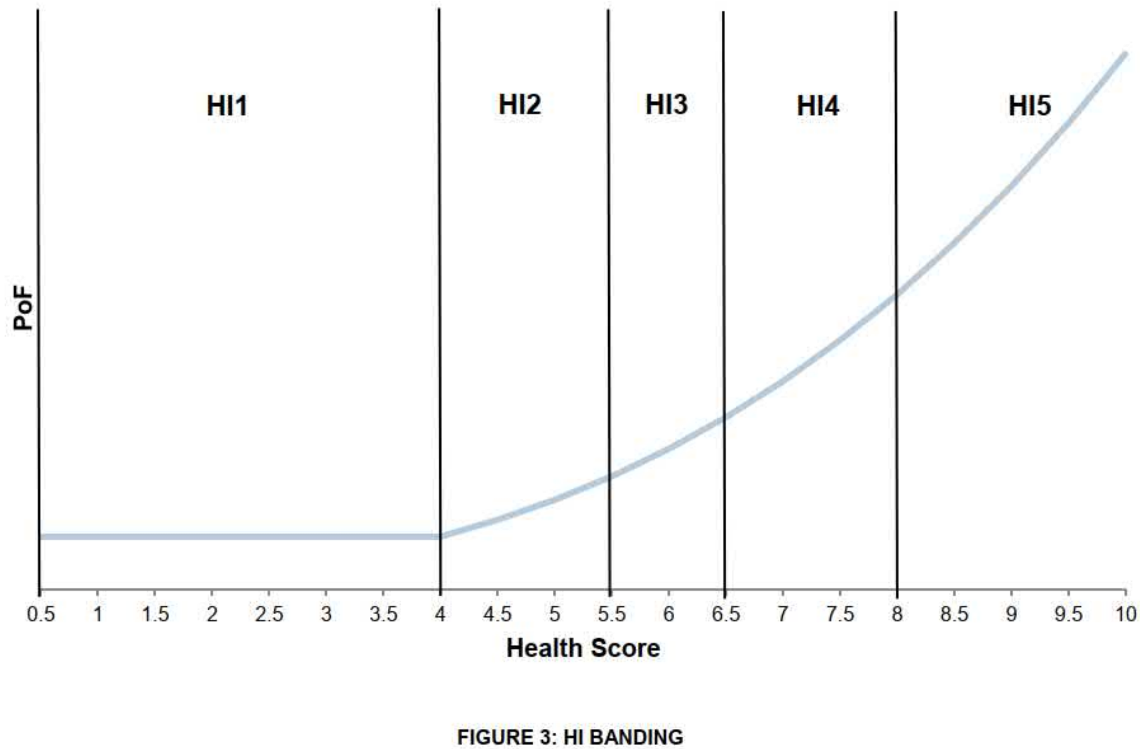


Figure 1: Mapping of Health Index Bands to Probability of Failure/Health Score[1]

QUESTION (B):

b) Please explain why the future forecast range of health scores is different (upper limit of 15) than the current range for those assets (upper limit of 10).

RESPONSE (B):

The cap on the future health score is extended to 15 in order to provide room for assets that are currently in poor condition to continue deteriorating in the future health score model. If this extension was not provided, assets would cluster around the maximum score of 10, which would

[1] https://www.ofgem.gov.uk/sites/default/files/docs/2021/04/dno_common_network_asset_indices_methodology_v2.1_final_01-04-2021.pdf, page 29, Figures 3

reduce the ability to differentiate between assets that are projected to be in relatively better or worse condition in the future.

QUESTION (C):

c) Why can't assets with a health score greater than 10 be in service today?

RESPONSE (C):

Please see response to part (b). Toronto Hydro's CBRM methodology is based on the CNAIM Framework. The CNAIM Framework adopts a standardized 0 to 10 scale for the current health score. As such, the calculated current health score cannot go beyond 10.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-153

References: **Exhibit 2B, Section D4, p. 2**
Exhibit 2B, Section D4, Appendix B, p. 2
NOTE: The report did not provide page numbers so OEB staff is unsure what constitutes Page 1 of Appendix B.
Exhibit 2B, Section D2, p. 6

Preamble:

Toronto Hydro is planning expenditures on the basis of being a summer peaking utility when its studies indicate that it is moving towards becoming a winter peaking utility in the 2030s.

QUESTION (A) AND (B):

a) Please explain why using the Summer Peak to drive the investment in long lived (multi-decade) assets is the prudent choice when the FES clearly indicates in all cases that Toronto Hydro is a Winter Peaking utility in the 2030s and beyond.

b) Please explain how Toronto Hydro's plans can be optimal if it is using a summer peak for planning purposes when it is becoming a winter peaking utility.

   i. Is Toronto Hydro only planning investments for the 2025-2029 period, and how does this summer peaking planning strategy reconcile with the "least regrets" strategy it purports to use?

   ii. How was the shift from summer to winter peaking accounted for in long-term regional planning with the IESO given that those forecasts are for 20 years?

RESPONSE (A) AND (B):

Please see Exhibit 2B, Section D4 at pages 8-12. Unlike the 10-year System Peak Demand forecast that Toronto Hydro has relied upon to prepare the investment plan in this application, the outputs of the Future Energy Scenario (FES) model do not predict what is likely to occur in the future.

Rather, the FES provide insight into future possible pathways of decarbonization, and were used to evaluate the System Peak Demand forecast and resulting capacity investments from a "least regrets" perspective. To that end, although the FES model suggests that Toronto Hydro will be a winter peaking utility the 2030s, Toronto Hydro expects to remain a summer peaking utility in the 2025-2029 rate period. This is because the 10-year System Peak Demand forecast, which underpins this rate application does not include the impact of wide-scale building electrification, as the policy and consumer-behaviour drivers of this type of demand remain uncertain.

To stress test the System Peak Demand forecast against the least regrets planning philosophy, Toronto Hydro assessed whether the utility could accommodate a growing winter peak (driven by building electrification) in the 2025-2029 rate period, if needed. To that end, the utility looked at scenarios of forecasted building heating loads derived from the FES outputs, and concluded that the capacity investment plan can meet higher levels of building heating loads (which contribute to winter peak) should this driver of electrification materialize at a faster pace than expected in the 2025-2029 rate period. This analysis gave Toronto Hydro confidence that the investments in system capacity that the utility proposes to make in the 2025-2029 rate period are least regrets to address growth and electrification drivers that the utility faces in this decade and the early part of the next decade. That being said, it is possible that the utility could be faced with incremental capacity constraints at a localized level as a result of accelerated transportation and building electrification demand in the next rate period. To address this challenge, the utility proposes a Demand Related Variance Account (DRVA) to track variances in actual versus forecasted expenditures in a number of demand-related investment programs. For more information about this proposal please refer to Exhibit 1B, Tab 2, Schedule 1 at pages 35-47.

The long-term regional planning process is underway and expected to wrap-up in the summer of 2024.[1] As part of this process, the IESO is considering the impact of electrification on both summer and winter forecasts over the longer-term outlook of 20 years. To consider the longer-term winter

[1] https://www.ieso.ca/Get-Involved/Regional-Planning

peak impact of electrification, Toronto Hydro layered heating load to its base 10-year System Peak Forecast to derive a long-term 20-year scenario.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-154

Reference: Exhibit 2B, Section D4, Pages 10-18

Preamble:

Toronto Hydro discusses the primary drivers of capacity needs and related investments over the 2025-2029 rate period, including customer connections, electrification of transit, electric vehicles, hyperscale data centres and Municipal Energy Plans and has shown the anticipated impact of these drivers relative to base load. Specific areas of Toronto Hydro's service territory are highlighted where significant load growth is expected, including: Port Lands, East Harbour, Horseshoe East (including the Golden Mile) and Horseshoe West (including Downsview).

QUESTION (A):

a) Please identify how Toronto Hydro adopted the direction from the OEB's January 2023 Framework for Energy Innovation both in how it investigated the use of third party owned DERs to meet planning needs as well as meaningfully investigated a market-driven solution before building/owning the solution themselves.

RESPONSE (A):

Toronto Hydro has been actively pursuing and deploying non-wires solutions since 2018 (at Cecil TS) and continues to build on this experience with the Etobicoke project in the Manby/Horner area of its grid. For the 2025-2029 rate period Toronto Hydro set an ambitious target to triple the amount of flexible system capacity to be procured from market-based providers. Procuring this capacity could help avoid about 25 percent of the total load required to be transferred in the targeted station areas. The history of this work, as well as the future plans are outlined in detail in the evidence at Exhibit 2B Section E7.2. For additional information about Toronto Hydro's 30 MW non-wires system capacity please see the response to 1B-Staff-88.

QUESTION (B):

b) Please explain in detail how Toronto Hydro is responding to the policy direction outlined in the OEB's Framework for Energy Innovation?

RESPONSE (B):

As noted in the response to part (a), Toronto Hydro has developed a plan to procure and leverage services from DERs with an ambitious target of 30 MW. In addition, Toronto Hydro has also put forward: (i) a Benefit Cost Analysis and an incentive proposal (as outlined Exhibit 1B, Tab 3, Schedule 1) that aligns with the OEB's policy direction; and (ii) an Innovation Fund proposal to explore more nascent areas of DER integration, enabling further development of capabilities in the area of DER integration. For more information on how innovation has shaped the 2025-2029 rate application, including integrating policy directives from the FEI report, please see Exhibit 1B, Tab 4, Schedules 1 and 2.

QUESTION (C):

c) Please list all non-wires solutions Toronto Hydro has considered for the areas identified to see significant load growth over the near and medium term, including grid modernization, geo-targeted conservation and demand management programs and discuss the decision factors for each, including benefit-cost analysis for various options to address these areas with non-wires solutions.

RESPONSE (C):

Please see the responses above. Toronto Hydro's use of non-wires solutions focuses on practical applications where i) capital avoidance or deferral opportunities can be identified and measured, and ii) non-wires solutions can be deployed with confidence that critical customer outcomes (i.e., reliability and cost-effectiveness) can be maintained.

To be able to leverage other types of DERs, particularly non-dispatchable resources, as part of distribution planning and system management, it is essential to have well-developed tools for grid observability and for DER monitoring and forecasting. Toronto Hydro is making significant efforts to improve grid observability, control and automation through *Intelligent Grid* and *Grid Readiness* initiatives, several of which could significantly improve monitoring capabilities for DERs (discussed in detail in Exhibit 2B, Section **Error! Reference source not found.** and D5.2.2).

QUESTION (D):

d) Please discuss and provide any analysis conducted of how expanded EV charging, predominantly during off-peak hours, could potentially lower costs for utility customers due to greater utilization and revenues from existing distribution system assets.

RESPONSE (D):

As noted in Exhibit 2B, Section D5.2.2.5, Toronto Hydro partnered with Plug'n Drive and Elocity Technologies to trial an EV Smart Charging Pilot aimed at understanding EV charging patterns and behaviours in Toronto and gathering information to assist in the development of future EV programs. Benefits of this pilot include supporting the development of additional tools for EV owners to monitor, schedule, and control their charging sessions, and collecting data and insights to understand impacts of EV charging on the distribution grid.

Third party aggregators what have developed controllability are free to participate in the LDR programs. Toronto Hydro is agnostic to the technology used to bid capacity into the program. Further details can be found in Exhibit 2B, Section 7.2.

QUESTION (E):

e) Please discuss and provide any analysis conducted that indicates when various aspects of Toronto Hydro's system would require capital upgrades to support various EV and DER adoption levels.

RESPONSE (E):

Toronto Hydro's System Peak Demand forecast in Exhibit 2B, Section D4 and the Customer and Generation Connections forecasts presented in Exhibit 2B, Section E5.1 consider growth, electrification and DER adoption rates that also underpin investment needs in the following capital expenditure programs: Load Demand, Stations Expansion, GMPC, Connections and Renewable Enabling Energy Storage Systems.

Toronto Hydro has conducted area-specific analyses in select neighborhoods to evaluate the impact of increased number of residential service upgrades on the local distribution system. This assessment aimed at visualizing and understanding the impact of these upgrades on the system, and to identify necessary alternatives. The conclusion drawn from these analyses to date is that Toronto Hydro will likely not need to do a complete overhaul of its distribution system to accommodate these connections. Rather, it is necessary to make investments to improve grid observability in order to monitor the loading conditions on primary and secondary system assets, helping to inform decision making (please see Intelligent Grid, Exhibit 2B, D5.2.1, p. 10-12 for details). Examples of such decisions include, but are not limited to, installation of upgraded or additional transformers, upsizing of buses and transferring loads among nearby feeders, busses or stations.

While Toronto Hydro's capacity plan ensures that the distribution system is adequately sized, external factors such as government incentives or market evolution could further accelerate customer adoption of electric vehicles or other fuel switching technologies. To that end, Toronto Hydro proposes a flexibility mechanism (known as a variance account) to reconcile differences between forecasted and actual demand-driven costs and revenues.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-155

Reference: Exhibit 2B, Section D4, p. 11

Preamble**:**

With regards to "Figure 4: Toronto Hydro System Peak Demand Forecast by Driver".

QUESTION(A):

a) Does Toronto Hydro consider DERs a negative peak demand or a source of capacity supply?

RESPONSE (A):

Toronto Hydro's System Peak Demand Forecast is a gross forecast. As a result, Figure 4 only displays drivers of load growth.

QUESTION (B):

b) Are DERs considered a negative energy load or a source of energy generation?

RESPONSE (B):

DERs are not considered negative energy load or energy generation as far as the peak demand forecast is concerned.

QUESTION (C):

c) Please restate Figure 4 from Reference 1 and provide tabular data so that System Peak Demand Forecast by Driver is stated in MW.

   i. If applicable, update Figure 4 to show DERs separately.

RESPONSE (C):

Toronto Hydro produces its System Peak Demand Forecast in apparent power, MVA. Please see the response provided to interrogatory 2B-SEC-46 part (b) for the requested tabular data in MVA. Regarding DERs, please see the response provided to part (a) above.

QUESTION (D):

d) Please provide a new figure and provide tabular data that shows System Energy by Driver in GWh or MWh, and as applicable show DERs separately.

RESPONSE (D):

Toronto Hydro is unable to provide the requested information as the utility's Peak Demand Forecast does not reflect a forecast of Energy Delivery (i.e. is not forecast using GWh or MWh). Please refer to the response provided to part b) above with respect to DER.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-156

References: **Exhibit 2B, Section D4, Appendix A**
Exhibit 2B, Section D4, Appendix B

<u>Preamble:</u>

Toronto Hydro has explained the "Future Energy Scenarios tool" and provided an appendix with an explanation of its outputs and a detailed report from the consultant that performed the study.

QUESTION (A):

a) Please confirm that the Future Energy Scenarios tool is not an internal tool, and more akin to a service purchased from a consultant. Please elaborate.

RESPONSE (A):

As noted in Exhibit 2B, Section D4, Appendix A, Section 1.3 (page 3), Toronto Hydro engaged a leading UK consultant, Element Energy, to develop the Future Energy Scenarios modelling tool. This model is now available as a software tool for internal business users at Toronto Hydro.

QUESTION (B):

b) Please provide the "Business Case" or similar document produced by the business unit that "uses" the Future Energy Scenarios tool to justify its acquisition or development. Please provide any other documentation used by or presented to Toronto Hydro decision makers to release the funding to acquire / develop the tool.

RESPONSE (B):

In the development of the Climate Action Plan in 2021-22, Toronto Hydro leaders engaged in numerous conversations about the energy transition. Through these conversions, a need was identified for greater strategic insight into the wide range of potential peak demand scenarios associated with various external perspectives on the likely future of the energy system. This need was investigated by looking at tools and best practices from other jurisdictions, including the work undertaken by Element Energy in the UK. A decision to procure a third-party service to develop this capability was made late in 2021 (background presentation setting out the context, purpose and target benefits attached as Appendix A), following which Toronto Hydro undertook a competitive process to procure the services. Element Energy was the successful vendor of that process, and the scope of work (attached as Appendix B) initiated the work with Element on this project.

QUESTION (C):

c) Please provide a brief summary of the benefits and costs for this tool, as portrayed to Toronto Hydro decision makers at the time of deciding to pursue this tool. Please reference the material from part b).

RESPONSE (C):

A brief summary of the expected benefits can be found in Appendix A to the response to part (b). The estimated cost was $990,000 for the model development and implementation project, plus annual maintenance costs of $36,000 per year for three years. The final cost of development and implementation was $1.29 million. Project variances were due to greater than anticipated stakeholder engagement efforts in the design of the scenario worlds and unforeseen challenges with model configuration.

Future Energy Scenarios - Proposal

26 July 2021

Context

- Ontario's energy system is set to undergo a revolution as it becomes increasingly decarbonized, decentralized, and digitized

- These changes are driven by national, provincial and municipal 2050 Net Zero targets, specifically focusing on the electrification of transport and heating, as well as increasing the penetration of renewable distributed generation

- Toronto Hydro and its distribution system will play a central role in enabling the achievement of 2050 Net Zero targets

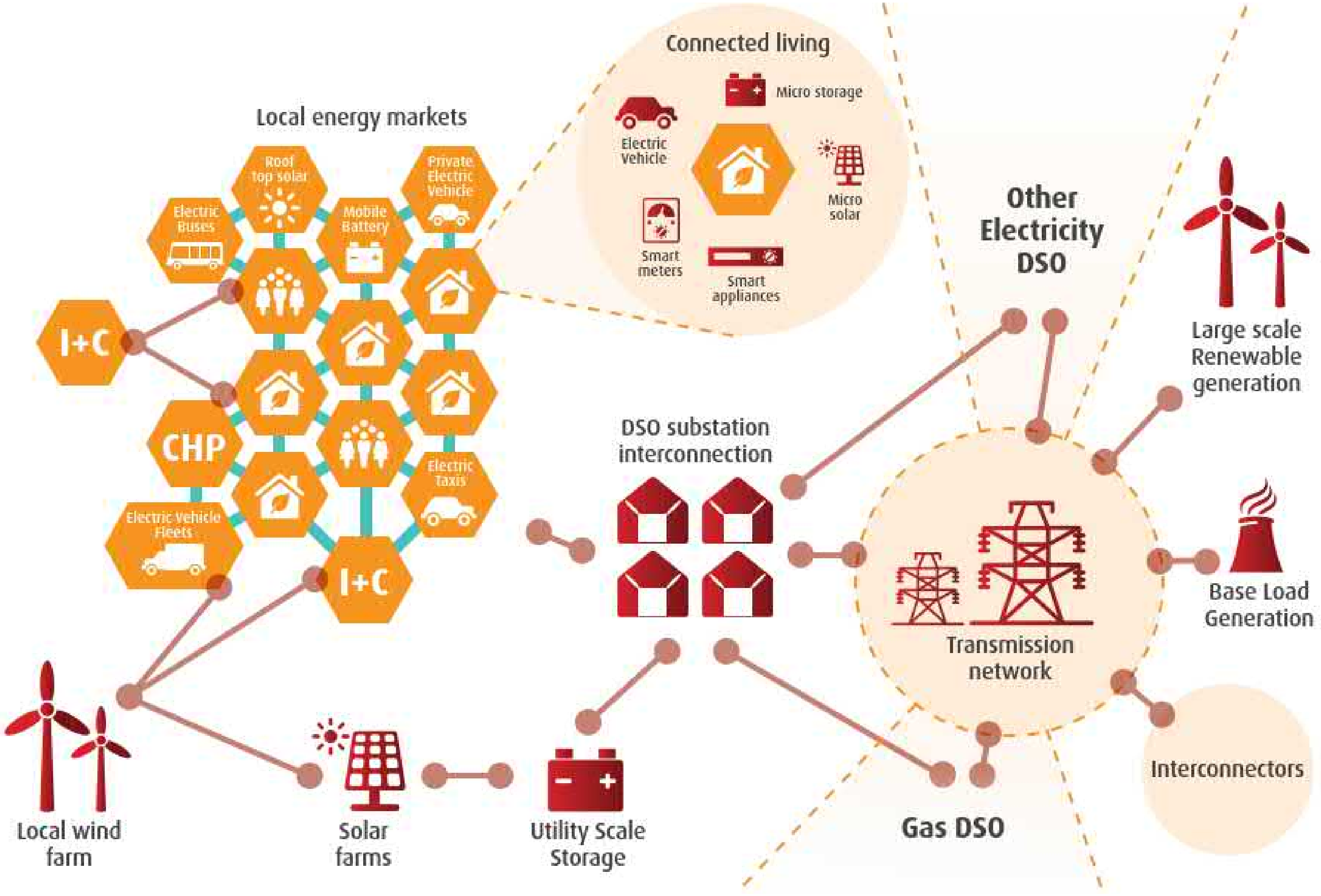
- In this context, long-term, scenarios-based forecasting will play an increasingly significant role in planning, including the development and justification of plans within regional resource and infrastructure planning and regulatory processes.

Future of the energy system (2030? 2050?)

Decarbonization
- Electrification of Heat and Transport
- Increased Distributed Renewable Generation
- Micro generation and storage
- Grid Scale Storage

Digitalization
- Grid IT/OT
- Smart Homes
- Virtual Power Plants
- Flexible Connections

Decentralization
- Microgrids
- Local Energy Markets
- Community Energy



Source: UK Power Networks, Future Smart Consultation Report

Purpose of the Future Energy Scenarios Study

- To provide Toronto Hydro and its stakeholders with an in-depth understanding of the way in which local electricity demand, consumption, and generation (including distributed resources) will change in the future, in order to:
  i. plan efficient and timely network capacity investments (including NWAs);
  ii. develop a grid modernization plan to enable and optimize increasing levels of DERs, EVs, NWAs, etc.;
  iii. develop a common strategic outlook to support different forecasting needs across the company, including load forecasting and revenue forecasting.

- Despite national, provincial and municipal clarity on achieving Net Zero by 2050, there is still significant uncertainty on how this ambitious goal will be achieved.

- Furthermore, the uptake of DERs such as EVs will likely cluster in certain geographic locations, and it is vital to capture these locations and better understand constraints.

- A Future Energy Scenarios study will capture this future uncertainty, as best as possible, and increase the robustness of Toronto Hydro's investment strategy

Target Benefits

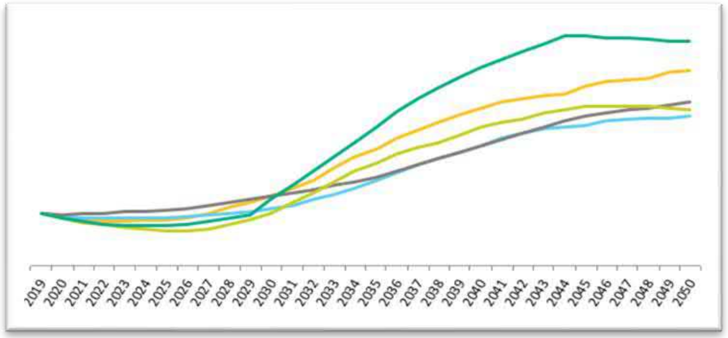
Creating a single Future Energy Scenarios report that models demand, consumption, and generation (including DERs) from today to 2050 as it pertains to Toronto Hydro's service territory will allows us to:

- Demonstrate reasonable and efficient investment plans in the 2025-2029 Rate Application
- Enable better decision making and strategic planning for both capacity-driven investment and other grid modernization investments
- Develop a Toronto Hydro position on the 2050 energy system, consistent across various business units, including revenue and connections forecasting
- Inform decisions on R&D projects and support effective implementation of the UoF strategy
- Enhance customer and stakeholder engagement activities

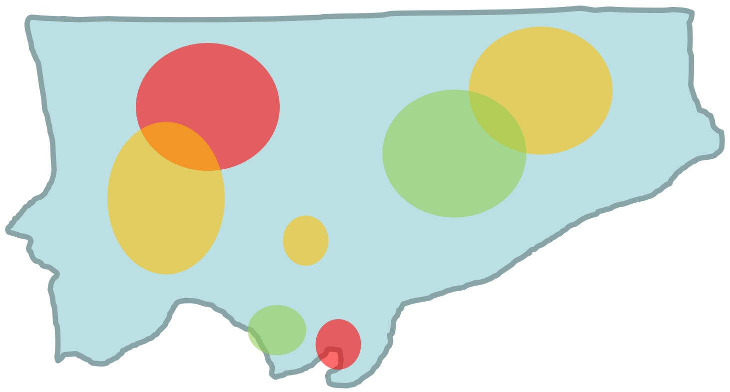
Scope

1. 2050 Demand & Generation Scenarios

- Domestic housing stock
- Industrial and commercial floorspace
- Distributed generation (BTM and FTM)
- Electric Vehicles
- Decarbonized heating (heat pumps)
- Battery storage
- Energy efficiency measures (CDM)
- Demand side response (flexibility)



2. Geospatial Disaggregation



Disaggregate network level forecasts down to an appropriate geospatial resolution to enable investment planning activities

3. Integrate into Business Processes

Strategic Investment Planning:

- Inform capacity driven investment planning programs; “least regret investment”
- Inform intelligent grid projects and strategic targeting of enhanced monitoring and control
- Align with regional planning process

Stakeholder Engagement & CIR Filing 2025-2029:

- Inform stakeholder engagement activities with customers; *bring them along on the journey*
- Solidify a Toronto Hydro position on a plausible future energy system
- Drive discussion on role of LDCs in the future energy system with OEB and policy makers

Agreement for Professional Consulting Services

THIS AGREEMENT is made this 7th day of February, 2022,

BETWEEN:

Toronto Hydro-Electric System Limited,

a corporation incorporated under the laws of Ontario

(hereinafter called "Toronto Hydro")

and

Element Energy Limited,

a limited company incorporated under the laws of England and Wales

(hereinafter called the "Consultant")

WHEREAS:

A. Toronto Hydro has retained the Consultant to provide certain consulting services as detailed in SCHEDULE A (collectively, the "Services");

B. The Consultant has indicated to Toronto Hydro that it has the skill and expertise to provide the Services on the terms and conditions set forth herein;

C. The Consultant has agreed to provide the Services to Toronto Hydro and Toronto Hydro has agreed to purchase the Services, upon the terms and conditions as set forth below; and

D. this Agreement is issued in connection with RFP # 21P-0905 October 6, 2021 (the "RFP"), including any schedules, attachments, amendments, supplements or addenda thereto and the Consultant's submission in response thereto dated October 10, 2021 (the "Proposal").

NOW THEREFORE, in consideration of the mutual covenants set forth herein and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the parties agree as follows:

1. INTERPRETATION

Unless otherwise indicated, all capitalized terms in this Agreement shall be as defined in SCHEDULE B and any reference to currency in this Agreement shall refer to lawful money of Canada.

2. RELATIONSHIP OF THE PARTIES

2.1 Retainer

Toronto Hydro hereby retains the Consultant to provide the Services, and the Consultant hereby agrees to provide the Services, during the Term, in accordance with the terms and conditions of this Agreement.

2.2 Independent Contractors

(a) Notwithstanding any provision hereof, this Agreement does not constitute and shall not be construed as constituting a partnership, joint venture, principal/agency relationship, or employer/employee relationship between the parties. The Consultant and Toronto Hydro shall at all times remain independent contractors of each other, and neither party shall represent itself to be an agent or employee of the other.

(b) Without limiting the generality of paragraph 2.2(a), the Consultant hereby acknowledges and agrees that neither it nor its Representatives shall be eligible or entitled, by reason of this Agreement, to participate in any employee-related program offered by Toronto Hydro or any of its Affiliates, including, without limitation, any benefit, insurance, compensation, health plan, bonus or retirement program.

(c) The Consultant hereby covenants and agrees to indemnify and save harmless Toronto Hydro and its Representatives from and against all costs, liabilities or claims whatsoever against Toronto Hydro or its Representatives resulting from or relating to the Consultant or its Representatives being deemed to be an employee of Toronto Hydro or any of its Affiliates.

2.3 Conflicts of Interest

The Parties acknowledge that there is potential for a conflict of interest based on services provided by the Consultant from time to time to Toronto Hydro. The Consultant agrees to take all reasonable steps to remove, mitigate or minimize such conflict of interest.

3. TERM

3.1 Term

Unless otherwise terminated in accordance with the provisions hereof, this Agreement shall be for a term of one (1) year, commencing on February 7, 2022 and terminating on February 6, 2023 (the “Initial Term”).

3.2 Toronto Hydro may, at its sole option, upon written notice to the Consultant, at least sixty (60) days before the end of the Initial Term, elect to renew this Agreement for three (3) additional one (1) year terms (each a "Renewal Term"). The same terms and conditions contained herein shall apply during the Renewal Term, save and except as amended in writing by the parties.

3.3 The Initial Term and the Renewal Term, if any, shall hereinafter together be referred to as the "Term".

4. SERVICE REQUIREMENTS

4.1 Services

During the Term, the Consultant shall perform the Services as detailed in SCHEDULE A hereto.

4.2 Applicable Laws

(a) The Consultant shall, at its sole expense, obtain and maintain during the Term of this Agreement, all permits, licences and approvals required by all Applicable Laws to perform its obligations under this Agreement. The terms and conditions of this Agreement shall be carried out in strict compliance with all Applicable Laws and in the event of any conflict between any Applicable Laws, the Applicable Laws with the most stringent standard shall apply.

(b) Without limiting the generality of the foregoing, and to the extent applicable to the Consultant, the Consultant shall comply with the *Municipal Freedom of Information and Protection of Privacy Act* (Ontario) ("MFIPPA"), the *Personal Information Protection and Electronic Documents Act* (Canada) ("PIPEDA"), the Information Protection and Privacy Contract Requirements set out in SCHEDULE C of this Agreement, and any other applicable privacy legislation (collectively, "Privacy Laws") with respect to any personal information collected, used or disclosed in connection with this Agreement and shall indemnify and hold harmless Toronto Hydro and its Representatives from and against any and all claims, demands, suits, losses, damages, causes of action, fines or judgments (including related expenses and legal costs) they may incur related to or arising out of any non-compliance therewith.

(c) Without limiting the generality of Subsection 4.2(b) above, the Consultant shall comply with the Information Protection and Protection of Privacy Contract Requirements attached as SCHEDULE C hereto.

(d) Where any Deliverable is subject to the approval or review of any authority, department, government or agency other than Toronto Hydro, such applications for approval or review shall, unless otherwise authorized by Toronto Hydro in writing, and where it is agreed in writing that these shall be prepared by the Consultant, be approved and submitted by and through the offices of Toronto Hydro, and the Consultant shall not have any direct dealings with the authority, department, government or agency in question with regards to the Deliverable.

(e) The Consultant and the Consultant's personnel shall comply with all rules and direction of Toronto Hydro, whether specified in this Agreement or otherwise, while working on Toronto Hydro's premises or when accessing or connecting to Toronto Hydro's information technology systems, including rules and directions concerning health, safety, security and environmental protection, including without limitation, Toronto Hydro's *Code of Business Conduct and Whistleblower Procedure,* Toronto Hydro's *Disclosure Policy,* Toronto Hydro's *Social Media and Digital Communication Policy,* Toronto Hydro's *Accessibility Policy,* Toronto Hydro's *Workplace Harassment Policy and Program,* Toronto Hydro's *Violence Prevention in the Workplace Policy,* Toronto Hydro's *Workplace Alcohol and Drug Policy*, Toronto Hydro's *Environmental Policy,* Toronto Hydro's *Occupational Health and Safety Policy,* Toronto Hydro's *Privacy Policy,* Toronto Hydro's *Cyber Security Policy*, Toronto Hydro's *Technology Use Guidelines*, Toronto Hydro's *Physical Security Policy*, Toronto Hydro's *COVID-19 Vaccination Policy,* and the *Affiliate Relationships Code for Electricity Distributors and Transmitters* issued by the OEB (together, the "Guidelines"). The Consultant agrees to comply with and to direct its Representatives to comply with such Guidelines, as amended.

4.3 Performance

(a) The Services shall be performed in accordance with the standards and specifications stated in this Agreement, and Toronto Hydro shall have the right at all reasonable times, to inspect or otherwise review the Services performed or being performed. The Consultant shall, upon the request of Toronto Hydro, acting reasonably, provide Toronto Hydro with written reports of the status of the Deliverables and the Consultant's progress in providing the Services.

(b) In the event of any dispute between Toronto Hydro and the Consultant relating to the quality or acceptability or rate of progress of any of the Services, or relating to the interpretation of any instructions or specifications concerning the Services, Toronto Hydro and the Consultant shall attempt to mutually reach a resolution in good faith. Failing a good faith resolution, the affected party shall have the right to bring a claim.

5. <u>REPRESENTATIONS, WARRANTIES, INDEMNITIES AND INSURANCE</u>

5.1 Representations and Warranties

The Consultant hereby represents, warrants and agrees that:

(i) it (or, where the Consultant is a corporation or partnership, its Representatives performing the Services) has/have the necessary experience and qualifications to perform the Services;

(ii) it (or, where the Consultant is a corporation or partnership, its Representatives performing the Services) will perform the Services in a diligent, expeditious and workmanlike manner, consistent with standards generally observed by reputable and competent members of the same industry providing similar services;

(iii) all Services shall be the Consultant's (or, where the Consultant is a corporation or partnership, its Representatives performing the Services) original work and none of the Services or any invention, development, use, production, distribution or exploitation relating thereto will infringe, misappropriate or violate any intellectual property or other right of any person or entity.

5.2 Indemnity

a) The Consultant shall be liable for and shall indemnify and hold harmless Toronto Hydro and its Representatives from all claims, demands, actions, penalties, damages, losses, judgments and settlements, liabilities, costs, expenses, including legal fees and other related costs and expenses arising out of, related to, or incident to, the Consultant or any of its Representatives' negligent performance of the Services under this Agreement, including, without limitation:

   i. any breach, violation or non-performance by the Consultant or any of its Representatives of any terms, conditions, warranties, obligations or covenants contained in this Agreement;
   ii. any breach or violation by the Consultant or any of its Representatives of any Applicable Laws; and
   iii. any negligent actions, omissions, negligence or wilful misconduct of the Consultant or any of its Representatives

   except to the extent caused by the negligence or wilful misconduct of Toronto Hydro or its Representatives.

b) In no event shall either party be liable for loss of profit or use or for any indirect, special, incidental or consequential damages of any nature or kind including but not limited to delays, loss of revenue, loss of use, loss of data, loss of product, costs of capital or costs or replacement power, even if that party has been advised of the possibility of such damages.

c) Subject to section 5.2(d), the Consultant's liability for a claim for damages shall be limited to two (2) times the amount payable by Toronto Hydro to the Consultant pursuant to this Agreement.

d) Notwithstanding the foregoing, no exclusion or limitation of liability shall apply to:

   i. Breach of the confidentiality or privacy obligations in this Agreement;
   ii. Intentional misconduct or gross negligence;
   iii. Breach of Applicable Law; or
   iv. Breach of intellectual property indemnity in Section 9.

5.3 Insurance

(a) The Consultant shall, during the Term, and at its own expense, maintain and keep in full force and effect (and, when requested, provide Toronto Hydro with proof thereof):

(b) commercial general liability insurance on an occurrence basis having inclusive coverage limit, including personal injury and property damage, of not less than four million Canadian dollars ($4,000,000) per occurrence and in aggregate which commercial general liability insurance shall be extended to cover contractual liability, products and completed operations liability, and owners/contractors protective liability;

(c) Computer Security and Privacy Liability insurance covering actual or alleged acts, errors or omissions committed by the Consultant or its Representatives of not less than five million Canadian dollars ($5,000,000.00). The policy shall expressly provide, but not be limited to, coverage for the following perils:

i. unauthorized use/access of a computer system

ii. defense of any regulatory action involving a breach of privacy

iii. failure to protect confidential information (personal and commercial information) from disclosure notification costs, whether or not required by statute;

(d) With the exception of Professional Indemnity insurance, all insurance coverages and limits required to be maintained hereunder shall: (i) be primary to any insurance maintained by Toronto Hydro, which insurance shall be excess and non-contributory; (ii) contain a cross liability clause and a severability of interest clause;

(e) The Consultant agrees that the insurance required hereunder in no way limits the Consultant's liability pursuant to the Liability and Indemnity provision in Section 5.3.

(f) With the exception of Professional Indemnity insurance, a waiver of subrogation shall be provided by the insurer(s) to Toronto Hydro.

6. <u>FEES</u>

6.1 Fees

(a) Subject to paragraphs 6.1(c) - 6.1(f), in exchange for the performance of the Services in accordance with the terms hereof, Toronto Hydro shall pay the Consultant the rates outlined in SCHEDULE A, not including HST (the "Fee").

(b) The Fee noted in subsection 6.1(a) shall be the only fee payable by Toronto Hydro under this Agreement. Without limiting the generality of the foregoing, the Consultant hereby agrees and acknowledges that all out-of-pocket expenses, travelling costs, and other disbursements shall be at the sole expense of the Consultant, except with the prior written approval from Toronto Hydro.

(c) Any disbursements for additional incidentals incurred by the Consultant in relation to this Agreement ("Disbursements") must be pre-approved by Toronto Hydro in writing.

(d) The Consultant shall not incur or submit invoices for any work outside the scope of the Services without prior written approval from Toronto Hydro.

(e) The Consultant shall make all payment of taxes, employment insurance premiums, pension plan contributions and any other taxes or other payment of any nature, imposed by any authority in respect of the Fee paid by Toronto Hydro to the Consultant under this Agreement (together, the "Remittances"), and the Consultant hereby covenants and agrees to indemnify and save harmless Toronto Hydro and its Representatives from and against all costs, liabilities and claims whatsoever against Toronto Hydro or its Representatives, in any way arising out of or relating to any failure to deduct, withhold, or remit any Remittance.

(f) Without limiting the generality of paragraph 6.1(a), Toronto Hydro reserves the right to deduct any applicable non-resident withholding taxes from any Fee owing to the Consultant under this Agreement and remit such amounts to the applicable taxation authority.

6.2 Payment

The Consultant shall submit invoices to Toronto Hydro on a monthly basis containing:

(i) a description of the Services performed during the invoice period;

(ii) the monthly payment amount;

(iii) the total HST applicable to the Services during the invoice period, as well as the Consultant's HST registration number; and

(iv) a detailed description of the Disbursements incurred around the invoice period, supported by documentation in a form acceptable to Toronto Hydro.

Unless otherwise provided in this Agreement, the Consultant shall invoice Toronto Hydro after final inspection and acceptance by Toronto Hydro of the Services performed and subject to receipt of all documents required by this Agreement. **Invoices must be sent electronically to: AP@torontohydro.com.** Subject to approval of the invoice by Toronto Hydro, receipt of all documents required by this Agreement, and final review by Toronto Hydro, Toronto Hydro shall make payment to the Consultant via electronic funds transfer not later than thirty (30) days following receipt of an acceptable invoice and the EFT Information (as set out below). **The Consultant must provide Toronto Hydro with, in the case of the first payment only, (i) a void cheque, pre-printed deposit slip or bank confirmation letter and (ii) the email address where the Consultant wishes to receive remittance information (together, "EFT Information"). EFT Information must be sent electronically to efthelp@torontohydro.com or to 14 Carlton Street, Toronto, ON, M5B 1K5, Attention: Treasury Department.** Toronto Hydro reserves the right to pay the Consultant through other payment methods.

7. SUSPENSION OR TERMINATION

7.1 Suspension or Termination

(a) Toronto Hydro may, at any time during the Term by notice in writing, suspend all or a portion of the Services. Upon receipt of such written notice, the Consultant shall perform no further work other than as directed by Toronto Hydro, and shall be entitled to payment for time spent in performing the Services up to the date of suspension.

(b) Either party may terminate this Agreement immediately upon written notice where the other party enters into liquidation, whether compulsory or voluntarily, or where a proceeding in receivership, bankruptcy or insolvency has been instituted by or against such party or its property.

(c) Toronto Hydro, at its sole discretion, may terminate this Agreement immediately upon written notice where due to an act or omission of the Consultant or any of its Representatives has been in material default in the performance of its duties, obligations or undertakings under this Agreement, and has not taken immediate steps to remedy such default within two (2) Business Days following written notice of the specific default by Toronto Hydro. For the purposes of this section, a material default shall include, without limitation, a breach of any of the representations or warranties contained herein or the failure or refusal to provide the Services in accordance with the terms and conditions of this Agreement.

(d) Notwithstanding any other provision in this Agreement, Toronto Hydro, at its sole discretion, shall have the right to terminate this Agreement, for any reason, upon 60 days' written notice to the Consultant.

(e) The Consultant shall have the right to terminate in the event of a breach by Toronto Hydro that is not remedied by Toronto Hydro within 60 days after receiving notice from the Consultant.

(f) In the event that this Agreement is terminated in accordance with this section 7.1 by either party, the Consultant shall be entitled to payment for time spent in performing the Services up to the date of suspension.

7.2 Effect of Termination

Upon the termination or expiration of this Agreement, upon Toronto Hydro's request, the Consultant shall return to Toronto Hydro and delete any and all electronic copies, with the exception of file server backups, the Consultant may have of all documents and materials in its possession relating to the Services or this Agreement, including all Confidential Information and all Deliverables, whether completed or not.

8. CONFIDENTIALITY

8.1 Non-Disclosure

In performing the Services required by this Agreement, the Consultant may be provided access to Confidential Information. The Consultant acknowledges and agrees that:

(a) the Consultant shall not disclose, permit access to, transmit, or transfer the Confidential Information to any third party without the prior written authorization of Toronto Hydro;

(b) the Consultant shall protect the confidentiality of the Confidential Information in its possession by exercising the same security measures it normally exercises with respect to its own confidential information and at minimum a reasonable standard of care;

(c) upon the request of Toronto Hydro, and in any event upon the expiration or termination of this Agreement for any reason, the Consultant shall, with the exception of file server backups, return (or delete, in the case of electronic documents) forthwith to Toronto Hydro all Confidential Information, including all copies and other materials containing the Confidential Information, which are in the possession or under the control of the Consultant; and

(d) the Consultant shall not use any Confidential Information for any purpose other than to perform the Services required by this Agreement. Without limiting the foregoing, the Consultant shall not, and shall not permit any of its Representatives to, use any Confidential Information in furtherance of its, or their, individual business or for its, or their, own benefit, profit or advantage, or for the benefit, profit or advantage of any other party.

Notwithstanding the foregoing, the Consultant may disclose such Confidential Information to any of the Representatives of the Consultant who agree to be bound by the obligations of confidentiality herein and who have a reasonable need to know such Confidential Information in the course of their duties for the Consultant but only for the purposes of the Consultant exercising its rights and obligations under this Agreement; and in the event that the Consultant believes it is required by law to disclose, or is requested by a governmental authority to disclose, any Confidential Information to a governmental authority; provided that the Consultant shall, to the extent permitted by law, first inform Toronto Hydro of the request or requirement for disclosure to allow an opportunity for Toronto Hydro to apply for an order to prohibit or restrict such disclosure.

8.2 Non-Solicitation

Not applicable.

9. INTELLECTUAL PROPERTY

9.1 Use

Nothing in this Agreement shall be deemed to transfer, license, assign, permit the use of, or otherwise convey an interest in whole or in part to the Consultant of any Intellectual Property belonging to Toronto Hydro or any of its Representatives or any third party whose Intellectual Property is in Toronto Hydro's custody or control, and the use by the Consultant of any such Intellectual Property shall be subject to the prior written approval of Toronto Hydro.

9.2 Ownership

The Consultant shall retain all intellectual property rights in the Deliverables provided by the Consultant for use by Toronto Hydro, and subject to payment in full, shall grant Toronto Hydro a licence to use the Consultant's intellectual property for the purposes specified in this Agreement. The Parties acknowledge and agree that the reporting outputs produced by the model may be provided to third-parties, including, but not limited to, the City of Toronto, the IESO, and the OEB, by Toronto Hydro in accordance with the Consultant's obligations set out in Section 1 of SCHEDULE A below.

9.3 Intellectual Property Protection

The Consultant expressly warrants that the manufacture, delivery, sale or use of the Consultant's Services will not infringe any Canadian or foreign patents, trademarks, copyrights, industrial design or other intellectual property rights and the Consultant shall indemnify and save Toronto Hydro harmless from all claims, judgments and decrees that may be entered against Toronto Hydro or its Representatives and against all damage, liability, costs and expenses (including legal fees and other attendant costs and expenses) Toronto Hydro incurs by reason of any infringement or claim thereof except to the extent that such infringement arises out of, or is caused by an instruction by Toronto Hydro, or by any use or modification of the services or deliverables in a manner not consistent with the purpose of the Services under this Agreement.

9.4 Pre-Existing Intellectual Property

Any pre-existing Intellectual Proprietary ("Pre-Existing IP") of Consultant or its licensors used to perform Services, or included in any Deliverable, including but not limited to software, appliances, methodologies, code, templates, tools, policies, records, working papers, know-how, data or other intellectual property, written or otherwise shall remain the exclusive property of the Consultant and its licensors (collectively, "Consultant Information"). For greater clarity, Consultant Information shall further include Consultant Software and any intellectual property, including Pre-Existing IP developed by Consultant during the Term of this Agreement, including that intellectual property that may occur during the provision of the Services under this Agreement, except that to the extent such Consultant Information incorporates Toronto Hydro Confidential Information, such Confidential Information remains the exclusive property of Toronto Hydro and Consultant shall not implement or use such Confidential Information except for the provision of the Services. To the extent that Consultant incorporates any Consultant Information into the Deliverable(s) and subject to payment in full of the fees under this Agreement, Consultant hereby grants to Toronto Hydro a fully paid up, royalty free, irrevocable and non-cancellable, non-exclusive, right to use the Consultant Information, except that any such use must be in conjunction with the Deliverables in which the Consultant Information is incorporated and not as a separate item. Consultant shall provide Toronto Hydro with a list of any freeware, shareware or open source software used in the Deliverables. Any pre-existing intellectual property of Toronto Hydro, including but not limited to software, appliances, methodologies, code, templates, tools, policies, records, working papers, know-how, data or other intellectual property, written or otherwise shall remain the exclusive property of Toronto Hydro.

10. HEALTH AND SAFETY

The Consultant shall be responsible for managing the health and safety of its own personnel and other Representatives.

11. MISCELLANEOUS

11.1 Survival

In addition to the terms in this Agreement that by their nature survive the expiry or termination of the Agreement, the terms of section 5 (Representations, Warranties and Indemnities), section 8 (Confidentiality), section 9 (Intellectual Property), and subsection 11.3 (Injunctive Relief) shall survive the expiry of this Agreement for a term of five (5) years.

11.2 Subcontracting

The Consultant may not subcontract the performance of any part of the Services without Toronto Hydro's prior written approval. Where Toronto Hydro provides its prior written approval to the Consultant to subcontract all or part of the Services, then the Consultant shall enter into agreements with such permitted subcontractor(s) to require the permitted subcontractor(s) to provide Services in accordance with all of the terms of this Agreement. Notwithstanding the foregoing, the Consultant shall remain liable for any and all acts or omissions of any subcontractor(s) as if such acts or omissions were those of Consultant.

11.3 Injunctive Relief

(a) The Consultant acknowledges and agrees that the terms of section 8 (Confidentiality) and section 9 (Intellectual Property) of this Agreement are reasonably necessary to protect the legitimate interests of Toronto Hydro, are reasonable in scope and duration, and are not unduly restrictive.

(b) The Consultant further acknowledges that a breach of any of the terms of section 8 (Confidentiality) or section 9 (Intellectual Property) would render irreparable harm to Toronto Hydro, and that a remedy at law for breach of these sections would be inadequate, and that Toronto Hydro shall therefore be entitled to seek any and all equitable relief, including, without limitation, injunctive relief, and any other remedy that may be available at law or in equity.

11.4 Force Majeure

Either party will be relieved of liability for delays in performance of its obligations hereunder where such delay is a result of Force Majeure. The party affected by the Force Majeure shall give prompt notice thereof to the other party and, upon cessation of the Force Majeure, shall take all reasonable steps to resume the performance of its obligations hereunder. If a delay in performance by reason of Force Majeure extends beyond thirty (30) Business Days, then either party may terminate this Agreement by written notice.

11.5 Non-Exclusive Agreement

This Agreement will not be interpreted to grant to the Consultant exclusive rights to provide the Services or to bind Toronto Hydro in any way to an exclusive relationship with the Consultant with regards to the Services or any other service.

11.6 Waiver

No delay on the part of either party in exercising any of its rights hereunder or failure to exercise the same, nor the acquiescence thereto shall operate as a waiver except in the specific instance for which it is given and where such waiver is provided in writing by the party waiving its rights.

11.7 Amendments

None of the terms, conditions or provisions of this Agreement shall be varied, modified or altered except by written agreement signed by an authorized representative of each parties.

11.8 Assignment

Save and except for Toronto Hydro's right to assign this Agreement to any of its Affiliates, neither party may assign this Agreement or any of their rights or obligations hereunder, without the prior written authorization of the other party, acting reasonably.

11.9 Enurement

This Agreement shall enure to the benefit of, and be binding upon, the parties hereto and their respective successors and permitted assigns.

11.10 Severability

In the event that any provision or portion of this Agreement is determined to be invalid or unenforceable for any reason, the remaining provisions or portions of this Agreement will be unaffected and will remain in full force and effect to the fullest extent permitted by law.

11.11 Neutral Construction

The parties to this Agreement agree that this Agreement was negotiated fairly between them at arm's length, that the final terms of this Agreement are the product of the parties' negotiations, and that this Agreement shall be deemed to have been jointly and equally drafted by them, and that the provisions thereof should not be construed against a party on the grounds that such party drafted the Agreement in whole or in part.

11.12 Entire Agreement

This Agreement constitutes the entire agreement between the parties relating to the subject matter hereof. This Agreement supersedes any and all prior correspondence, warranties, covenants, collateral undertakings, or agreements, oral or otherwise, express or implied, unless otherwise contained herein.

11.13 Notices

(a) All questions or other communications regarding this Agreement, including any notices required by this Agreement, are to be addressed to the following addresses:

to Toronto Hydro:

Name:	**Matthew Higgins**
Title:	Director, Integrated Planning & Modernization
Address:	500 Commissioners St., Toronto Hydro, ON M4M 1N7
Telephone:	(416) 450-2713
Email:	mhiggins@torontohydro.com

with copy to:

Title:	EVP, Public and Regulatory Affairs & Chief Legal Officer
Address:	14 Carlton, Toronto Hydro, ON M5B 1K5
Telephone:	(416) 542-3000
Email:	legal@torontohydro.com

to the Consultant:

Name:	**Mark Hughes**
Title:	Partner
Address:	Element Energy, Suite 1, Bishop Bateman Court, Thompson's Lane, Cambridge, CB5 8AQ, UK
Telephone:	+44 (0)1223 852 499
Email:	mark.hughes@element-energy.co.uk

(b) All notices or communications shall be deemed to be received on the date of acceptance (as evidenced by the signature of the party) if delivered by personal delivery or courier, on the fifth (5^{th}) Business Day after mailing, if mailed by first class mail, or on the first (1^{st}) Business Day after transmission, if sent by facsimile (provided the transmission is evidenced by documented proof of proper fax transmittal).

11.14 Governing Law

This Agreement shall be governed by and construed in accordance with the law of the Province of Ontario and the laws of Canada applicable therein.

[remainder of this page intentionally left blank]

11.15 Execution

This Agreement may be signed in counterparts and delivered by electronic means, each of which shall be deemed an original and all of which, together, shall have the same effect as if all constitute one and the same Agreement.

IN WITNESS WHEREOF, the parties have duly executed this Agreement as of the date first written above:

Element Energy Limited

Per: ______________________________

Name: Mark Hughes

Title: Partner

I have authority to bind the Consultant.

Toronto Hydro-Electric System Limited

Per: ______________________________

Name: Elias Lyberogiannis

Title: Executive Vice President, Planning, Chief Engineering, and Modernization Officer

I have authority to bind Toronto Hydro.

SCHEDULE A

SERVICES AND RATES

1. Services to be Performed

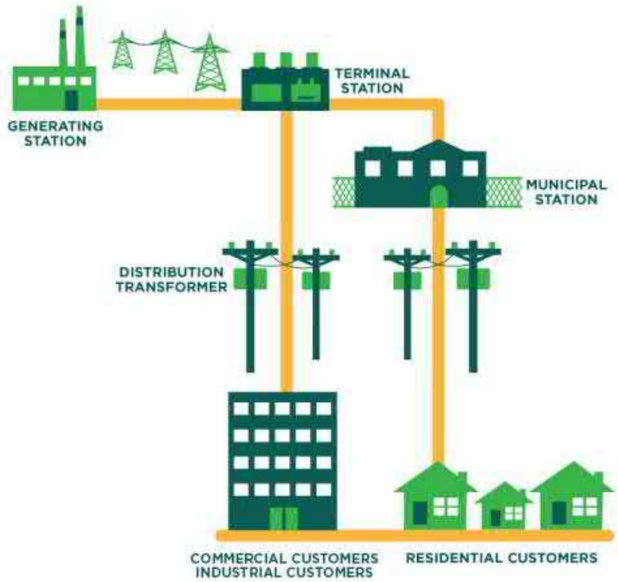
(a) Future Energy Scenarios Model

Toronto Hydro requires the development of a future energy scenarios model that produces scenario-based 2050 forecasts for peak load (kVA), generation (kW), and energy consumption (kWh). The model will be used to understand the range of possible future energy scenarios in order to inform capacity-driven investment, grid modernization investment, as well as revenue forecasting.

Toronto Hydro is supplied electricity from Hydro One Networks Inc. (HONI) at 230kV, 115kV, 27.6kV, or 13.6kV at 37 Terminal Stations (TS) located across the City of Toronto. Electricity is then delivered to end-users through the distribution system. Refer to Figure 1 below for a basic structure of the electricity system infrastructure. The future energy scenarios must be modelled, at a minimum, at the 37 Terminal Stations and associated buses. A more granular geospatial resolution may also be considered. The project is proposed to be carried out in two phases, as described in the following sections. Any alternative approaches should be described in detail and provided in addition to proposed approach. If alternative approaches are included, a clear justification of why the approach is more favourable to Toronto Hydro is required.

The Consultant shall designate a primary contact who will delegate work to its team as requested by Toronto Hydro, and is the key contact person for managing the working relationship with Toronto Hydro.

Figure 1. Basic electricity system infrastructure



Phase 1: Energy Scenario Development & Stakeholder Engagement

This phase requires the development of a minimum of 3 and up to 5 future energy scenarios. The future energy scenarios must model the base load as well as the uptake of the key drivers listed in table 1 below up to 2050. The model must not rely on pre-existing Toronto Hydro models and must build up these models using a bottom-up approach and aggregate up to the terminal station bus level.

The forecasts for technology uptake must be built using the Consultant's own models, tools and methodologies. It is preferred that technology uptake scenarios are modelled bottom-up, using consumer choice modelling by analyzing economic and demographic data and leveraging publicly available data for the City of Toronto. This requirement will enable Toronto Hydro to increase the sophistication of its modelling practices and future-proof the model for when Toronto Hydro chooses to model at a more granular geospatial resolution.

Table 1. Key drivers required for the future energy scenarios model

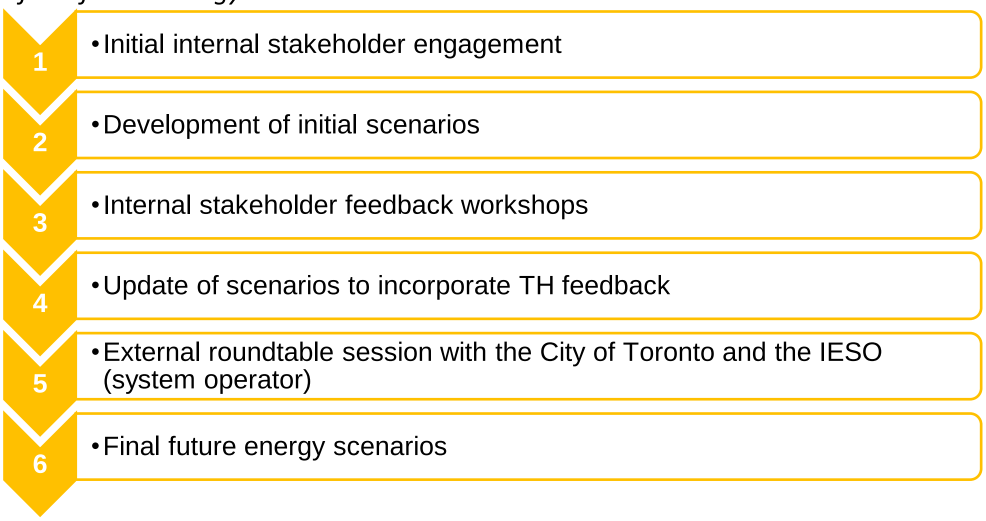
No.	Key Driver
1	Residential housing growth
2	Industrial & Commercial growth broken down by type (retail, office, industrial etc.)
3	Electric vehicle uptake by type (light duty private, fleet, buses, taxis etc.)
4	Distributed generation by type and size (solar, wind, bio-gas, diesel, and natural gas/CHP must all be considered)
5	Appliance growth by type
6	Conservation demand management driven by province wide programs and by natural customer choices (also referred to as energy efficiency)
7	Decarbonized heating (air source and ground source heat pumps)
8	Domestic and grid-scale Battery Energy Storage Systems (BESS)
9	Customer flexibility (services available to manage network constraints, such as vehicle to grid, smart EV charging and other demand side response technology)
10	Any other key drivers deemed important for the Toronto Hydro service area as part of the

	research and stakeholder engagement activities in this phase

(b) Stakeholder Engagement

The scenarios must be designed through continuous engagement with internal project stakeholders to seek agreement on assumptions and projections. The Consultant is also required to support some external stakeholder engagement to meet, at a minimum, the level of engagement outlined in figure 2 below. The timing of the roundtable sessions with external stakeholders will be determined by Toronto Hydro in accordance with its regulatory stakeholder engagement process.

Figure 2. Minimum level of internal and external stakeholder engagement required for the development of the future energy scenarios



Phase 2: Network Data Cleansing and Modelling

This phase requires the cleansing of Toronto Hydro network and customer data, as well as the modelling of the future energy scenarios. This requires:

- Cleansing and analyzing network load, energy and generation data.
- Cleansing and analyzing network topology and connectivity data.
- Cleansing and analyzing customer connection requests data for inclusion in the forecast (for first 1-5 years).
- Producing annual and monthly peak demand (kVA), energy consumption (kWh), generation (kW) and customer number forecasts from 2022 to 2050. Coincident and non-coincident peak demand should be calculated. Forecasts are required at the following levels:
  - Total distribution system, aggregate and by customer class
  - By each terminal station bus level, aggregate and by customer class
  - By each key driver, aggregate and by customer class
    - For EVs, Distributed Generation, and Heat Pumps, forecasts should also include the volume of each type of technology

The following data sets provided by Toronto Hydro will aid the Consultant with this task. The Consultant must specify any other data sets required outside of the list below. The Consultant should assume an extensive level of cleansing required for most of the data sets provided.

- Complete network topology of all transformer stations per voltage level and their associated feeders, along with the number, location and type of customers connected.
- Hourly monitored demand data for all substations for the most recent full year.
- List of known distributed generation and energy storage installations across the network with technology type, start year, and connectivity to the network.
- Hourly monitored generation data for large-scale distributed generation installations, where available.
- Total units distributed (kWh) annually and hourly by customer class for the most recent full year
- Customer numbers by customer class.

(c) Non-Functional Requirements

- The future energy scenarios model must be agile, enabling Toronto Hydro to quickly and easily change parameters and assumptions for each scenario, without having to re-configure the model each time.
- The model must be designed in a manner that allows Toronto Hydro to update various elements of the model internally, without the reliance on the Consultant. Training for the model must be included in the Consultant's proposal.
- The model must be easy to use and include a functional user interface
- The model must be delivered with a detailed user manual explaining the inner mechanics of the model.
- The model must provide visual graphs and charts that are useful for communicating the output of the model in a stakeholder friendly manner. At a minimum, the visuals should include:
    - Each of the technology drivers, aggregated and by single driver, at a network level and at each substation, from current year to 2050.
    - The base load, aggregated and by type of customer, at a network level and at each substation, from current year to 2050.
    - Each of the future energy scenarios.
- If the proposed model is cloud-based, the Consultant must meet Toronto Hydro's IT Security standards for how the model is hosted and updated in the future.
- Toronto Hydro will own all rights, title, and interest, including without limitation, all intellectual property rights in the information provided by Toronto Hydro to the Consultant as part of this project, including any output of the model.

(d) Project Management Requirements

The Consultant is required to participate in weekly project meetings through video conferencing with the core internal Toronto Hydro team, and to provide project status updates at these meetings in an agreed upon format. They must also participate in internal workshops with a wider group of internal stakeholders as and when required, through virtual video conference calls or in-person.

(e) Project Deliverables

The project Deliverables shall include:

- The Future Energy Scenarios model that meets the requirements outlined in earlier sections.

- A detailed user manual for the model that outlines the inner mechanical workings of the model and that may be used for training of Toronto Hydro staff.
- A detailed internal-facing final report that outlines all of the modelling assumptions, input data, modelling methodologies, as well as the results from the project.

The Consultant may also be required to deliver, at Toronto Hydro's request, an external-facing report that meets regulatory requirements and appropriately describes the results of the future energy scenarios model. The Fees for this additional Deliverable shall be in accordance with the rates set out below..

(f) Annual Update and Maintenance of Model

The Consultant must outline the recommended level of model maintenance and updates, and the pricing for this activity on an annual basis. These costs should be separated and will not be considered as part of the initial project execution but will be taken into consideration when assessing the suitability of the model for Toronto Hydro. Should Toronto Hydro require the Consultant to provide annual updates, Toronto Hydro may do so as part of this Agreement at its own discretion.

(g) Participation in Toronto Hydro's Regulatory Application Process

The Consultant must be available to speak to the work carried out as part of this project in a regulatory proceeding as required by the Ontario Energy Board and as directed by the Toronto Hydro Regulatory team.

(h) Weather Correction of Network Data

The Consultant will provide a weather correction service (i.e. correcting hourly true demand data for each network asset, or on other such frequencies as requested by Toronto Hydro) as part of Phase 1 and Phase 2. The Fees for such service shall be a lump-sum, as more particularly set out in section 2(a) of this SCHEDULE A below.

2. <u>Rates</u>

a) Model Fees

In exchange for the Services set out in Section 1 of this SCHEDULE A (and in particular, subsections (a), (b), (c), (d), (e), and (h) thereto), Toronto Hydro shall pay the Consultant the following Fees on a milestone basis, as more particularly set out in the tables below:

Phase 1		
Milestone #	**Description**	**Fixed Cost/Fee ($)**
MS 1:	Kick-off meeting	[redacted]
MS 2:	Initial round of stakeholder engagement conducted	
MS 3:	Final round of stakeholder engagement (internal and external) completed	
MS 4:	Final scenarios with associated documentation to Toronto Hydro	

Total		[redacted]

Phase 2		
Milestone #	**Description**	**Fixed Cost/Fee ($)**
MS 1:	Kick-off meeting	[redacted]
MS 2:	Present proposed approaches for customer archetypes, geographical distributions, profile shapes and load factors to Toronto Hydro	
MS 3:	Provide preliminary model outputs to Toronto Hydro for review	
MS 4:	Final EELG model with associated documentation to Toronto Hydro	
Total		

	Total Project Cost (Phase 1 and Phase 2):	[redacted]
Weather Correction of Network Data		
Rate	Weather correction (annual or on a frequency prescribed by Toronto Hydro)	[redacted]

Project Total	[redacted]

b) <u>Annual Maintenance</u>

<u>In addition to the Fees set out in subsection 2(a) above, should Toronto Hydro elect to exercise the Renewal Terms of this Agreement, Toronto Hydro shall further pay to the Consultant, the following Fees for the Services set out in subsection 1(f) of this SCHEDULE A above. The Fees indicated below shall be payable on the commencement of each Renewal Term:</u>

Annual Maintenance		
Year	**Description**	**Annual Fixed Cost/Fee ($)**
1	Year 1	[redacted]
2	Year 2	
3	Year 3	
Maximum Possible Total		

c) Consultant Rate Card

In addition to the Fees further set out above, where Consultant shall be required to assist Toronto Hydro with respect to any external discussions, at Toronto Hydro's sole option and request, as more particularly set out in section 1 of this SCHEDULE A above (in particular, subsections (e) and (g) thereto), Toronto Hydro shall compensate the Consultant on an hourly basis in accordance with the following rates for each of Consultant's personnel:

Rate card		
Rate ID	**Role / Description**	**Hourly rate ($)**
Rate 1:	Partner	[redacted]
Rate 2:	Principal Consultant	[redacted]
Rate 3:	Senior Consultant	[redacted]
Rate 4:	Consultant	[redacted]

SCHEDULE B

DEFINITIONS

In this Agreement, the following definitions shall apply:

"Affiliates"	has the meaning prescribed to it in the *Business Corporations Act* of Ontario, as amended from time to time;
"Agreement"	means this Agreement for Professional Consulting Services, including all recitals, schedules and attachments thereto;
"Applicable Laws"	means all federal, provincial and municipal statutes, regulations, codes, by-laws, orders in council, directives, rules, guidelines and ordinances applicable to the Consultant's services under this Agreement, including without limitation all applicable OEB codes, rules or guidelines;
"Business Day"	means a day on which banks are open for business in the City of Toronto, Ontario, but does not include a Saturday, Sunday, or a civic or statutory holiday in the Province of Ontario;
"Confidential Information"	means the terms of this Agreement and any and all data or information relating to the business, management or affairs of Toronto Hydro, its customers, employees, or any of its Affiliates disclosed by Toronto Hydro to the Consultant pursuant to this Agreement, whether or not such Confidential Information is expressly identified as confidential. Notwithstanding the foregoing, Confidential Information does not include any information or data which: (a) information or data that is or becomes publicly known through no breach of the terms or conditions of this Agreement; (b) information or data that is independently developed without reference to Confidential Information and without breach of the terms and conditions of this Agreement; or (c) Confidential Information that is required by court order or other legal compulsion to be disclosed, in which case the Consultant shall give Toronto Hydro prior written notice of such disclosure, as permitted by law;
"Deliverable"	means any and all works prepared, generated, created or designed by the Consultant pursuant to this Agreement, including without limitation all drawings, models, designs, formulae, methods, documents, reports, software, specifications, or source codes, and any related works, enhancements, modifications or additions thereto;
"Disbursements"	shall have the meaning as prescribed in paragraph 6.1(c);
"Fees"	shall have the meaning as prescribed in paragraph 6.1(a);

"Force Majeure"	means any impediments beyond the control of the applicable party due, wholly or in part, directly or indirectly, to include: strikes, lockouts, riots, epidemics, war, governmental regulations, fire, explosions, acts of God, or any other impediment beyond the control of the party affected;
"Hourly Rate"	shall have the meaning prescribed in paragraph 6.1(a);
"HST"	means Harmonized Sales Tax;
"Guidelines"	has the meaning prescribed in paragraph 4.2(e);
"Intellectual Property"	includes all trademarks, copyrights, patents, business names, trade secrets, proprietary software, analysis or techniques (whether or not patented or patentable), confidential or secret designs and processes, source codes, plans or devices, or other proprietary and intellectual property rights;
“Representatives”	in respect of a party, means such party's directors, officers, employees, agents and contractors, the party's Affiliates, and all such Affiliates' respective directors, officers, employees, agents and contractors;
"Remittances"	has the meaning prescribed to it in paragraph 6.1(e);
"Term"	has the meaning prescribed to it in subsection 3.1; and
"Toronto Hydro"	means Toronto Hydro-Electric System Limited.

SCHEDULE C

INFORMATION PROTECTION AND PRIVACY CONTRACT REQUIREMENTS

The Vendor shall comply with the all of the provisions of the Toronto Hydro Information Protection and Privacy Contract Requirements ("**IPPCR**"), which are scheduled to and form an integral part of the Agreement.

1. **Definitions**. In this IPPCR, the following terms have the following meanings and any capitalized terms that are not defined below have the meaning attributed to them in the Agreement:

(a) "**access**", in connection with TH Data, means capable of being accessed by a person, whether or not that person has the right or authority under any law or agreement to access the TH Data;

(b) "**Authorized Users**" means those employees and representatives of Vendor and of any subcontractors of Vendor who require access to TH Data for the purpose of providing the Services;

(c) "**disclose**", in connection with TH Data, means the access of TH Data by or the transfer custody or control of TH Data to a third party who is not an Authorized User or a subcontractor using the TH Data solely for the purposes of the Agreement;

(d) "**including**" means including without limitation;

(e) "**IPC**" means the Information and Privacy Commissioner of Ontario;

(f) "**Personal Information**" means information about an individual (or any information that is combined with such information) including information that can be used to authenticate that individual, that is:

(i) provided to Vendor by Toronto Hydro; or

(ii) collected, accessed, used, stored or disclosed by Vendor on behalf of Toronto Hydro

in connection with Vendor's obligations pursuant to the Agreement;

(g) "**Privacy Laws**" means all laws and regulations and orders, standards, guidelines and recommendations of a regulatory authority with jurisdiction regarding Personal Information, including the *Municipal Freedom of Information and*

Protection of Privacy Act (Ontario) ("**MFIPPA**"), as amended from time to time, all regulations made pursuant to MFIPPA, and any applicable orders, standards, guidelines or recommendations of the IPC;

(h) "**Security Incident**" means any set of facts or circumstances that would lead a reasonable person to conclude that there has been the loss of or improper, unauthorized or unlawful access to, use of, destruction of, or disclosure of TH Data;

(i) "**store**" and "**stored**" means held, backed up or stored by any means whatsoever, including in hard and electronic formats and includes storage in a server or database or any form of electronic memory;

(j) "**Toronto Hydro**" means the Toronto Hydro-Electric System Limited;

(k) "**TH Data**" means (i) the Personal Information and (ii) any other related data that Vendor collects, uses, or stores pursuant to the Agreement that contains the confidential or proprietary information of Toronto Hydro and that is intermingled with the TH Data;

(l) "**use**" means to handle TH Data in any manner, including to copy, download and temporarily hold TH Data; and

(m) "**Vendor"** means, with respect to this SCHEDULE C, the Consultant.

2. **Conflict**. The provisions of this IPPCR are in addition to any obligations of Vendor under the Agreement. In the event of a conflict or inconsistency between this IPPCR and any other provision of the Agreement (including any contractual duties of confidentiality), the provisions of this IPPCR shall prevail to the extent of the conflict or inconsistency.

3. **Compliance**. Vendor represents, warrants, and covenants that it:

(a) does and will comply with all Privacy Laws applicable to the Personal Information; and

(b) has developed and implemented, and will maintain and monitor, a written and comprehensive information security program in compliance with this IPPCR and applicable Privacy Laws; and

(c) will certify, in writing, its compliance with the foregoing annually upon request from Toronto Hydro.

4. **Relationship**. Vendor is a third-party service provider to Toronto Hydro. Vendor is responsible for ensuring the compliance with the terms of this IPPCR by all of its Authorized Users and subcontractors.

5. **Ownership of TH Data**. Nothing in the Agreement provides Vendor, its subcontractors or Authorized Users with any rights in or to the TH Data or data derived from the TH Data. As between Vendor and Toronto Hydro, TH Data will remain under the control of Toronto Hydro, including without limitation, when Vendor is using or storing TH Data. Vendor shall not and shall not permit its subcontractors to aggregate or otherwise modify TH Data for any purpose other than as provided for in the Agreement. Vendor shall not and shall not permit its subcontractors to withhold any TH Data from Toronto Hydro to enforce any alleged payment obligation or in connection with any dispute relating to the terms of the Agreement or any other matter between Vendor and Toronto Hydro.

6. **Restrictions Relating to TH Data**. Vendor shall and shall cause its subcontractors to:

   (a) only collect, access, store, and use Personal Information to the extent required for the purpose of fulfilling Vendor's obligations under the Agreement;

   (b) not disclose TH Data except (i) in accordance with the provisions of the Agreement and this IPPCR, (ii) if required by applicable law (provided Vendor provides notice in accordance with section 12 of this IPPCR), or (iii) with the written consent of Toronto Hydro; and

   (c) ensure Authorized Users are bound by written policies, procedures or confidentiality agreements containing (i) a duty to protect the confidentiality of the TH Data, (ii) restrictions on the collection, access, storage, use and disclosure of Personal Information, and (iii) return or destruction of TH Data that are consistent with and no less restrictive as the terms of this IPPCR.

7. **Subcontractors**. Vendor shall only permit subcontractors to collect, access, store, use or disclose TH Data with the written approval of Toronto Hydro, acting reasonably, which approval may be withheld until Toronto Hydro has been provided with satisfactory evidence that the subcontractor has entered into a contract with Vendor containing (i) a duty to protect the security, integrity, confidentiality and availability of the TH Data and (ii) restrictions on the collection, access, storage, use and disclosure of the TH Data that are consistent with the terms of this IPPCR.

8. **Security Administration**.

(a) Vendor shall and shall require its subcontractors to establish and maintain administrative, technical and physical safeguards to protect the security, integrity, confidentiality and availability of the TH Data, including to protect the TH Data against any anticipated threats or hazards and to protect against any loss of or unauthorized or unlawful access to, use of, or disclosure of the TH Data.

(b) Vendor shall and shall require its subcontractors to take reasonable steps, through security and privacy awareness training and the application of appropriate sanctions, to ensure compliance by all Authorized Users and subcontractors with Vendor's privacy and security obligations under this IPPCR. The training shall be consistent with best practices in the industry and designed, at a minimum, to educate all such individuals on maintaining the security, confidentiality, integrity and availability of TH Data, and shall occur before such individuals are allowed access to TH Data and no less than annually thereafter.

(c) Without limiting the generality of paragraph 8(a), Vendor shall and shall require its subcontractors to implement the following safeguards in respect of the Personal Information or TH Data, as applicable (unless otherwise agreed to in writing by Toronto Hydro):

(i) TH Data must be stored in facilities meeting or exceeding then-current industry standards relating to the protection of sensitive information;

(ii) Personal Information must be encrypted when transferred electronically between Vendor and Toronto Hydro and between Vendor and subcontractors;

(iii) TH Data must be encrypted in transit when accessed or transmitted over the Internet;

(iv) TH Data may only be accessed by Authorized Users or subcontractors over the Internet using currently accepted industry standard communications encryption and multi-factor user access authentication, provided that the scenario model that forms part of the Services under the Agreement shall, at all times, where commercially feasible, be hosted on Toronto Hydro's cloud environment, unless otherwise agreed by the parties in writing;

(v) TH Data must be encrypted when stored;

(vi) TH Data in electronic form must be physically or logically segregated from other data stored by Vendor;

(vii) Each individual with access to TH Data in electronic form must be identified by a unique user ID;

(viii) The security access principles of “segregation of duties” and “least privilege” shall be implemented to restrict access to TH Data;

(ix) All sessions involving access to TH Data must be logged and logs retained for a sufficient period of time to permit an investigation into unauthorized access;

(x) All applicable and necessary security patches will be deployed promptly to all systems in which TH Data is stored or through which TH Data is accessed or used, including operating system and open source and application software; and

(xi) Only supported software (software under active maintenance, including operating system, open source, application software and/or the like) will be deployed on any systems in which Personal Information is stored or through which it is accessed and used.

(d) If Vendor or its subcontractors will be accessing, using or storing TH Data in connection with an Internet facing application, at Toronto Hydro’s request and cost, the Vendor shall or cause its subcontractors to provide Toronto Hydro (at least semi-annually) a summary attestation from a vulnerability threat assessment test or such other testing demonstrating that the Internet facing application has no material security vulnerabilities. The attestation report must include, at a minimum, a definition of how the vulnerabilities are rated (e.g., high / medium / low, serious / moderate / minimal) and evidence that the application has no open vulnerabilities at the highest rating and shows the number of vulnerabilities at any lower ratings. The vulnerability threat assessment shall be performed by an assessor mutually agreed to by Vendor and Toronto Hydro acting reasonably.

(e) Toronto Hydro may provide Vendor with test data that is approved for use within its development and test environments. Vendor agrees that no other TH Data will be used by Vendor or its subcontractors in development and/or test systems unless authorized by Toronto Hydro.

(f) Vendor shall and shall require its subcontractors to maintain and enforce retention policies for any and all reports, logs, audit trails and any other documentation that provides evidence of security, systems, and audit processes and procedures.

(g) Vendor shall and shall require its subcontractors to implement procedures to ensure that, upon termination of employment or affiliation with Vendor or its subcontractors, each Authorized User's ability to access TH Data is terminated, any and all TH Data being temporarily held by such Authorized User for the provision of the Services is returned to Vendor and such Authorized User is reminded of his or her continuing obligations with respect to the confidentiality of the TH Data.

9. **Improvements**.

(a) If, in the opinion of the Chief Security Officer of Toronto Hydro (or equivalent), acting reasonably, there is a real risk of the loss of or improper, unauthorized or unlawful access to, use of, destruction of, or disclosure of TH Data, Toronto Hydro may, in addition to any other rights it may have under the Agreement, suspend the Agreement until such risks are mitigated to the satisfaction of Toronto Hydro, acting reasonably. If the parties cannot agree, within 15 days, on a timeline for the implementation of remedial action to mitigate such risks, Toronto Hydro may terminate this Agreement pursuant to Section 7 of the Agreement. The parties agree to discuss in good faith, responsibility for the costs of any such correction of deficiency or improvement.

(b) If Vendor proposes to materially modify the process, method or means by which TH Data is stored, accessed or otherwise transmitted or handled, Vendor shall provide Toronto Hydro at least ninety (90) days prior written notice. Toronto Hydro shall have the right, acting reasonably, to determine if the modifications represent unacceptable risks to TH Data and to prohibit Vendor from implementing any such material modification until such time as the risks can be mitigated or an alternate provider of the services under the Agreement can be found.

10. **Assurance and Assistance**.

(a) Toronto Hydro’s rights under paragraph 8(a) of this IPPCR may be exercised by an authorized representative of Toronto Hydro who enters into a confidentiality agreement with Vendor in a form acceptable to Toronto Hydro and Vendor acting reasonably or by the IPC or other regulator with jurisdiction.

(b) Vendor acknowledges that Privacy Laws and regulatory requirements to which Toronto Hydro is subject may change during the term of the Agreement. Vendor shall:

(i) vary or eliminate any practice that causes Toronto Hydro to be in violation of Privacy Laws; and

(ii) provide information and assistance to Toronto Hydro, acting reasonably, that Toronto Hydro requires for privacy impact assessments and threat risk assessments, and/or any other purposes as reasonably required by Toronto Hydro in relation to cybersecurity controls protecting TH Data.

11. **Security Incidents**. Vendor shall notify Toronto Hydro promptly of a Security Incident and, in any case, within 24 hours of the Vendor becoming aware of a Security Incident pertaining to Personal Information, and in any case within 72 hours of becoming aware of any other Security Incident. In the event that Vendor notifies Toronto Hydro of a Security Incident or the Vendor is notified by Toronto Hydro or any third party of a Security Incident, Vendor shall and shall cause its Authorized Users and subcontractors to:

(a) fully cooperate with Toronto Hydro and its third-party advisors in investigating and resolving the vulnerability giving rise to the Security Incident;

(b) provide Toronto Hydro with information regarding: (i) the Personal Information that is the subject of the Security Incident; (ii) the names and contact information (if known) of individuals who may be affected by the Security Incident; (iii) the steps taken to contain the Security Incident and to mitigate any harm to individuals as a result of the Security Incident; and (iv) any remedial actions taken to prevent further occurrences of the Security Incident;

(c) fully cooperate with Toronto Hydro with respect to: (i) reporting the Security Incident to the IPC and any other governmental authority with jurisdiction; (ii) answering all inquiries of the IPC and any other governmental authority with jurisdiction; (iii) providing notification to individuals affected by the Security Incident; and (iv) providing notification or reports to other third parties who may assist in mitigating the possible harm to affected individuals.

Unless otherwise required by applicable Privacy Laws or other laws, the decision whether to make a report to the IPC and any other governmental authority or to notify individuals and third parties, and the content of any such reports and notifications shall be solely at the discretion and direction of Toronto Hydro.

12. **Individual Access Requests**. Vendor shall and shall cause its subcontractors to:

(a) notify Toronto Hydro promptly of any request by an individual for access to or correction of Personal Information that is about that individual and promptly follow all instructions provided by Toronto Hydro with respect to responding to such requests;

(b) cooperate with Toronto Hydro by:

(i) furnishing it with complete information concerning Vendor's access and use of Personal Information, including responding, if requested to do so, to any inquiry by a privacy regulatory authority and/or to any complaint; and

(ii) cooperating in the conduct of any regulatory or court proceedings arising out of a complaint relating to the management of Personal Information, including attending hearings and assisting in securing and giving evidence and obtaining the attendance of witnesses.

13. **Judicial or Governmental Requests**. Vendor shall notify Toronto Hydro promptly of any request, order, subpoena, or warrant from a domestic or foreign court or governmental authority (including domestic or foreign law enforcement) for access to or the production of all or any part of the TH Data stored by Vendor or its subcontractors, unless Vendor or its subcontractors is prohibited from doing so by a court or governmental authority with jurisdiction over Vendor, its subcontractors or the TH Data. At Toronto Hydro's expense, Vendor shall, if requested to do so, provide reasonable assistance to Toronto Hydro in objecting to access to or the production of all or part of the TH Data.

14. **Return of TH Data**. Upon the termination or expiry of the Agreement (for any reason), Vendor shall and shall cause each subcontractor to forthwith return to Toronto Hydro, as directed by Toronto Hydro, all TH Data, with the exception of file server backups, being stored by Vendor or its subcontractors or, at Toronto Hydro's option, destroy all such TH Data as directed by Toronto Hydro (including any copies thereof), and provide Toronto Hydro with an officer's certificate attesting to such destruction. Any TH Data stored on file server backups will remain encrypted for one (1) year following the date

of the last file server backup performed by the Vendor upon which the Vendor or its subcontractors will destroy all such TH Data, and upon request, provide Toronto Hydro with an officer's certificate attesting to such destruction. Vendor shall not access any archival copies retained (including file server backups) except in accordance with the terms of this Agreement.

15. **Indemnification**. Vendor shall, at its own expense, defend, indemnify and hold Toronto Hydro harmless from and against any and all claims, suits, demands, actions, damages, losses, liabilities, proceedings, litigation, costs and expenses, including reasonable legal fees, relating to or arising out of this IPPCR, resulting from a claim by a third party that arises out of or is related to a fact or circumstance involving (i) any misrepresentation or breach of warranty made by Vendor or its subcontractors or (ii) any breach of this IPPCR by Vendor, Authorized Users or Vendor's subcontractors. The right to indemnification in this section 14 is in addition to any right to indemnification in the Agreement.

16. **Survival**. Notwithstanding the termination or expiry of the Agreement, Vendor shall and shall cause each subcontractor to continue to govern itself in accordance with this IPPCR and the obligations of Vendor under this IPPCR shall survive the expiry or termination of the Agreement until Vendor and each subcontractor no longer has custody or access to the TH Data and has destroyed all copies of the TH Data in accordance with this IPPCR.

17. **Notices**. Any notice required in this IPPCR to be provided to Toronto Hydro shall be made in writing to:

Privacy Officer, Toronto Hydro-Electric System Limited

Address: 14 Carlton Street, Toronto Hydro, ON M5B 1K5
Telephone: (416) 542-3000
Email: legal@torontohydro.com

RENEWAL AND AMENDING AGREEMENT

THIS RENEWAL AND AMENDING AGREEMENT (the "Amending Agreement") is made effective as of June 1, 2022 (the "Effective Date") between **ELEMENT ENERGY LIMITED** (the "Consultant") and **TORONTO HYDRO-ELECTRIC SYSTEM LIMITED** ("Toronto Hydro").

WHEREAS:

1. Toronto Hydro and the Consultant (each a "Party" and collectively, the "Parties") previously entered into an agreement for professional consulting services dated February 7, 2022 (the "Consulting Agreement"), pursuant to which the Consultant would develop a future energy scenarios model (the "FES Model"), as well as related services related to maintenance of the model, stakeholder engagement on behalf of Toronto Hydro, and weather correction of network data (the "Services");

2. The Parties hereto wish to amend the Consulting Agreement to clarify the scoping requirements related to the FES Model, set out related changes to pricing, implementing a change request process, and renewing the term of the Consulting Agreement for a further one (1) year, as more particularly set out herein;

NOW THEREFORE, THIS AMENDING AGREEMENT WITNESSES that in consideration of the mutual covenants contained herein and for other valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Toronto Hydro and the Consultant agree as follows:

1. Any capitalized terms used but not defined herein shall be as defined in the Consulting Agreement, where applicable. The recitals above are agreed by the Parties to be true and deemed to form part of this Amending Agreement as if specifically restated herein.

2. The first paragraph to section 1(a) Future Energy Scenarios Model of SCHEDULE A of the Consulting Agreement is hereby deleted and replaced with the following:

   Toronto Hydro requires the development of a future energy scenarios model <u>(the "FES Model")</u> that produces scenario-based 2050 forecasts for peak load (kVA), generation (kW), and energy consumption (kWh). The model will be used to understand the range of possible future energy scenarios in order to inform capacity-driven investment, grid modernization investment, as well as revenue forecasting.

3. The Parties agree to utilise one (1) of the Renewal Terms set out in section 3.2 of the Consulting Agreement, and to renew the Term outlined in section 3.3 of the Consulting Agreement until February 6, 2024.

4. The following is hereby inserted as subsection 1(b.1) to SCHEDULE A of the Consulting Agreement. For greater clarity, the newly added subsection 1(b.1) shall be inserted following subsection 1(b) but prior to subsection 1(c) of SCHEDULE A of the Consulting Agreement:

   <u>(b.1) On-Premise Hosting Requirements</u>

   <u>**Phase 3: On-Premise Hosting**</u>

   <u>The Consultant shall further ensure that the model be hosted and deployed at Toronto Hydro's premises. In addition to the per-phase requirements and other components of the Services described in this SCHEDULE A, Consultant shall ensure the FES Model shall adhere to the specifications set out in APPENDIX A.1 – On-Premises Hosting Requirements attached to this SCHEDULE A of this Agreement.</u>

5. The document attached hereto as Appendix 1 to this Amending Agreement is hereby appended as APPENDIX A.1 – On-Premises Hosting Requirements to SCHEDULE A of the Consulting Agreement. For greater clarity, APPENDIX A.1 shall form part of SCHEDULE A to the Agreement and shall not constitute an independent schedule.

6. Section 2(a) of SCHEDULE A of the Consulting Agreement is hereby deleted and replaced with the following:

a) Model Fees

In exchange for the Services set out in Section 1 of this SCHEDULE A (and in particular, subsections (a), (b), (c), (d), (e), and (h) thereto), and APPENDIX A.1 to this SCHEDULE A, Toronto Hydro shall pay the Consultant the following Fees on a milestone basis, as more particularly set out in the tables below:

PHASE 1		
Milestone #	**Description**	**Fixed Cost/Fee ($)**
MS 1:	Kick-off meeting	[redacted]
MS 2:	Initial round of stakeholder engagement conducted	
MS 3:	Final round of stakeholder engagement (internal and external) completed	
MS 4:	Final scenarios with associated documentation to Toronto Hydro	
TOTAL		

PHASE 2		
Milestone #	**Description**	**Fixed Cost/Fee ($)**
MS 1:	Kick-off meeting	[redacted]
MS 2:	Present proposed approaches for customer archetypes, geographical distributions, profile shapes and load factors to Toronto Hydro	
MS 3:	Provide preliminary model outputs to Toronto Hydro for review	
MS 4:	Final EELG model with associated documentation to Toronto Hydro	
TOTAL		

PHASE 3		
MS 3.1:	All resources set up and Element Energy able to access all required aspects of TH IT environment	[redacted]
MS 3.2:	Initial adaptation of subset of model functionality to enable trial deployment on TH premises completed	
MS 3.3:	Fully adapted model deployed to Dev environment with deployment steps documented	
MS 3.4:	User Acceptance Testing (UAT) completed	
MS 3.5:	Model Go-Live completed	
TOTAL		

TOTAL PROJECT COST (PHASE 1 & PHASE 2, & PHASE 3)	[redacted]

Weather Correction of Network Data		
Rate	Weather correction (annual or on a frequency prescribed by Toronto Hydro)	[redacted]

PROJECT TOTAL	[redacted]

7. Section 2(c) of SCHEDULE A to the Consulting Agreement is hereby deleted and replaced with the following:

c) Additional Services Fees

In addition to the Fees and Services further set out above, Consultant shall, at Toronto Hydro's sole option and express request, further assist Toronto Hydro by providing the following Services:

i. Providing assistance with respect to any external discussions, as more particularly set out in section 1 of this SCHEDULE A above (and in particular, subsections (e) and (g) thereto);
ii. Ad-hoc Services with respect to the functionality of the FES Model as may otherwise be agreed upon in writing between Toronto Hydro and the Consultant, including, but not limited to:
   a. Extensions of phase 1 of the Services as described above, including the building of more iterations or updates to the FES Model outputs, as may be required by Toronto Hydro for senior management review and approval;
   b. The provision of more detailed documentation as may be required by Toronto Hydro;
   c. The operation of different output scenarios and generation of additional reports as may be required by Toronto Hydro; and
   d. Other additional services as may be agreed upon by Toronto Hydro and the Consultant in writing.

For all additional Services as described under this subsection 2(c), Toronto Hydro shall compensate the Consultant on a time and materials basis in accordance with the following rates, as applicable, for each of Consultant's personnel:

Rate card		
Rate ID	**Role / Description**	**Hourly rate ($)**
Rate 1:	Partner	[redacted]
Rate 2:	Principal Consultant	
Rate 3:	Senior Consultant	
Rate 4:	Consultant	

With respect to the Services described in subsection 2(c)(ii) above only, where such additional Services require a material change in the scope or implementation of the Services, the parties shall document such change through entering into a change request in the form prescribed in APPENDIX A.2 to SCHEDULE A of this Consulting Agreement. No obligations shall exist with respect to the additional Services until such change request has been executed by an authorised representative of both parties.

8. The document attached hereto as Appendix 2 to this Amending Agreement is hereby appended as APPENDIX A.2 – CHANGE REQUEST FORM to SCHEDULE A of the Consulting Agreement. For greater clarity, APPENDIX A.2 shall form part of SCHEDULE A to the Agreement and shall not constitute an independent schedule.

9. All other terms and conditions of the Consulting Agreement remain continuously in full force and effect, unamended and shall be deemed to apply to this Amending Agreement.

10. This Amending Agreement, together with the Consulting Agreement, shall hereinafter constitute the entire agreement between the Parties with respect to the Services as further described in the Consulting Agreement, and supersedes any and all other agreements, understandings, discussions, negotiations, representations and correspondence which may have been made by or between the Parties respecting the same.

IN WITNESS WHEREOF the Parties hereto have executed this Amending Agreement as of the date first written above.

ELEMENT ENERGY LIMITED

Per: ______________________________

Name: Mark Hughes

Title: Partner

I have the authority to bind the Consultant.

TORONTO HYDRO-ELECTRIC SYSTEM LIMITED

E.Lyberogiannis

Per: ______________________________

Name: Elias Lyberogiannis

Title: Executive Vice President, Planning, Chief Engineering & Modernisation Officer

I have the authority to bind Toronto Hydro.

Appendix 1 to this Amending Agreement

APPENDIX A.1 – On-Premises Hosting Requirements

[please see attached]

TH - FES Model -
Phase 3 On Premise

elementenergy
an ERM Group company

APPENDIX A.1

On-Premises Hosting Scope Requirements: FES Model for Toronto Hydro

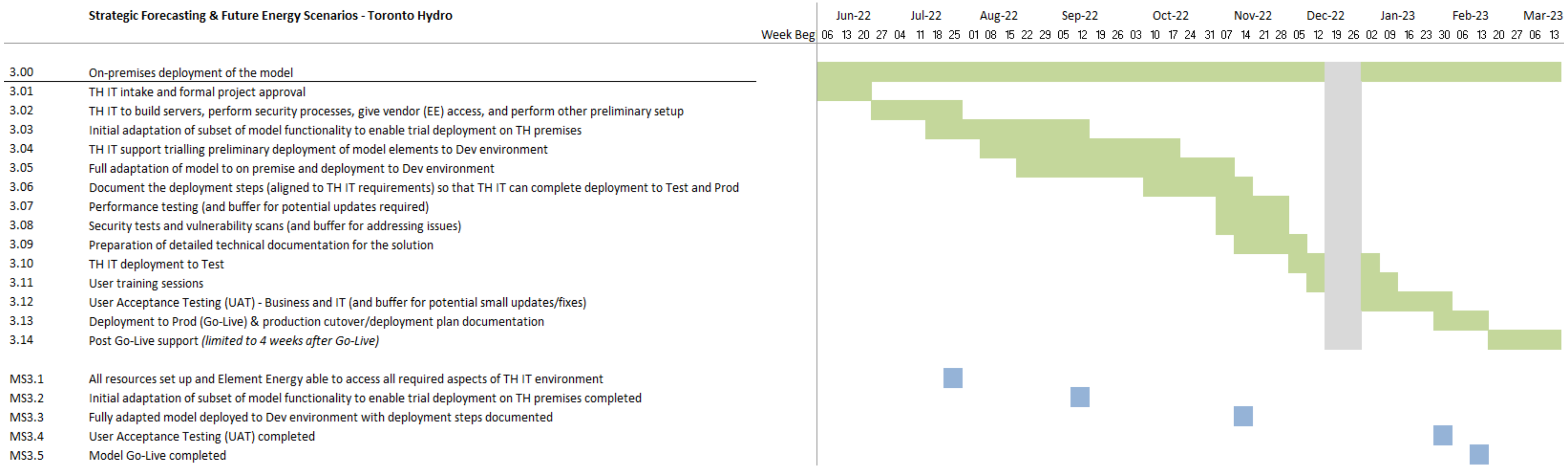
Authors: Rebecca Feeney Barry (Element Energy), Madhushan Perera (Element Energy), Mark Hughes (Element Energy)
Date: 27-06-2022

Project Summary

Topic	Details
Application/System Name	Future Energy Scenarios (FES) Model
Brief Summary including interfaces (if any)	Hosted on Toronto Hydro premises. The FES Model is a strategic load forecasting system. It is used to view and run scenarios of load, generation, and storage growth to 2050. The application is accessed via a bespoke web interface available on Toronto Hydro's intranet.
Number of Users	1 – 3
User Location	Within Toronto Hydro
Hours of Operation	TBD

Draft On-Premises Deployment Timeline

The below Gantt illustrates the extension to the original project timeline and outlines the set of high-level steps and requirements to deploy the solution on Toronto Hydro premises. In conjunction with Toronto Hydro's IT team, the model deployment timeline will be further refined. It is expected that tasks that are predominantly led by the Toronto Hydro IT team (i.e. 3.01, 3.02, 3.04, 3.10, 3.13) will require only minimal effort / time from Element Energy. Should this not be the case, the timeline and allocated budget will need to be reviewed accordingly. Additionally, many tasks are also likely to require significant joint effort from both teams (i.e. 3.06 to 3.09); time will need to be made available to progress these tasks together (e.g. task 3.08 will require dedicated time from Toronto Hydro's IT team to aid the resolution of issues as they arise based on the conducted security tests by Toronto Hydro).



The table below lays out each task, aligned to the Gantt above:

Task Number	Task
3.01	TH IT intake and formal project approval
3.02	TH IT to build servers, perform security processes, give vendor (EE) access, and perform other preliminary setup

3.03	Initial adaptation of subset of model functionality to enable trial deployment on TH premises
3.04	TH IT support trialling preliminary deployment of model elements to Dev environment
3.05	Full adaptation of model to on premise and deployment to Dev environment
3.06	Document the deployment steps (aligned to TH IT requirements) so that TH IT can complete deployment to Test and Prod
3.07	Performance testing (and buffer for potential updates required)
3.08	Security tests and vulnerability scans (and buffer for addressing issues)
3.09	Preparation of detailed technical documentation for the solution
3.10	TH IT deployment to Test
3.11	User training sessions
3.12	User Acceptance Testing (UAT) - Business and IT (and buffer for potential small updates/fixes)
3.13	Deployment to Prod (Go-Live)
3.14	Post Go-Live support (limited to 4 weeks after Go-Live)

Note: System Integration Testing is out of scope and not shown in the project plan above.

The table below lays out each milestone, aligned to the Gantt above:

Milestone Number	Description	Associated Deliverable(s)
MS3.1	All resources set up and Element Energy able to access all required aspects of TH IT environment	[TH] Element Energy user accounts with access to all required components of TH IT environment.
MS3.2	Initial adaptation of subset of model functionality to enable trial deployment on TH premises completed	[EE/TH] Successful test / proof-of-concept deployment of a subset of model functionality in TH Dev environment.
MS3.3	Fully adapted model deployed to Dev environment with deployment steps documented	[TH/EE] Installation/configuration and deployment document including updated technical documentation (e.g. architecture diagram).
MS3.4	User Acceptance Testing (UAT) completed	[EE] UAT test cases, [TH] two rounds of UAT, [TH] sign-off to proceed to Go-Live
MS3.5	Model Go-Live completed	[TH/EE] Production cutover/deployment plan and documentation of steps

Model Data Requirements

The below lists give an overview of the key data inputs that are used in the load model itself. It should be noted that the validation of data and its incorporation into the model will be conducted prior to the on-premises deployment of the model and so are out of scope for this document. For further details on testing and validation, please see subsection "Full Diagnostic Testing of the Load Model" under "Reference notes".

Please note that when the model is deployed on Toronto Hydro premises, there will be no data integration within the scope of deployment. The data will be imported to the on-premises database using a data import script provided by Element Energy in a one-time annual data upload. If the model needs to be refreshed or updated, the input data in the database will be fully replaced.

Network Topology

- Network topology for all assets to be included in the model and mapping between levels.
- List of distribution transformers, with associated customer counts, locations, and connectivity.
- Load transfers to be incorporated into the base topology.

Demand

- Hourly monitored demand data for all substations (terminal stations and terminal station buses) for the most recent full year.
- Total units distributed, annual total and per hour if available, split into customer categories if available, for the most recent full year.
- List of new demand connections with demand type, capacity (kW), start year, connectivity.
- Hourly load for high voltage (HV) customers with demand type and connectivity.

Generation & storage

- List of known distributed generation and energy storage installations across the network with technology type, capacity (kW), connectivity.
- List of distributed generation and energy storage pipeline data with technology type, capacity (kW), start year, connectivity.
- Half-hourly monitored generation data per generator (or generation type) for the most recent full year.

Other

- Historic temperature data for Toronto.
- Profile shapes and load factors for DERs and net zero drivers.

System Requirements

Component	Requirements

Virtual machines	• 2 Linux machines, one hosting the UI and one for the backend API which runs the model.
	  o The backend API machine: 8 vCPUs and 32GB of RAM.
	  o The frontend machine: estimate of 4 vCPUs and 8GB of RAM (this will require testing).
	• These two machines communicate via an API hosted by the backend machine.
	• Red Hat Enterprise Linux v8/v8.2 is supported for the Linux Operating System.

Databases	• 2 SQL Server databases, one for the UI (Django web application), and one for the backend API.
	  o The UI database is likely to be small (<100MB), and it is expected that the backend data base be larger (<500MB).
	  o Microsoft SQL Server 2017 configured with Always On Availability Groups is supported.

Object storage	• Azure blob storage is normally used to store results in CSV and Parquet format, in a location that can be accessed by both the UI and backend model machines.
	  o An initial volume requirement for this is 200GB.
	  o Should Toronto Hydro wish to use NAS File based storage, this can be acceptable and supported (instead of Object/Blob storage) but will require some code changes within the model.
	  o The protocol to connect to the NAS (e.g. NFS, CIFS) will need to be investigated further in conjunction with support from Toronto Hydro's IT team (including any best practices here).

Frontend access	• The UI VM hosts a web application which needs to be accessible to TH users via the TH intranet. • The webserver the model development team normally uses is Nginx, which runs in docker on the same VM as the UI. o The configuration of the application to allow Toronto Hydro users to access it via their intranet will need to be investigated further in conjunction with support from Toronto Hydro's IT team.
Deployment	• Docker images are deployed to the Azure container registry, and these are pulled by start-up scripts on the virtual machines. • The Docker platform will need to be installed and configured. o To determine how best to deploy docker images to the servers without an Azure container registry, further investigation is required in conjunction with support from Toronto Hydro's IT team.
Authentication	• Utilise Azure AD (or TH ADFS) for authentication; to implement OAuth 2.0 Authorization against Toronto Hydro's OAuth Provider (Microsoft Active Directory Federation Services), further investigation is required in conjunction with support from Toronto Hydro's IT team.
Test/development environment	• A development/test environment will be built such that new versions of the application can be tested prior to deployment. o Two separate environments will be built: one for test QA, and one for production.

Backups/resiliency	• Azure backup services will be used for backup of the databases, virtual machines, and model outputs. o Should Toronto Hydro wish to back up the databases using Native SQL Server tools (which will have the capabilities of doing point in time restores and servers backing up daily via snapshot based host level backups), this should be suitable.
Dependency Software	• To identify software to be pre-installed in the TH servers, further investigation is required in conjunction with support from Toronto Hydro's IT team to compile a list of requirements. • Based on current knowledge, no software licenses are needed. o Should any software need to be procured and/or licensed by Toronto Hydro, further investigation will be conducted in conjunction with support from Toronto Hydro's IT team.
Software	• The software to be deployed will be the "Strategic Forecasting System" application. Docker software will be required on the servers, as the application is run inside a Docker container. o Further investigation alongside Toronto Hydro's IT team is required to understand what dependency software may be required and how it will be sourced to be used in this project deployment.
Hardware Dependency	• The servers, databases, and file storage are required.
Access	• The Element Energy team will require SSH access to the VMs and access to the file storage in order to configure and test the solution. o This can be via a VPN or similar; Toronto Hydro's IT team are to provide recommendations on how we access the system.

Performance Expectations

Run time

The development team cannot guarantee the speed until the model is fully set up. For the level of granularity of the model outputs (i.e. terminal station and terminal station bus), the runtime should still be relatively fast – i.e. the run time should be on the order of seconds for a single site, or minutes when running for all terminal stations. The solution is not suitable for low voltage modelling.

Simultaneous users

An on-premises solution would only allow a small number of simultaneous users (i.e. subject to testing, it is estimated 1-3 concurrent users). We expect that only one “multi-asset” (bulk run of all HV substations) would be able to run at a time. User requests for these model runs will be queued accordingly.

[redacted]

Deployment requirements

TH = Toronto Hydro
EE = Element Energy

Component	TH Responsibilities	EE Responsibilities	Deliverables
Performance testing	• TH may need to implement hardware upgrades should the performance of the initial deployment not be considered adequate after testing.	• Test runtimes for a sample of substations, and for all substations on the Dev system. • Test number of concurrent users for scenario configuration and single asset calculations.	• [EE] Report runtimes and concurrent user support for different model run types on the Dev system.
User training	• TH (i) super users and (ii) general users will undergo a training session of the tool.	• An initial training session with 2-3 model superusers will be hosted prior to user acceptance testing (UAT). • A final training session will be held for a wider group of model users. • Training material / documentation will be provided.	• [EE] Two training sessions held and training material / documentation. • [EE] User manual explaining how to navigate the tool.
User acceptance testing (UAT)	• TH super users will undergo User Acceptance Testing (UAT) to confirm that TH can use the provided functionality before deploying it to all users.	• Develop UAT template for TH super users to utilise and fill out during testing. • Prioritise and respond to TH feedback on the tool (as required).	• [EE] Provision of UAT template. • [TH] Completed UAT template and confirmation to proceed to Go-Live.
Support design	• TH will define the surrounding operational and technical support structure to facilitate effective use of the deployed solution in line with existing Toronto Hydro on-premises hosting IT support procedures. o Regarding the potential Support Model & Service Level Agreement, this will need to be further investigated. For reference, please refer to the "Support Model & Service Level Agreement"	• TBD – potentially Tier 3 support.	• [TH] Defined support model and service level agreement. • [TH] Provision of Tier 1 and Tier 2 Support. • [EE] Provision of Tier 3 Support.

	subsection under "Reference notes" further down in this document. It is likely that TH will provide the Tier 1 and Tier 2 services.		
Communication / Change plan	• TH will put in place their own communication strategy / change plan to allow for future changes to the solution and effectively communicate those changes to the relevant individuals / teams within the business. o E.g. this may be a document which outlines the process to request and approve changes, as well as to communicate these changes to the key internal stakeholders within the business that (i) own the solution, (ii) are required to be informed prior to changes, and (iii) are required to be informed after a change has been implemented.	• EE is happy to support Toronto Hydro with this process. o This support component is to be further investigated to understand if Toronto Hydro have a formal change process to which this application will need to adhere. If not, EE can simply notify application users and a chosen Toronto Hydro IT representative by email prior to any change once the application has gone live. • The previously mentioned EE-hosted training sessions will be a key part of the overall communication strategy.	• [TH] TH communication strategy. • [EE] Training sessions.
Compliance with TH IT Standards	• Ensure the deployed tool undergoes Nexpose and Webinspect security tests and vulnerability scans.	• Address all critical, medium and high priority issues flagged based on CVSS rating, and apply fixes as required. • Develop installation and configuration documentation and provide to TH to setup the Production environment. • Develop technical documentation for the solution implemented.	• [TH] Confirmation of underwent Nexpose and Webinspect security tests and vulnerability scans. • [EE] Installation and configuration documentation. • [EE] Technical documentation for the solution implemented.
Data validation	This will be out of scope at the on-premises deployment stage of the project.		
Functional testing	Phase 2 of the project will include functional testing of the model, including data validation, in-built model testing, and manual QA/QC tests on final outputs. Element Energy will document this testing in Phase 2, with Toronto Hydro's participation. The		

	scope of phase 3 testing will only involve regression testing, which requires re-running all test cases carried out in phase 2 to ensure the on-premise deployment of the model is functioning per requirements from phase 2.
Systems integration testing (SIT)	This will be out of scope at the on-premises deployment stage of the project.
Coding standards	Coding standards are not applicable.
Mobile Application	Mobile application standards are not applicable.

Reference notes

On-premises Deployment & LV Modelling

The below two sets of notes have been agreed by Element Energy and Toronto Hydro regarding the on-premises deployment, which has been confirmed as the path forward for this iteration of the model. Future iterations of the model deployment may consider cloud-based deployment.

On-premises deployment

- An on-premises solution will run more slowly compared to a cloud-based system since there does not exist the same scalability around accessing computing power.
  - A corollary of the above point is that the on-premises solution would not be suitable for modelling LV networks in future, as these require large volumes of parallel computations.
  - Running calculations for all TS's and buses in the network will take longer and it is expected that only one scenario will be able to run at a time. In contrast, via a cloud solution, multiple scenarios could be run in parallel.
- An on-premises solution would only allow a small number of simultaneous users (i.e. subject to testing, it is estimated 1-3 concurrent users).
- These points have been reviewed with Toronto Hydro and these drawbacks were deemed acceptable for the initial deployment of this project.

Future LV modelling (not currently in-scope)

- LV modelling would likely only be possible in the cloud.
  - This can be assessed further after initial deployment of this iteration of the modelling tool, but the current assumption is that it is unlikely that an on-premises solution would be sufficiently capable (particularly considering Toronto Hydro's needs for model run time).
  - The compute requirements for the LV modelling are much more significant. For example, on other projects, this model uses one 120 core VM per model run, with many model runs occurring in parallel, along with an autoscaling database. The ability to achieve comparable runtimes with on-premises hardware is highly uncertain.
- A cloud solution would also enable the model to support more concurrent users and would allow for better performance in general.
  - It would minimise the time that is needed to spend adapting/configuring the model (i.e. adapting the model from on-premises to cloud for LV modelling is expected to be much less time-intensive than potentially amending an on-premises solution to work for LV modelling).

Support Model & Service Level Agreement

The following text is based on what was included in Element Energy's original proposal for this work, describing the support model and potential Service Level Agreement. This proposal was drafted with the context of a cloud-based deployment but has been amended below to reflect support for an on-premises model. Considering that the decision from Toronto Hydro for this iteration of modelling is to deploy on-premises, this support model and service agreement will need to be amended to be adapted for the decided deployment solution. <u>After deployment of the FES Model, Element Energy</u>

and Toronto Hydro will finalize the ongoing support agreement for the model based on the below guidance. The below information is for reference only.

Initial proposal for ongoing support

For the on-premises model, we propose that all support queries will initially be handled by the Toronto Hydro IT help desk. Queries are divided into three Tiers. For Tier 1 we anticipate that support will be delivered by the internal Toronto Hydro IT help desk and will provide the following services:

- Initial support level for basic user issues.
- Provide guidance on simple questions e.g. how to access and navigate the software.
- Handle straightforward issues such as username/password problems and creating new user accounts (we propose that existing Toronto Hydro Active Directory user credentials are used for authentication, so this would be covered by existing IT processes).

This Tier 1 support will be accessed via the standard internal Toronto Hydro IT support channels. Element Energy will provide the Toronto Hydro IT support help desk with the necessary system documentation to be able to address queries of these types.

We propose that Element Energy will handle Tier 2 and Tier 3 level support, though if the system is deployed to a Toronto Hydro on-premises environment, Tier 2 support may be provided by Toronto Hydro's existing IT team should that be the preferred option. Support issues of this nature will be escalated from the internal help desk to Element Energy and charged on a time materials basis as per the day rates provided in the pricing schedule.

Tier 2 support includes:

- More in-depth technical support level.
- Reviews information captured by Tier 1 support personnel.
- Troubleshoots errors by reviewing status of model components and log files.
- Handles global model configuration issues.
- Handles whole system environment and data interface issues.
- Escalates technical model issues to relevant Tier 3 support group.

Tier 3 support includes:

- Most advanced technical support level.
- Reviews troubleshooting logs provided by Tier 1 and Tier 2 support personnel.
- Debugging and error fixing of technical issues in individual calculation modules.
- Answer questions on detailed model queries if not covered by model documentation.
- Liaise with module developer to roll out bug fixes to model users.

How Tier 2 and Tier 3 queries are escalated to the Element Energy support team will depend upon the priority level of the query in question. We split queries into priority levels, and have different response time requirements for each level. Since the forecasting system is not a piece of critical infrastructure, Priority level 1 queries are not supported under this service level agreement. For Priority level 2 or 3 we expect that the help desk will both email and call the nominated Element Energy support contacts to ensure that they are made aware of the issue in a timely fashion. For Priority level 4 an email to the Element Energy helpdesk will be sufficient. The Element Energy help desk will then acknowledge receipt of the issue to the original system user within the response time outlined in the table below. The Element Energy troubleshooting team will then handle the query and aim to resolve the issue within the timeline laid out below.

<table>
<tr><th>Priority</th><th>Response</th><th>Resolution</th><th>Success target</th><th>Availability</th><th>Recovery Time Objective (RTO)</th><th>Recovery Point Objective (RPO)</th></tr>
<tr><td>1</td><td colspan="3">Not supported</td><td rowspan="4">98% available</td><td rowspan="4">Less than 2 days</td><td rowspan="4">Less than 24 hrs</td></tr>
<tr><td>2</td><td>12 hrs</td><td>2 days</td><td>99%</td></tr>
<tr><td>3</td><td>24 hrs</td><td>5 days</td><td>99%</td></tr>
<tr><td>4</td><td colspan="3">Reasonable endeavours</td></tr>
</table>

Full Diagnostic Testing of the Load Model

In parallel with the review by Toronto Hydro, Element Energy will conduct full diagnostic and quality assurance testing of the load model, in order to sense check and validate the outputs as well as testing that all functionality works correctly and that there are no bugs. Input assumptions and functionalities will have been tested and sense-checked when under development, and similarly unit tests already exist in the EELG model and will be added as any new functionality is added. Hence, Element Energy will follow a pre-defined list of quality assurance checks and tests (both manual and automated) to ensure quality of model outputs.

Appendix 2 to this Amending Agreement

APPENDIX A.2 – CHANGE REQUEST FORM

[please see attached]

APPENDIX A.2 -
CHANGE REQUEST F

Change Request #[x]

Change Request Number:	
Toronto Hydro Contact:	
Vendor Contact:	
Requestor:	
Date of Request:	
Priority:	High ☐ Med. ☐ Low ☐

Description of Change: i.e., nature and scope	
Impact of Change: i.e., pricing i.e., schedule/timing	
Reason for Change:	
Ramifications of Change:	Schedule ☐ Staffing ☐ Other ☐ (explain ramifications below)
Toronto Hydro's Responsibilities:	
Vendor's Responsibilities:	

Approval of Change Request		
Toronto Hydro-Electric System Limited		**[INSERT VENDOR NAME]**
Name:		**Name:**
Signature:		**Signature:**
Title:		**Title:**
Date:		**Date:**

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-157

References: Exhibit 2B, Section D4, Appendix B

Preamble:

Toronto Hydro's Future Energy Scenarios utilizes a multitude of external data sources

QUESTION(A):

a) Please complete the following table:

Data Source	Model Input that uses the source	Date that source was published

RESPONSE FROM TORONTO HYDRO (A):

Please see the tables provided in Toronto Hydro's response to interrogatory 2B-Staff-159, part a) and 2B-PP-36, part c). The date for each of the sources is provided within the reference.

QUESTION (B):

b) What is the time period over which Element Energy performed its work to run their model. Please explain the instances where Element Energy did not use the most recently available information. For example, staff note Element Energy references the "City of Toronto 2012 Growth Plan" in Figure 21, where the City of Toronto has published more recent growth plans[1]

[1] The City of Toronto's Official Plan Review notes a 2019 growth plan that came into effect and other related strategies and assessments available since the 2012 Growth Plan. The City's Official Plan Review website is available at https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/official-plan/official-plan-review/

RESPONSE FROM ERM (B):

The first phase of the project, which included all information and data gathering, was conducted between January and July 2022. The data referenced was provided to Element Energy by the City of Toronto and was the latest information available at the time.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-158

References: **Exhibit 2B, Section D4, Appendix A**
Exhibit 2B, Section D4, Appendix B
Exhibit 2B, Section D4, Figure 5
Exhibit 2B, Section D4

Preamble**:**

Figure 3 from Reference 1 is reproduced below.

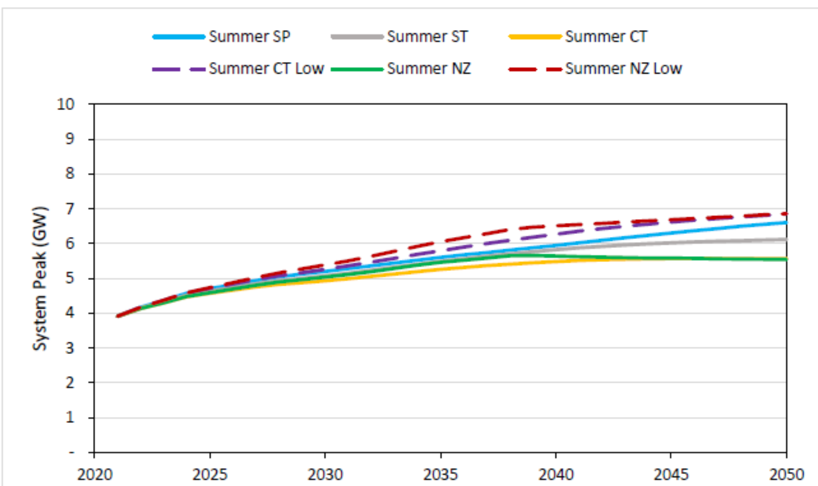
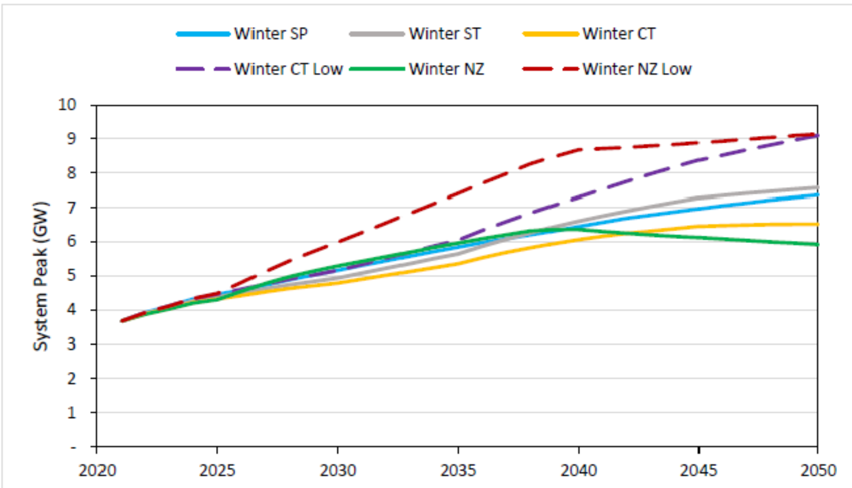
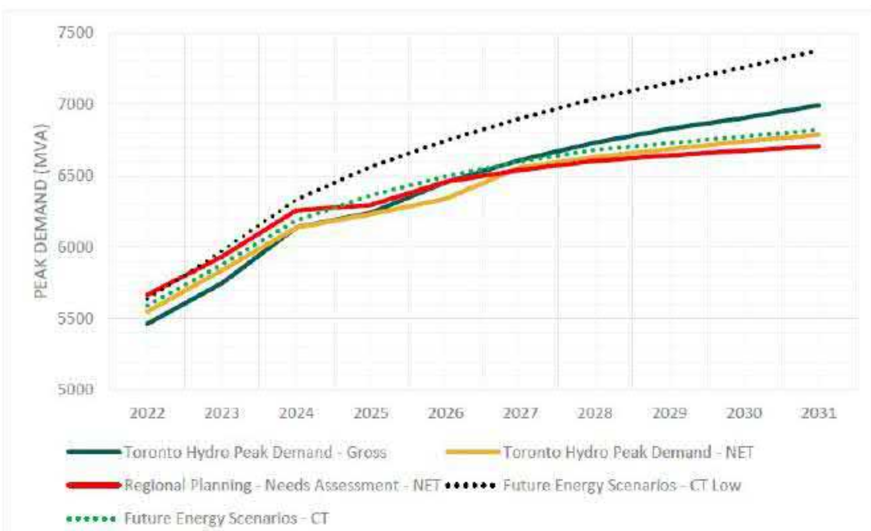


Figure 4 from Reference 1 is reproduced below.



Reference 3 is reproduced below.



QUESTION (A):

a) Please complete the following table for all the years shown in Figure 3 above, with MW values:

Summer System Peak for Scenario Worlds

Peak Load (MW)	SP	ST	CT	CT-low	NZ	NZ-low
2021						
2022						
2023						
2024						
2025						
Through to						
2050						

RESPONSE (A):

Please see Table 1.

Table 1. Summer System Peak (Coincident) for Scenario Worlds (MW)

	SP *(MW)*	ST *(MW)*	CT *(MW)*	CT Low *(MW)*	NZ *(MW)*	NZ Low *(MW)*	Stations *(MVA)*
2021	3,912	3,912	3,912	3,912	3,912	3,912	n/a
2022	4,170	4,144	4,135	4,170	4,135	4,170	n/a
2023	4,366	4,323	4,298	4,368	4,298	4,369	4,905
2024	4,574	4,514	4,472	4,579	4,481	4,589	5,080
2025	4,706	4,632	4,575	4,718	4,591	4,737	5,229
2026	4,817	4,737	4,664	4,842	4,695	4,879	5,383
2027	4,936	4,842	4,753	4,967	4,801	5,024	5,475
2028	5,042	4,931	4,827	5,077	4,896	5,159	5,659
2029	5,123	4,999	4,878	5,166	4,966	5,272	5,835
2030	5,201	5,069	4,932	5,257	5,036	5,385	5,941
2031	5,282	5,148	4,994	5,360	5,109	5,504	6,029
2032	5,363	5,232	5,060	5,467	5,194	5,635	6,136
2033	5,445	5,318	5,128	5,577	5,290	5,779	n/a
2034	5,526	5,405	5,196	5,688	5,380	5,919	n/a
2035	5,604	5,486	5,258	5,793	5,463	6,051	n/a
2036	5,674	5,565	5,316	5,899	5,525	6,169	n/a
2037	5,740	5,637	5,365	5,998	5,586	6,286	n/a
2038	5,809	5,704	5,409	6,093	5,648	6,405	n/a
2039	5,877	5,766	5,449	6,185	5,657	6,471	n/a
2040	5,948	5,823	5,483	6,271	5,644	6,515	n/a
2041	6,021	5,878	5,515	6,355	5,625	6,548	n/a
2042	6,094	5,922	5,537	6,430	5,608	6,582	n/a
2043	6,166	5,960	5,552	6,498	5,596	6,616	n/a
2044	6,237	5,994	5,563	6,562	5,586	6,651	n/a
2045	6,305	6,024	5,573	6,620	5,581	6,685	n/a
2046	6,371	6,045	5,574	6,670	5,573	6,719	n/a
2047	6,433	6,065	5,573	6,719	5,566	6,754	n/a
2048	6,497	6,082	5,570	6,766	5,559	6,790	n/a
2049	6,553	6,100	5,570	6,810	5,553	6,825	n/a
2050	6,606	6,118	5,571	6,854	5,547	6,859	n/a

QUESTION (B):

b) Please complete the following table for all the years shown in Figure 4 above, with MW values:

Winter System Peak for Scenario Worlds

Peak Load (MW)	SP	ST	CT	CT-low	NZ	NZ-low
2021						
2022						
2023						
2024						
2025						
Through to						
2050						

RESPONSE (B):

Please see Table 2.

Table 2. Winter System Peak (Coincident) for Scenario Worlds (MW)

	SP *(MW)*	**ST** *(MW)*	**CT** *(MW)*	**CT Low** *(MW)*	**NZ** *(MW)*	**NZ Low** *(MW)*	**Stations** *(MVA)*
2021	3,671	3,672	3,671	3,671	3,671	3,671	n/a
2022	3,920	3,896	3,886	3,920	3,876	3,920	n/a
2023	4,114	4,072	4,046	4,116	4,029	4,117	4,812
2024	4,318	4,260	4,217	4,324	4,197	4,332	4,988
2025	4,451	4,378	4,320	4,465	4,302	4,481	5,142
2026	4,577	4,494	4,420	4,603	4,541	4,804	5,290
2027	4,730	4,622	4,531	4,760	4,778	5,134	5,383
2028	4,890	4,739	4,631	4,905	4,981	5,443	5,537
2029	5,028	4,834	4,707	5,030	5,143	5,724	5,642
2030	5,163	4,934	4,788	5,163	5,288	5,996	5,699
2031	5,303	5,075	4,901	5,335	5,424	6,266	5,740
2032	5,441	5,218	5,014	5,512	5,559	6,546	5,795
2033	5,578	5,364	5,129	5,694	5,697	6,834	n/a
2034	5,713	5,508	5,241	5,876	5,834	7,117	n/a
2035	5,843	5,646	5,353	6,052	5,963	7,401	n/a
2036	5,979	5,874	5,535	6,334	6,092	7,702	n/a
2037	6,091	6,072	5,686	6,587	6,208	7,980	n/a
2038	6,206	6,259	5,825	6,832	6,320	8,260	n/a
2039	6,322	6,436	5,951	7,069	6,360	8,482	n/a
2040	6,446	6,601	6,065	7,298	6,363	8,682	n/a
2041	6,570	6,753	6,163	7,521	6,305	8,711	n/a
2042	6,687	6,891	6,245	7,748	6,252	8,747	n/a
2043	6,781	7,027	6,312	7,967	6,206	8,790	n/a
2044	6,874	7,157	6,385	8,177	6,162	8,835	n/a
2045	6,966	7,275	6,453	8,375	6,124	8,887	n/a
2046	7,054	7,345	6,478	8,526	6,083	8,934	n/a
2047	7,137	7,411	6,499	8,676	6,043	8,989	n/a
2048	7,218	7,470	6,511	8,822	6,002	9,044	n/a
2049	7,292	7,523	6,516	8,960	5,962	9,096	n/a
2050	7,363	7,577	6,518	9,101	5,921	9,144	n/a

QUESTION (C):

c) Please add the summer and winter peak system load forecasts that underly the investment plan, as shown in Reference 3 to the tables of a) and b), acknowledging that the forecasts of Reference 3 may not be performed through to include 2050.

RESPONSE (C):

Please refer to Tables 1 and 2 as provided above. Please note that the graph referenced in Reference 3 was updated on January 29, 2024.

QUESTION (D):

d) Reference 2 states that the "steady progression" (SP) scenario world is aligned with the TransformTO "Business as Planned" scenario. With Reference 4, Toronto Hydro states that its system peak demand forecast is generally aligned with the Consumer Transformation (CT) scenario. Please articulate the key differences and similarities, as they relate to Toronto Hydro's investment plan, between the SP scenario, the CT scenario, and the forecasts that underly the proposed investment plan in this proceeding.

RESPONSE (D):

The key assumptions used for the SP and CT scenarios are explained in Exhibit 2B, Section D4, Appendix B, Section 2 (pages 3 – 7) while the description of the process for the forecasts that underly the proposed investment plan can be found in Exhibit 2B, Section D4.1.1 (pages 2 – 6).

QUESTION (E):

e) Please articulate how the Future Energy Scenarios (FES) tool has informed system planning for the rate period of this application. How did the FES tool inform capital investments and operations and maintenance plans for this period? How will the FES tool continue to be used moving forward?

RESPONSE (E):

Please refer to response in 3-Staff-274 g), 1B-CCC-30 and Exhibit 2B, Section D4, Appendix A, Section 1.3 (page 4). The FES tool continues to be valuable because it allows Toronto Hydro to identify investments that would be required to reinforce the grid in different scenarios. This capability supports Toronto Hydro's least regrets planning philosophy in that it allows the utility to stress test its Peak Demand Forecast against plausible scenarios to ensure that the utility (1) does not overbuild the system and (2) does not become a barrier to particular decarbonization pathways.

The FES tool may be updated on an as-needed basis when material new information is released.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-159

Reference: **Report of the Board: Renewed Regulatory Framework for Electricity Distributors: A Performance-Based Approach, October, 2012**
Exhibit 2B, Section D4, Appendix B

Preamble:

Reference 1 states that "the output of any methodology will need to be transparent, robust and reproducible, and include forecast information from independent and authoritative sources where these are publicly available."

None of the links in the footnotes in Reference 2 are functioning hyperlinks.

QUESTION (A):

a) Please provide all the links in the report as attachments to the response to this interrogatory. Where the footnote references a data file, provide as xlsx/csv file where it is available in that format from the source.

RESPONSE FROM ERM (A):

Section	Section Heading	Provided Link(s)
Executive Summary	N/A	CER, Canada's Energy Future, 2021 IESO, Annual Planning Outlook, 2022 City of Toronto, TransformTO, 2021
3.2	Local Factors and Customization to Toronto	City of Toronto, About Toronto Neighbourhoods, 2022. *Note that since the time of analysis, some neighbourhoods have been split up because of very high population growth. Effective after April 12, 2022, the number of neighbourhoods in Toronto is 158.*

4.1.1	Core Demand - Archetype Definitions	Statistics Canada, The Census of Population – Neighbourhood Profiles, 2016 Natural Resources Canada, Survey of Household Energy Use Data Tables, 2015 North American Industrial Classification System NAICS & SIC Identification Tools | NAICS Association
4.1.2	Core Demand - Building Stock	Watson & Associates, City of Toronto Development Charge Background Study, 2008 Toronto Data Management Group, Traffic Zones Boundary Files, 2006 (Toronto Hydro's network area covers 677 traffic zones). City of Toronto, SmartTrack Stations Program, 2021
4.1.3	Core Demand - Core Electrical Efficiency	National Resources Canada, Canada-wide Energy Use Dataset | Energy Efficiency Trends Analysis Tables, 2000 – 2018 National Resources Canada, 2015 Survey of Household Energy Use (SHEU-2015) Data Tables , 2015 National Resources Canada, Energy Star | Choosing and Using Appliances With EnerGuide, 2013 Natural Resources Canada, Residential Sector Canada Table 37: Appliance Stock by Appliance Type and Energy Source Toronto Public Health, Protecting Vulnerable People from Health Impacts of Extreme Heat, July 2011 Natural Resources Canada Comprehensive Energy Use Database (2000 – 2018) | Commercial/Institutional Sector – Ontario Natural Resources Canada, Canada-wide Energy Use Database (2000 – 2018) | Total End-Use Sector - Energy Use Analysis Efficiency Canada and Carleton University, Canada's Climate Retrofit Mission, June 2021 City of Toronto, City of Toronto NetZero Existing Buildings Strategy and Technical Appendix, 2021
4.1.4	Core Demand - Flexibility Measures	Ontario Energy Board (OEB), Frequency of Regulated Price Plan Switching Under Consumer Choice, 2021
4.2.2	Low Carbon Heating - Policy Assumptions	The Independent Electricity System Operator, Pathway to Decarbonization – Assumptions for Feedback, March 2022
4.2.3	Low Carbon Heating - Thermal Efficiency	Natural Resources Canada, National Energy Use Database – Ontario, 2018 The City of Toronto, Net Zero Existing Buildings Strategy, May 2021
4.2.4	Low Carbon Heating - Uptake	The Canadian Gas Association, Potential Gas Pathways to Support Net Zero Buildings in Canada, October 2021

	Modelling Results	
4.3.1	Electrification of Transport - Modelling Approach	Government of Canada, Incentives for Zero-Emissions Vehicles (iZEV), April 2022 Statistics Canada, Vehicle registrations by type of vehicle, September 2020 Ontario Data Catalogue, Vehicle Population Data 2016, March 2019 Statistics Canada, New zero-emission vehicle registrations, January 2022 Toronto Transit Commission, Service Summary 2021, January 2022
4.3.2	Electrification of Transport - Cars and Light Trucks	Canada Energy Regulator, Canada's Energy Future, 2021 Bloomberg NEF, Electric Vehicle Outlook, 2021
4.3.3	Electrification of Transport - Medium- and Heavy-Duty Trucks	Government of Canada, Incentives for Medium- and Heavy-Duty Zero-Emission Vehicles Program, July 2022 California Air Resource Board, Medium- and Heavy-Duty ZEV requirement, 2020
4.3.4	Electrification of Transport - Buses	Toronto Transit Commission, TTC Green Initiatives, 2022
4.3.5	Electrification of Transport - Rail	The City of Toronto, Transit Expansion, June 2022
4.3.6	Electrification of Transport - Charging Distribution	Element Energy and WSP Parsons Brinckerhoff, Plug-in electric vehicle uptake and infrastructure impacts study, 2016 Element Energy, Electric Vehicle Charging Behaviour Study, 2019 Statistics Canada, 2021 Census of population, 2021 Toronto Metropolitan University, Household car ownership, 2018 City of Toronto Open Data Portal, Land use zoning by-law, 2022 Element Energy for Transport & Environment, Battery electric HGV adoption in the UK: barriers and opportunities, November 2022
4.3.7	Electrification of Transport - Smart Charging and Vehicle-to-Grid	Element Energy, V2GB – Vehicle to Grid Britain Requirements for market scale-up (WP4), June 2019 Bauman, J. et. al., Residential Smart-Charging Pilot Program in Toronto: Results of a Utility Controlled Charging Pilot, June 2016 IAEE, Driver Experiences with Electric Vehicle Infrastructure in Ontario, Canada and the Implications for Future Policy Support, Fourth Quarter 2020 FleetCarma, Charge the North, 2019
4.4.1	Electricity Generation -	IESO, Active Generation Contract List, June 2021

	Modelling Approach	
4.4.2	Electricity Generation - Solar Photovoltaics	NREL, Solar Futures Study, 2021 OEB, Electricity Rates, 2022 IESO, microFiT Program, 2022 IESO Capacity Auction, 2022 City of Toronto, Physical area of parking lots, 2019
4.4.4	Electricity Generation - Non-Renewables	Ontario Clean Air Alliance, Ontario Municipalities that have endorsed gas power phase-out, March 2021
4.5.1	Energy Storage - Domestic Battery Storage	NREL, Cost Projections for Utility-Scale Battery Storage: 2021 Update, June 2021 KPMG, Development of decentralized energy and storage systems in the UK, October 2016
4.5.2	Energy Storage - Industrial and Commercial Battery Storage	IESO, Hourly Ontario Energy Price, 2022 IESO, Industrial Conservation Initiative Backgrounder, July 2022 IESO, Ancillary Services, 2022

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-160

Refences: Exhibit 2B, Section D5, Page 4
Exhibit 2B, Section D5, Page 69

Preamble:

Regarding Toronto Hydro's forecasted DER penetration, DER caused potential complexity to system operations, and DER hosting and load capacity map.

QUESTION (A):

a) Please provide Toronto Hydro's DER connection policies that are being put into place to limit the complexity and instability caused by DERs?

RESPONSE (A):

Toronto Hydro has clear DER connections guidelines, as outlined in Toronto Hydro's Conditions of Service Reference 3 document. By following these guidelines and working with its customers through the DER Connections process, Toronto Hydro ensures that safety, technical and operating requirements are satisfied with respect to DER connections. This helps the utility manage potential complexities that may be introduced to the grid.

QUESTION (B):

b) Is Toronto Hydro implementing policies to incentivize DER development in areas where the grid has excess capacity, and disincentivize DERs in areas with restricted capacity?
   i. If yes, please provide documentation.
   ii. If no, please explain why this is prudent from a ratepayer and legislative perspective.

RESPONSE (B):

Toronto Hydro supports DER connections in accordance with the Distribution System Code (DSC) and plans to incent DER development by providing customers with better visibility and essential information regarding available capacity (Hosting Capacity Assessment and Maps – Exhibit 2B, Section D5.3.4) so that customers can be well informed about system constraints when planning their DER projects. In addition, through an expanded Local Demand Response initiative as part of the Non-Wires Solution program (Exhibit 2B, Section E7.2) Toronto Hydro continues to offer financial incentives (i.e. capacity payments) for DER resources that can offer demand response services to the grid. This offering includes the development of online DR Capacity Auction tool to make it easier for customers and aggregators to participate in Local DR.

QUESTION (C):

c) Who bears the cost of expenditures needed to enable DER connections on feeders that do not have excess hosting capacity?

   i. Why is this prudent from a ratepayer perspective?

RESPONSE (C):

In accordance with section 3.3.3 of the DSC, system enhancements costs are borne by the distributor rather than by individual customers. Distribution investments to connect, or enable the connection, of Renewable Energy Generation ("REG") facilities to Toronto Hydro's distribution system are eligible for provincial rate recovery under section 79.1 of the *Ontario Energy Board Act, 1998*. Please see Exhibit 2A, Tab 5, Schedule 1 for more information.

QUESTION (D):

d) Does the Hosting Capacity Analysis (HCA) discourage or otherwise inhibit potential DER candidates from connecting to the grid in areas that have capacity constraints? Please discuss.

   i. If not, what is the value to ratepayers of the expenditures required for the HCA?

RESPONSE (D):

Yes. A public-facing HCA map or data portal can potentially discourage DER candidates from connecting to the grid in areas with capacity constraints. This is because the map may show that the local grid cannot support additional DERs without significant upgrades or modifications. Knowing this, potential candidates might choose not to invest in DERs in these areas due to the anticipated costs, delays, or uncertainties associated with grid upgrades.

Conversely, a HCA map can also empower DER candidates by providing them with preliminary information about the grid's capacity. This transparency enables them to make more informed decisions regarding where and how to invest in DER technologies. For example, they might decide to install DER in areas with more capacity or consider smaller systems that fit the existing grid capabilities.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-161

Reference: Exhibit 2B, Section D5.2.1, Page 11

<u>Preamble:</u>

Toronto Hydro writes that it is "adding more sensors, relays and monitoring technology at specific nodes across the distribution grid, including customer meters. These assets will provide additional data collection points across the grid, which Toronto Hydro will leverage to improve overall situational awareness ("grid transparency"), facilitate quicker fault location, and gain access to important insights at the edge of the grid."

QUESTION (A):

a) Please provide several representative examples where Toronto Hydro is proposing to put these sensors and relays and explain why they are being proposed for these locations relative to the rest of Toronto Hydro's territory.

RESPONSE (A):

To clarify, the reference to "specific nodes" is intended to convey the fact that there are various locations within the design of the distribution system (as opposed to the geography) where certain sensors and technologies can provide value. Some examples include:

- AMI 2.0 meters, which provide observability and control at the customer-level;
- Network Condition Monitoring and Control technologies, which provide observability and control on Toronto Hydro's network system; and
- Stations Digital Relays, which provide observability and control at the stations level.

For a comprehensive overview of how these technologies support Toronto Hydro's Grid Modernization Strategy, and how the utility is pacing and prioritizing deployment, please refer to Exhibit 2B, Section D5.2.1 and Sections E5.4, E6.6, and E7.3.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-162

Reference: Exhibit 2B, Section D5.2.1.2, p. 14

Preamble:

"One of the most significant objectives for Toronto Hydro's Grid Modernization Strategy in the 2025-2029 rate period is to advance the ongoing process of readying Horseshoe system feeders for the transition to a self-healing operation beginning in 2030."

QUESTION (A):

a) Please quantify the anticipated improvement in SAIDI and SAIFI after Toronto Hydro transitions to self-healing operations in the Horseshoe region.

RESPONSE (A):

Based on preliminary network simulations, Toronto Hydro estimates that a successful full-scale implementation of Fault Location, Isolation, and Service Restoration ("FLISR"), otherwise referred to as Distribution Automation ("DA"), across the Horseshoe region could deliver improvements in the range of 20% and 25% for SAIDI and SAIFI, respectively.

QUESTION (B):

b) If Toronto Hydro anticipates a material improvement in SAIDI and SAIFI due to self-healing operations, please reconcile the associated investments against Toronto Hydro's strategy of maintaining historic reliability.

RESPONSE (B):

Toronto Hydro expects to realize the improvements from automated FLISR beginning in 2030. Please see response 1B-Staff-175 for more information on Toronto Hydro's reliability objectives related to modernization more broadly.

QUESTION (C):

c) Why is the horseshoe the area of focus versus the downtown or other parts of Toronto?

RESPONSE (C):

Toronto Hydro's Horseshoe and Downtown systems are fundamentally different in design. The Horseshoe area is configured as an open-loop primary system, with many feeder ties (including intra- and inter-station feeder ties) and sectionalizing points which are SCADA-enabled. The Horseshoe system also has a high proportion of overhead feeders, which are exposed to the elements. By contrast, the Downtown system is largely a combination of dual-radial and networked configurations, which are designed to provide a very high degree of day-to-day reliability for high density areas and critical loads. The Horseshoe system, due to its various design features, is substantially less reliable on a day-to-day basis, and is also more exposed to major reliability events due to high winds and ice accumulation. In fact, the Horseshoe system accounts for 76% of total system SAIDI and 89% of total system SAIFI on average.

The system design differences stem from the fundamental trade-off between cost and reliability in distribution system design. The density and criticality of loads in the Downtown area (combined with the fact that space for utilities is at a premium in the urban core) justifies a higher-cost, largely underground system, whereas this is less the case in the comparatively lower density Horseshoe area of the city. FLISR implementation represents an opportunity for Toronto Hydro to stack a proven and cost-effective digital enhancement on top of the existing features of the Horseshoe system in order to deliver a necessary step-change improvement in the long-term reliability, resiliency, and operational efficiency of this system. For more details on FLISR, please refer to Section D5.2.1.2 and D5.3.2.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-163

References: Exhibit 2B, Section D5.2.1.2, Page 15
Exhibit 1B, Tab 3, Schedule 3, App A, Page 30

Preamble:

Toronto Hydro states that a U.S. Department of Energy report on FLISR implement found that "FLISR reduced the number of Cis ("Customers Interrupted") by up to 45 percent and reduced the CMIs ("Customer Minutes of Interruption") by up to 51 percent for a relevant outage event." The footnote indicates that the time basis of calculating momentary outages in the study is different than that used by Toronto Hydro.

QUESTION (A):

a) Please quantify the reported improvement in Toronto Hydro's FLISR metrics if Toronto Hydro uses the same metric definition as in the U.S. Department of Energy Study.

RESPONSE (A):

As detailed in Exhibit 2B, Section D5.2.1.2, Toronto Hydro anticipates substantial benefits from the introduction of automatic FLISR starting in 2030. See response to interrogatory 2B-Staff-162, part (a) for anticipated benefits of a full-scale implementation of FLISR across the Horseshoe Region.

It is important to note that the level of benefits achieved from automatic FLISR will ultimately depend on the specific technical and operating realities with respect to integrating FLISR into Toronto Hydro's existing distribution system. The utility will have a more accurate expectation of likely benefits once it has made substantial progress on the "manual FLISR" implementation planned for the 2025-2029 rate period.

The maximum benefits cited from the U.S. Department of Energy report were derived from feeder-level data collected from 266 FLISR events observed over the course of a year. By comparison, Toronto Hydro evaluated the expected impact of FLISR on its system-wide reliability statistics, meaning that the benefits are statistically diluted by including outages that would not be impacted by FLISR (see 2B-Staff-162 for more information).

QUESTION (B):

b) Please update Table 11 in Reference 2 (PDF Page 364/1113) based on using the same definition of SAIFI for Toronto Hydro and its peers.

RESPONSE (B):

Please note the reliability benchmarking results provided in Table 11, and others in the Reliability Benchmarking Study prepared by Clearspring Energy Advisors, are based on different interruption reporting practices, which are not applied to Toronto Hydro and other distributors in Ontario. Most notably, Toronto Hydro and its peer distributors in Ontario and across Canada follow a one-minute threshold for sustained interruptions, which differs from the predominant five-minute interruption definition used in the US for sustained interruptions, as detailed in Exhibit 1B, Tab 3, Schedule 3, App A, Pg. 25. Based on available data, Toronto Hydro is not able to reproduce Table 11 on a one-minute sustained interruption threshold, however, in order to maintain consistency with the benchmarking approach, it provided its interruption data on a 5-minute sustained interruption threshold, which underpins the information provided in Table 11.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-164

References: Exhibit 2B, Section D5.2.2, Page 28
Exhibit 2B, Section D5.2.2, Page 35
Exhibit 2B, Section E3, Page 14

Preamble:

Toronto Hydro states, in Table 3. Grid Readiness Program Summaries, Technology - Grid protection, Monitoring and Control, "Toronto Hydro has identified and forecasted a number of stations with short circuit capacity limits, capping the amount of DER connections. Additionally, several feeder circuits have surpassed the recommended generation to minimum load ratio..."

QUESTION (A):

a) Which stations have been identified and forecasted to experience short circuit capacity limits in the planning period?

RESPONSE (A):

Please see Exhibit 2B, Section E5.5 at page 7, Table 4.

QUESTION (B):

b) Please expand Table 3 from the second reference to include columns that indicate for each station:
   i. the first year in which its short circuit capacity will be exceed in its present configuration,
   ii. the year in which the bus-tie reactors will be installed,
   iii. the new short circuit capacity once bus tie reactors are installed, and
   iv. the first year in which that capacity will again be exceeded.

RESPONSE (B):

Please see updated Table 3 below.

Table 3: Locations of Proposed Bus Tie Reactors (2025-2029)

Station Name	Bus	Forecasted Year of Capacity Exhaustion	Planned Installation Year	Bus-tie Reactor Size*	Forecasted Year of Capacity is to be exceeded**
Cecil	CE-A1A2	2025	2027	To Be Determined	To Be Determined
Esplanade	X-A1A2	2025	2028	To Be Determined	To Be Determined
Leslie	51-BY	2025	2029	To Be Determined	To Be Determined
Richview	88-BY	2023	2025	To Be Determined	To Be Determined
Runnymede	11-JQ	2025	2026	To Be Determined	To Be Determined
Woodbridge	D6-BY	2023	2029	To Be Determined	To Be Determined

Notes:

(*) – To be determined after HONI study.

(**) – To be determined after bus-tie reactor size is determined.

QUESTION (C):

c) What is the lead time required to acquire and install each of the bus tie reactors planned for the upcoming test period?

RESPONSE (C):

Lead time estimates varies from 1 to 2 years. This includes the feasibility study, procurement, installation and commissioning of the projects.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-165

Reference: Exhibit 2B, Section D5.2.2.4, Page 42

Preamble:

Toronto Hydro states, "As of the end of 2022, Toronto Hydro has 2,424 unique DER connections to its distribution grid with a total capacity of 304.9 MW."

QUESTION (A):

a) Please provide a table that breaks down the DERs connected to Toronto Hydro's system by technology (CHP, solar PV, battery, etc.) type, capacity (MW), customer class, and connected station.

RESPONSE (A):

Please see Tables 1-14 below.

Table 1: Batteries Connected by Station, Customer Class and Capacity (MW)

Station	Customer Class	Capacity (MW)
Basin	Commercial / Industrial	0.500
Bridgman	Commercial / Industrial	0.037
	Residential	0.008
Cecil	Commercial / Industrial	2.000
Esplanade	Commercial / Industrial	1.050
Fairchild	Commercial / Industrial	1.000
Finch	Commercial / Industrial	1.498
John	Commercial / Industrial	0.300
Malvern	Commercial / Industrial	5.200
Manby	Commercial / Industrial	2.365
	Residential	0.003
Rexdale	Commercial / Industrial	0.600

Station	Customer Class	Capacity (MW)
Richview	Commercial / Industrial	1.000
	Residential	0.003
Runnymede	Commercial / Industrial	0.999
Scarborough	Commercial / Industrial	0.999
Sheppard	Commercial / Industrial	1.139
Total Battery Capacity (MW)		**18.7**

Table 2: Bi-Fuel (Natural Gas & Diesel) Connected by Station, Customer Class and Capacity (MW)

Station	Customer Class	Capacity (MW)
Cecil	Commercial / Industrial	1.275
Terauley	Commercial / Industrial	5.400
Total Bi-Fuel (Natural Gas & Diesel) Capacity (MW)		**6.675**

Table 3: Biogas Connected by Station, Customer Class and Capacity (MW)

Station	Customer Class	Capacity (MW)
Horner	Commercial / Industrial	4.700
Sheppard	Commercial / Industrial	0.500
Total Biogas Capacity (MW)		**5.200**

Table 4: CHP Connected by Station, Customer Class and Capacity (MW)

Station	Customer Class	Capacity (MW)
Bermondsey	Commercial / Industrial	0.035
Cavanagh	Commercial / Industrial	0.120
Duplex	Commercial / Industrial	0.035
Ellesmere	Commercial / Industrial	0.755
Fairbank	Commercial / Industrial	0.210
Fairchild	Commercial / Industrial	0.146
Finch	Commercial / Industrial	2.528
Horner	Commercial / Industrial	0.397
Leaside	Commercial / Industrial	0.140
Leslie	Commercial / Industrial	0.375

Station	Customer Class	Capacity (MW)
Manby	Commercial / Industrial	0.525
Rexdale	Commercial / Industrial	0.125
Richview	Commercial / Industrial	0.140
Runnymede	Commercial / Industrial	0.490
Scarborough	Commercial / Industrial	0.390
Sheppard	Commercial / Industrial	0.380
Warden	Commercial / Industrial	0.845
Total CHP Capacity (MW)		**7.636**

Table 5: Diesel Connected by Station, Customer Class and Capacity (MW)

Station	Customer Class	Capacity (MW)
Basin	Commercial / Industrial	5.000
Bathurst	Commercial / Industrial	6.000
Bermondsey	Commercial / Industrial	4.250
Cecil	Commercial / Industrial	1.500
Ellesmere	Commercial / Industrial	5.000
Esplanade	Commercial / Industrial	1.000
Fairbank	Commercial / Industrial	1.350
Fairchild	Commercial / Industrial	0.900
Horner	Commercial / Industrial	1.200
John	Commercial / Industrial	4.050
Leaside	Commercial / Industrial	9.350
Leslie	Commercial / Industrial	7.800
Richview	Commercial / Industrial	1.600
Terauley	Commercial / Industrial	8.550
Wiltshire	Commercial / Industrial	0.500
Total Diesel Capacity (MW)		**58.050**

Table 6: Gas Engine Connected by Station, Customer Class and Capacity (MW)

Station	Customer Class	Capacity (MW)
Cavanagh	Commercial / Industrial	0.250
Gerrard	Commercial / Industrial	4.233

Station	Customer Class	Capacity (MW)
Total Gas Engine Capacity (MW)		**4.483**

Table 7: Gas Turbine Connected by Station, Customer Class and Capacity (MW)

Station	Customer Class	Capacity (MW)
Esplanade	Commercial / Industrial	0.750
Total Gas Turbine Capacity (MW)		**0.750**

Table 8: Microturbine Connected by Station, Customer Class and Capacity (MW)

Station	Customer Class	Capacity (MW)
Agincourt	Commercial / Industrial	0.060
Scarborough	Commercial / Industrial	0.035
Total Microturbine Capacity (MW)		**0.095**

Table 9: Natural Gas Connected by Station, Customer Class and Capacity (MW)

Station	Customer Class	Capacity (MW)
Agincourt	Commercial / Industrial	0.220
Bathurst	Commercial / Industrial	20.000
Bermondsey	Commercial / Industrial	0.999
Bridgman	Commercial /Industrial	0.355
Cecil	Commercial / Industrial	6.000
Duplex	Commercial / Industrial	0.342
Esplanade	Commercial / Industrial	7.150
Fairbank	Commercial / Industrial	0.340
Fairchild	Commercial / Industrial	1.750
Finch	Commercial / Industrial	6.829
Horner	Commercial / Industrial	4.000
John	Commercial / Industrial	8.500
Leaside	Commercial / Industrial	7.900
Leslie	Commercial / Industrial	1.250
Richview	Commercial / Industrial	0.540
Runnymede	Commercial / Industrial	18.200
Scarborough	Commercial / Industrial	4.099
Strachan	Commercial / Industrial	1.600

Station	Customer Class	Capacity (MW)
Warden	Commercial / Industrial	0.750
Total Natural Gas Capacity (MW)		**90.824**

Table 10: Photovoltaic Connected by Station, Customer Class and Capacity (MW)

Station	Customer Class	Capacity (MW)
Agincourt	Commercial / Industrial	5.622
	Residential	0.203
Basin	Commercial / Industrial	0.668
	Residential	0.038
Bathurst	Commercial / Industrial	7.115
	Residential	0.503
Bermondsey	Commercial / Industrial	4.299
	Residential	0.387
Bridgman	Commercial / Industrial	0.440
	Residential	0.146
Carlaw	Commercial / Industrial	0.955
	Residential	0.258
Cavanagh	Commercial / Industrial	2.608
	Residential	0.242
Cecil	Commercial / Industrial	0.468
	Residential	0.226
Charles	Commercial / Industrial	0.292
	Residential	0.069
Copeland	Commercial / Industrial	0.208
Dufferin	Commercial / Industrial	1.458
	Residential	0.679
Duplex	Commercial / Industrial	0.198
	Residential	0.151
Ellesmere	Commercial / Industrial	4.837
	Residential	0.401
Esplanade	Commercial / Industrial	0.668
	Residential	0.038
Fairbank	Commercial / Industrial	3.369
	Residential	0.493

Station	Customer Class	Capacity (MW)
Fairchild	Commercial / Industrial	2.801
	Residential	0.488
Finch	Commercial / Industrial	11.702
	Residential	0.491
Gerrard	Commercial / Industrial	0.015
	Residential	0.020
Glengrove	Commercial / Industrial	0.475
	Residential	0.157
Horner	Commercial / Industrial	3.349
	Residential	0.386
John	Commercial / Industrial	0.040
Leaside	Commercial / Industrial	0.919
	Residential	0.441
Leslie	Commercial / Industrial	5.228
	Residential	0.474
Main	Commercial / Industrial	1.274
	Residential	0.265
Malvern	Commercial / Industrial	3.269
	Residential	0.188
Manby	Commercial / Industrial	4.477
	Residential	0.604
Rexdale	Commercial / Industrial	6.251
	Residential	0.223
Richview	Commercial / Industrial	6.018
	Residential	0.409
Runnymede	Commercial / Industrial	2.230
	Residential	0.302
Scarborough	Commercial / Industrial	7.330
	Residential	0.690
Sheppard	Commercial / Industrial	4.990
	Residential	0.841
Strachan	Commercial / Industrial	1.291
	Residential	0.102

Station	Customer Class	Capacity (MW)
Terauley	Commercial / Industrial	0.354
	Residential	0.020
Warden	Commercial / Industrial	3.538
	Residential	0.721
Wiltshire	Commercial / Industrial	0.316
	Residential	0.110
Woodbridge	Commercial / Industrial	0.100
	Residential	0.062
Total Photovoltaic Capacity (MW)		**110.003**

Table 11: Steam Connected by Station, Customer Class and Capacity (MW)

Station	Customer Class	Capacity (MW)
Cecil	Commercial / Industrial	0.500
Strachan	Commercial / Industrial	0.275
Total Steam Capacity (MW)		**0.775**

Table 12: Turbo Expander Connected by Station, Customer Class and Capacity (MW)

Station	Customer Class	Capacity (MW)
Leslie	Commercial / Industrial	1.000
Total Turbo Expander Capacity (MW)		**1.000**

Table 13: Underwater Compressed Air Connected by Station, Customer Class and Capacity (MW)

Station	Customer Class	Capacity (MW)
Strachan	Commercial / Industrial	0.660
Total Underwater Compressed Air Capacity (MW)		**0.660**

Table 14: Wind Turbine Connected by Station, Customer Class and Capacity (MW)

Station	Customer Class	Capacity (MW)
Fairchild	Residential	0.003
Manby	Residential	0.007

Station	Customer Class	Capacity (MW)
Sheppard	Residential	0.003
Strachan	Commercial /Industrial	0.750
Total Wind Turbine Capacity (MW)		**0.763**

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-166

Reference: Exhibit 2B, Section D5, Page 59

Preamble:

With regards Toronto Hydro's commentary around AMI 2.0 and future-proofing the meter to provide over-the air updates.

QUESTION (A):

a) Would updating meters after they are sealed require a re-sealing event?

RESPONSE (A):

No, over-the-air firmware upgrades do not require re-sealing.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-167

Reference: Exhibit 2B, Section D5, Page 30

<u>Preamble:</u>

In order to equip customers with easily accessible and up-to-date information as to where DERs can be accommodated most efficiently, Toronto Hydro has proposed a creation of a Hosting and Load Capacity Map (or equivalent data portal) which will provide estimate available capacity for DER interconnection and load capacity at different locations on the network.

QUESTION (A):

a) Please confirm whether the Hosting and Load Capacity map (or equivalent data portal) will provide estimated available capacity for connections other than DERs (for example, load connections such as EV charging connections).

RESPONSE (A):

Toronto Hydro is currently in the planning phases of these projects and assessing the scope and intricacies involved. As stated in Exhibit 2B Section D5.3.4, the utility will explore opportunities to calculate and present complimentary analyses, including load capacity constraints. The utility's priority remains to ensure that any tools or information provided to customers is accurate, reliable, sustainable (i.e., cost-effective), and aligned with Toronto Hydro's commitment to delivering value-for-money.

QUESTION (B):

b) Please confirm how often the data on the Hosting and Load Capacity Map (or equivalent data portal) will be updated.

RESPONSE (B):

As Toronto Hydro is currently assessing the requirements and developing a plan for this project, the utility cannot confirm how often the Hosting and Load Capacity Map would be updated. Toronto Hydro is currently reviewing industry best practices for similar maps and will use the outcome of this review, along with thorough stakeholder and customer engagement, as input to determine the update frequency.

QUESTION (C):

c) Please provide the "Business Case" or similar document produced by the business unit related to the creation of a Hosting and Load Capacity Map (or equivalent data portal). Please provide any other documentation created by Toronto Hydro that provides an overview of the technical requirements of this map or data portal.

RESPONSE (C):

Toronto Hydro has just begun exploring options for the creation of the hosting and loading capacity maps and therefore no "Business Case" or similar document exists. Toronto Hydro is currently reviewing industry best practices for similar maps and will identify next steps including defining the technical requirements.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-168

Reference: **Exhibit 2B, Section E1.1, p. 1**

Exhibit 1B, Tab 1, Schedule 3, p.5

Preamble:

Toronto Hydro states "In the current rate period, Toronto Hydro's operating parameters shifted from a relatively linear and stable environment to a more dynamic growth-oriented context."

QUESTION (A):

a) Please reconcile the statement above with the negative Total Normalized MVA (% change), and Total Normalized GWh (% change) as shown in Table 5 in Reference 2.

RESPONSE (A):

Reference 1 refers to significant increases in *future* customer demand driven by an unprecedented energy transition that is creating new and expanded roles for electricity within the economy. To gain insight into the challenge posed by the energy transition, Toronto Hydro commissioned an industry leading consumer-choice modelling Future Energy Scenarios study to assess the impacts of different energy transition scenarios on Toronto Hydro's distribution system. The Future Energy Scenarios study (filed in Exhibit 2B, Section D3) reveals that in the next two-three decades, a significant increase in peak demand across all scenarios is expected to occur, including the least ambitious steady progression scenario that falls short of meeting Net Zero 2050 objectives. This outlook is consistent with other leading studies, such as the Independent Electricity System Operator's ("IESO") Pathways to Decarbonization ("P2D") report, which estimates that in a high-growth scenario, in less than 30 years, Ontario could need more than double its electricity generating capacity.

Reference 2 refers to Toronto Hydro load forecast for billing purposes in the 2025-2029 rate term.

Please see response to 1B-PP-18 for the further details.

QUESTION (B):

b) Is the described shift in operating parameters from “linear and stable” to “more dynamic growth-oriented” a key driver of Toronto Hydro’s step-increase in overall capital spending relative to historical spending?

RESPONSE (B):

As noted in Exhibit 2B, Section A at page 2, investing in the performance and long-term viability of an aged, deteriorated, and highly utilized system, while preparing the system to meet the demands of increased electrification, is a key priority of Toronto Hydro’s 2025-2029 Distribution System Plan.

As noted in Exhibit 2B, Section E4.2 on page 15, compared to the current 2020-2024 rate period, there is a shift in the 2025-2029 rate period towards System Access and System Service investments to:

i) keep pace with the demands of customers in a city that is growing, digitizing and decarbonizing its economy, and

ii) prepare the grid for the energy transition that is set to unfold over the next two decades by modernizing the utility’s infrastructure and operations to improve resiliency, enable DER integration and deliver long-term reliability and efficiency benefits to customers.

Please see Exhibit 2B, Section E4 starting on page 15 for a detailed summary of forecast (2025-2029) vs. historical (2020-2024) expenditures by investment category.

QUESTION (C):

c) Does the shift from “linear and stable” to “more dynamic growth-oriented” materially affect the pace of renewal spending? If yes, please explain why.

RESPONSE (C):

When normalized for inflation, the pace of renewal investment in the next rate period is increasing by approximately 25% compared to historical investment levels (see 2B-Staff-69). As summarized in Exhibit 2B, Section E4.2.2 at page 17, this increase is necessary to manage significant safety, reliability, and environmental asset risks, maintain the system in a state of good repair by managing the overall health demographics of assets, and ensure stable and predictable grid performance for current and future customers. Expansion of capacity as part of renewal projects is not a major incremental driver of the proposed level of System Renewal expenditures in this rate filing.

However, Toronto Hydro expects that the shift to a more dynamic growth-oriented context could place incremental pressures on the System Renewal programs and influence the way renewal projects are prioritized. The utility expects that accommodating neighbourhood-level growth due to electrification will require upgrading the capacity of primary cables and conductors, distribution transformers, secondary buses, and protection schemes, which in turn could have cascading effects such as the need to accelerate voltage conversion projects. When Toronto Hydro replaces an asset or rebuilds an area as part of a planned renewal project, it examines the demand in the area to determine whether the new equipment should be built to a larger standard and whether the feeder more broadly requires reconfiguration or load balancing. In a high electrification scenario, a greater share of the allotted System Renewal funding will need to go toward these expansionary costs, in turn reducing the extent to which expenditures are targeted more narrowly at mitigating asset failure risk. In the long-term, Toronto Hydro cannot neglect asset deterioration and asset failure risk, as this would lead to worsening reliability, heightened safety and environmental risks, and an overall backlog of deteriorating assets that would need to be addressed at higher costs in the future. Therefore, in the long-term, under a high electrification scenario, the utility expects the dual drivers of reliability and growth to result in a higher overall need for System Renewal investment.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-169

Reference(s): **Exhibit 2B, Section E1.1, Page 2**
Exhibit 2B, Section E1.2, Page 4
Filing Guidelines for Incentives for Electricity Distributors to Use Third-Party DERs as Non-Wires Alternatives, March 28, 2023, Ontario Energy Board
FRAMEWORK FOR ENERGY INNOVATION: Setting a Path Forward for DER Integration, January 2023, Ontario Energy Board

<u>Preamble:</u>

Toronto Hydro states "Sustainment and Stewardship: Risk-based investments in the renewal of aging, deteriorating and obsolete distribution equipment to maintain the foundations of a safe and reliable gird."

QUESTION (A):

a) Toronto Hydro is proposing to increase its renewal spending by 35% relative to historical levels (reference 2). Please explain the extent to which this overall increase is being driven by any of the following factors:
    - changes in the rate of deterioration of Toronto Hydro's assets
    - a backlog in historically unaddressed renewal needs
    - a change in the deemed acceptable failure risk threshold for specific asset types
    - other reasons.

RESPONSE (A):

Toronto Hydro continues to face asset demographic challenges in operating a mature distribution system. As summarized in Exhibit 2B, Section A3.1, both condition and age demographics identify a number of critical asset classes with significant investment needs over the 2025-2029 period. These needs are driven by various factors, including those listed in the question above. Through its investments in Sustainment and Stewardship, Toronto Hydro is aiming to maintain reliability and asset risk current levels. Toronto Hydro has not materially changed its risk threshold for any major asset classes from the previous rate period. However, as part of the utility's strategy for improving resiliency in parts of the overhead system that are critical and vulnerable to increased adverse weather, Toronto Hydro has reintroduced an Overhead Infrastructure Resiliency segment to allow for targeted relocation and undergrounding (Exhibit 2B, Section E6.5), and this partially explains the increase in the Overhead System Renewal program compared to 2020-2024.

The following paragraphs provide a brief summary of the three major drivers of increases in the System Renewal category: inflation; overhead and underground system health and reliability; and asset deterioration in stations.

Inflation

As discussed and illustrated in Exhibit 2B, Section D2.1.3, and as reflected in the unit cost pressures noted in other interrogatory responses (e.g., 2B-Staff-212), Toronto Hydro has dealt with significant inflationary pressures in the current rate period. Calculating the actual amount by which labour and materials inflation has impacted historical costs at the project level is a data-intensive undertaking. However, using the OEB's inflation factor, in combination with Toronto Hydro's forward-looking inflation assumptions, to adjust all of the expenditures in the 2020-2029 period to 2020 dollars, the utility estimates that 60% of the increase in System Renewal expenditures is due to inflation.[1]

Overhead and Underground System Health and Reliability

The condition of Toronto Hydro's overhead and underground systems has deteriorated since 2018. As shown in Table 2 in Exhibit 2B, Section E2, the percentage of assets on the overhead system that are in HI4/HI5 condition has increased from 6% to 9%. While the underground system percentage is stable at 3%, the projected rate of deterioration is higher looking out to 2029 as compared to the equivalent analysis done in 2018 (i.e., seven percentage points vs. four percentage points of

[1] Toronto Hydro applied the 2021-2023 OEB inflation factors to 2020-2022. The OEB's inflation factors lag actual inflation by approximately two years.

deterioration without investment). Toronto Hydro also notes that the most critical asset on the underground system from a reliability perspective is primary cable. This asset class is not reflected in the condition models, and as discussed in Exhibit 2B, Section E6.2, Toronto Hydro has seen a deterioration in reliability performance for this asset type during this rate period, with customer interruptions increasing from a previous low of 105,000 in 2019 to 199,000 in 2022. For more information, please refer to 2B-Staff-211.

Deterioration in asset condition and performance is partly related to the deferral of volumes of work from the 2020-2024 period. This deferral was the result of inflationary pressures, as well as the need to constrain expenditures in the major renewal programs as a means of balancing-out unanticipated cost pressures from demand-related programs. This is discussed in Exhibit 2B, Section E4.1. In recent years (and continuing through 2025), Toronto Hydro has also been focused on removing transformers at risk of containing PCBs from its overhead and underground systems, and this has diminished the utility's ability to target assets and areas of the system in the worst condition and most at risk of failure.

The Horseshoe area renewal programs are the capital programs that have the most significant impact on the day-to-day reliability of the grid. Toronto Hydro has proposed the minimum pace of investment necessary to manage asset risk and maintain reliability performance over the 2025-2029 period. For full details on the programs, please refer to Exhibit 2B, Sections E6.2 and E6.5 For more information on drivers of increases in the Overhead System Renewal program, please refer to 2B-Staff-219. For a comprehensive discussion on expected changes in asset demographics as a result of Toronto Hydro's 2025-2029 investment plan, please refer to 2B-SEC-44.

Asset Deterioration in Stations

Toronto Hydro also intends to accelerate its investment in the Stations Renewal program beyond the pace set during the 2020-2024 period by 61%. This is in response to a considerable backlog of aging and deteriorating assets, with the goal of securing the long-term reliability performance of these critical asset populations. Table 2 in Toronto Hydro's response to 2B-SEC-44 highlights the condition demographics for key station assets. Additionally, the program is experiencing rising unit costs for MS Switchgear, Power Transformers, and MS Primary Supply projects. For more detailed information on the expenditure increases within the Stations Renewal program, refer to Exhibit 2B, Section E6.6.

QUESTION (B) AND (C):

b) Please provide a copy of Toronto Hydro's internal distribution system planning process and identify how it addresses non-wires solutions. What are the planned changes to the planning process to better address identified non-wires objectives as per References 3 and 4.

c) In the present application did Toronto Hydro evaluate Non-Wires Solutions whenever existing traditional "wires" assets (such as poles, conductor systems, underground cable, transformers, switchgear, etc.) were identified as requiring replacement?

   i. If yes, please provide documentation of some representative evaluations that have been undertaken.

   ii. If no, please explain why not, considering the recent guidance in References 3 and 4.

RESPONSE (B) AND (C):

Toronto Hydro's capacity planning process involves a ground up analysis of system capacity needs, driven by load forecasts, as described in Exhibit 2B, Section D4. Planners pre-screen the types of needs that could reliably be addressed by non-wires solutions based on credible opportunities to defer or avoid capital investment through procurement of non-wires capacity. This pre-screening is based on the size of the capacity need and the ability for Toronto Hydro to aggregate sufficient quantities of dispatchable demand response (DR) to meet this need. For example, granular feeder-level issues are difficult to address using NWS, as the total capacity of dispatchable DR on an individual feeder is rarely sizeable enough to meet the need. On the other hand, station level issues are often driven by capacity requirements that are too large to be reliably and cost-effectively met through DR.

Where appropriate use cases have been identified, the planning process includes a consideration of non-wires solutions at the options analysis phase. Figure 1 below provides a high-level summary of this process.

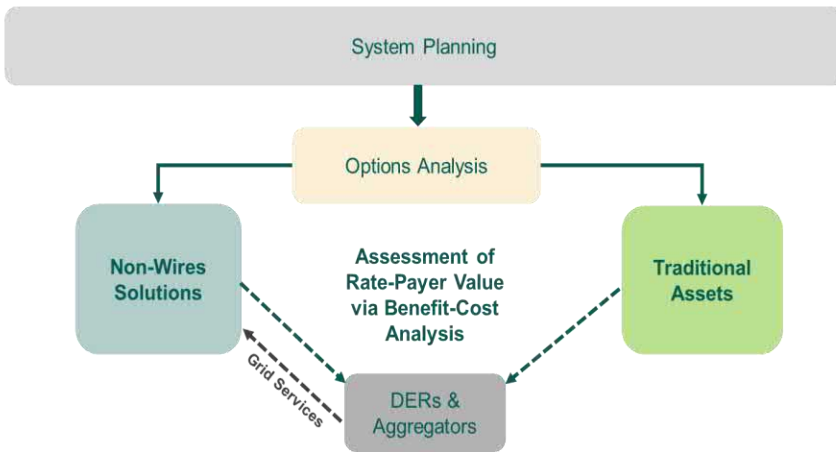


Figure 1. High-level Schematic of Toronto Hydro's Planning Process

Based on experience over the last two rate periods, Toronto Hydro's identified use case of non-wires solutions focuses on capital deferral or avoidance of bus-level load transfers, which can be achieved through the procurement of dispatchable demand response from aggregators or customers. Toronto Hydro also assesses non-wires solutions as alternatives to Station Expansion, as illustrated in the Downsview TS business case at Exhibit 2B, Section E7.2 Appendix A, and discussed in the response to 2B-Staff-253.

In accordance with the use case and the guidance in Reference 3, Toronto Hydro set an ambitious target to procure 30MW of non-wires capacity to defer or avoid approximately 25% of the load transfers that would otherwise be required at the targeted stations in the next rate term. As the NWS market matures, and the ability the procure reliable DER services increases, Toronto Hydro will continue evolve its planning process to identify and develop other credible use cases of non-wires solutions. Please see the responses to 1B-Staff-88 and 1B-Staff-89 for more information.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-170

References: Exhibit 2B, Section 1.1, p. 2
Exhibit 2B, Section E1.2, p. 4

Preamble:

Toronto Hydro states "Modernization: Developing advanced technological and operational capabilities that enhance value and make the system better and more efficient over time."

QUESTION (A):

a) Does Toronto Hydro quantify the expected value enhancement and system efficiency improvements per dollar spent "developing advanced technological and operational capabilities"?
   i. If yes, please provide documentation of value quantifications of representative modernization investments.
   ii. If no, please explain why Toronto Hydro is confident that all of its planned modernization investments cost effectively add value for ratepayers.

   Contextualize your answer in consideration of the proposed 56% increase in System Service spending over the upcoming test period relative to historical as shown in reference 2.

RESPONSE (A):

Yes. While there is no single "value […] per dollars spent" metric, Toronto Hydro undertakes business case evaluations and expected benefits analyses for modernization projects at the appropriate stage prior to release of funding.[1] The exact form of these analyses will vary depending on the type of

[1] Note that for its full-scale programmatic system investments, including segments within the System Enhancements program, Toronto Hydro is in the process of developing a value framework that will eventually support project-based comparison of quantified value. For more information, see Exhibit 2B, Section D1.

investment and the nature of the benefits (e.g., software vs. field technology; pilot vs. full implementation).

For grid modernization field technologies that have reached the level of full-scale implementation (e.g., overhead SCADA switches), investment decisions are handled in the same manner as any other system investment program, i.e., as part of the utility's Investment Planning & Portfolio Reporting ("IPPR") process and associated Scope & Project Development process (refer to Exhibit 2B, Section D1.2 for more information). Through the IPPR process, planners propose investment pacing options which are evaluated on a risk and outcomes basis (using relevant leading and/or lagging indicators). Management assesses trade-offs versus other programs that may achieve (i) similar outcomes in different ways, or (ii) different, but no less important, outcomes (e.g., reliability vs. compliance). This process results in an integrated capital expenditure (and maintenance) plan, designed to achieve an appropriate balance of outcomes within the given financial constraints, leveraging a combination of Growth, Sustainment, and Modernization investments. Throughout this process, Toronto Hydro's objectives for customer-focused outcomes remain tied to objectives established within the applicable five-year Distribution System Plan.

Note that the System Service investment category consists of both Modernization and Growth (Stations Expansion) investments. The largest driver of increases in this category is the accelerated pace of Contingency Enhancement (Exhibit 2B, Section E7.1) – specifically, the deployment of additional SCADA tie and sectionalize points and the introduction of reclosers as part of the broader strategy of enhancing System Controllability & Automation in the Horseshoe, and the longer-term goal of achieving self-healing grid operations in the Horseshoe beginning in 2030. For a full overview of the need for and expected benefits of Toronto Hydro's System Controllability & Automation investments (including various quantified benefits), please refer to Exhibit 2B, Section D5.2.1.2.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-171

Reference: Exhibit 2B, Section E1.2, Page 4

<u>Preamble:</u>

With respect to Table 2: Planned Capital Investment by OEB Investment Category ($ Millions)

QUESTIONS (A) AND (B):

a) Please compare the proposed increase in System Access spending to the historical and forecasts rates of energy and demand growth.

b) Please provide a chart showing actual and forecast trends in System Access spending, peak load demand and annual energy deliveries for each year from 2020 to 2029, expressed in terms of percentage change relative to the prior year.

RESPONSES (A) AND (B):

Please see the table below. Please note that the System Access category is made up of five programs, not all of which relate directly to load growth. In particular, three of the five programs (i.e. (i) the Metering program which also addresses a renewal need, (ii) the Externally Initiated Plant Relocations and Expansion program, which is driven by third-party initiated infrastructure development in the City of Toronto, and (iii) Generation Protection Control and Monitoring program, which is driven by DER connections) have a very limited relation to load. Excluding these three programs, Table 1 below provides the information requested.

With respect to the trends observed in Table 1 below, Toronto Hydro notes that this comparison is not meaningful for a number of reasons.

- First, the system access investments captured below (namely Customer Connections and Load Demand) reflect the targeted and localized system expansion and enhancement investments to ensure timely and efficient connections and service upgrades, and to alleviate capacity constraints to maintain service quality in high-growth areas (e.g., the downtown core and along the transit corridors). As observed in the table, the rate of change of expenditures in these programs can swing significantly from one year to another due to the myriad of factors as noted in the evidence at Exhibit 2B, Section E5.1.3.

- Second, the level of investment in system access is affected by customer contribution rates, which can vary significantly year-over-year based on: (i) the size and location of the connection; (ii) the degree of system expansion required to meet the obligation to serve, (iii) economic evaluations of the customers' load and revenue projections vis-à-vis the cost of expansion, and (iv) the impact of different cost allocation rules under the Distribution System Code amendments.
- Lastly, consistent with the customer connection horizon outlined in the DSC, there is an approximate five-year lag between Customer Connection related investments and energy/demand materialization on the system.

	2021	2022	2023	2024	2025	2026	2027	2028	2029
System Access: Customer Connections & Load Demand Expenditures	105%	-12%	-8%	-9%	43%	7%	-2%	7%	6%
System Peak Demand Forecast	-0.1%	-3.2%	3%	3.6%	2.9%	2.9%	1.7%	3.4%	3.1%
Electricity Consumption (Revenue Forecast)	-0.4%	1.8%	-1.3%	0.0%	-0.9%	-0.2%	-0.1%	0.5%	-0.2%

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-172

References: Exhibit 2B, Section E1.3, Page 5
Exhibit 1B, Tab 5, Schedule 1, Appendix A, Page 5

Preamble:

Toronto Hydro states that: "Toronto Hydro strives to maintain and improve reliability at local, feeder-wide, and system-wide levels by continuously optimizing its system and deploying cost-effective technologies and solutions."

Question (A):

a) Does Toronto Hydro quantitatively evaluate its reliability investments to determine if they are cost neutral or cost reducing?
   i. If yes, please provide some representative benefit-cost analyses.
   ii. If no, please explain how Toronto Hydro determines that its proposed reliability improvement investments are benefit-cost effective.

RESPONSE (A):

Toronto Hydro is unclear as to what is meant by "cost neutral or cost reducing" in the context of "reliability investments." Investments to maintain or improve reliability are typically evaluated through a "least cost" lens. This involves identifying the most cost-effective solutions to achieve desired reliability levels. It prioritizes investments that provide the greatest reliability improvements for the lowest cost. Toronto Hydro achieves this through its outcomes-oriented, programmatic approach to investment planning, which is driven by customer needs and preferences. The utility has a diverse portfolio of established investments across its System Renewal and Service programs which contribute to reliability performance. Through the Investment Planning & Portfolio Reporting process, the utility assesses trade-offs across investment programs and develops an overall expenditure plan that is calibrated within given financial constraints to deliver the best achievable reliability outcomes across relevant time horizons. Note that cost, (including cost-savings from new technology) is a factor in this "least cost" investment planning approach. However, cost is treated as its own variable to be optimized through the planning process. This is achieved by (i) constraining the investment plan within budget parameters, and (ii) updating bottom-up capital and operational cost assumptions to ensure savings from past and future technology deployments are embedded in expenditure plans each year. An example of this would be the operational savings from deploying Network Condition Monitoring & Control technology, which have been embedded in future expenditure plan assumptions for the relevant maintenance program. (See Exhibit 2B, Section E7.3, page 12 for more information.)

As discussed in Section D1.2.1.1, as part of its ongoing multi-year effort to implement an industry leading Engineering Asset Investment Planning ("EAIP") platform, Toronto Hydro is developing a custom value framework which assigns relative value to investments based on their likely contribution to Toronto Hydro's key performance outcomes (including System Reliability). This will further deepen the utility's "least cost" optimization approach by increasing the consistency and objectivity of these evaluations at the project level.

Outside of this programmatic approach to investment planning, the utility also endeavors to offer customers value-for-money by exploring new technologies adopted by the industry, which may be more cost-effective than the current status quo. Toronto Hydro's Product Change Committee reviews and conducts pilot projects to assess the feasibility of new technologies and products. Typically, after a detailed pilot phase, the technology or product is evaluated for its cost-effectiveness in contributing to the utility's objectives, including the improvement of system reliability. For example, following a successful evaluation of mid-line reclosers through multiple pilot projects, the utility is now proceeding to deploy this innovative and cost-effective technology system-wide (Exhibit 2B, Section E7.1). The additional reliability benefits, such as reducing interruption frequency and duration for customers, supplement the remotely operated SCADA switches that Toronto Hydro has used for decades.

QUESTION (B):

b) Has Toronto Hydro identified unacceptable reliability trends relative to its historical performance or its peers? Please explain.

  i. If no, is Toronto Hydro only undertaking reliability improvement investments that are either cost neutral or cost reducing?

RESPONSE (B):

Toronto Hydro views its reliability performance as acceptable, both in comparison to historical data and in competitiveness among its peers. The utility continuously assesses reliability performance and trends relative to historical data, using measures reported on the EDS, as well as internally tracked measures. Toronto Hydro also completed a Reliability Benchmark study as part of developing this rate application, as detailed in Exhibit 1B, Tab 3, Schedule 3, Appendix A. In addition to tracking reliability measures, the utility investigates outages that significantly impact its customers on a weekly basis. In addition to interruptions originating from the distribution system, Toronto Hydro works in close partnership with Hydro One to ensure Loss of Supply events are investigated thoroughly and mitigated through appropriate action.

Toronto Hydro recognizes that on-going investments are required to maintain current levels of reliability performance and developed a plan that largely maintains system reliability over the next rate period while investing in modernization efforts capable of providing reliability benefits over the longer term to manage the impacts of electrification and other pressures and complexities. Please refer to the response to part (a) above, which describes the utility’s programmatic, outcomes-focused, least-cost approach to investment planning.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-173

Reference: Exhibit 2B, Section E1.3, Page 5

Preamble:

Toronto Hydro States: "Expected load changes can impact service consistency and demand requirements for the system. To address this, Toronto Hydro proactively adjusts and expands its infrastructure to optimize reliability and meet evolving customer needs."

QUESTION (A):

a) Please explain how Toronto Hydro evaluates non-wires solutions, for example, to ensure that the capacity of its existing wires assets is being optimally utilized prior to undertaking incremental system investments to expand capacity.
   i. Please provide several representative examples.

RESPONSE (A):

Please see Toronto Hydro's response to 2B-Staff-169 (b) and (c) for an explanation of how Toronto Hydro evaluated non-wires solutions. As described in the Load Demand program, a key tool for meeting capacity needs and ensuring system reliability and efficiency is bus level load transfers (i.e. load transfers between station buses to alleviate overloaded buses).[1] The Flexibility Services non-wires program directly supports Load Demand by identifying opportunities to defer or avoid these load transfers when and where it is appropriate. Station bus load forecasts are re-evaluated annually. Based on updated results, it may be necessary for Toronto Hydro to reprioritize load transfers. As part of this prioritization process, there is explicit consideration of the application of LDR.

[1] Exhibit 2B, Section E5.3.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-174

Reference: Exhibit 2B, Section E2, Page 14

Preamble:

Regarding the number of network transformers that materially deteriorated and will be undergoing replacement.

QUESTION (A):

a) Please reconcile the quantities of network transformers to be replaced, the numbers indicated that Toronto Hydro is replacing 225 units by the end of 2029, but only 192 units are currently and forecasted to be in HI4 and HI5 condition by 2029.

RESPONSE (A):

Toronto Hydro would like to clarify that it forecasted a total of 149 units in HI4 and HI5 condition by 2029 (which includes 43 already in HI4 and HI5 as of the end of 2022) and not 192 as stated in the question. While network transformer condition demographics is an important factor, Toronto Hydro also considered other drivers when developing its 2025-2029 plan for network unit replacement. As noted in Exhibit 2B, Section E2, these included:[1]

> *(1) the continuing prevalence of non-submersible network units, which are at a higher risk of catastrophic failure due to flooding regardless of their condition; and (2) an anticipated wave of network demographic issues beyond 2029, with over 50 percent of network units projected to be at or beyond end of useful life by 2034 without intervention.*

Toronto Hydro considered the above in developing the plan to replace 26 units per year over 2025-2029, a reduction of approximately 26 percent from the 2020-2024 pacing.

[1] Exhibit 2B, Section E2 at page 14, lines 4-7.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-175

References: Exhibit 2B, Section E2.1.1, Page 4

<u>Preamble:</u>

From Table 1: 2025-2029 Performance Objectives Toronto Hydro states: “Improve system reliability through enhanced fault management, leveraging automation and advanced metering through AMI 2.0”

QUESTION (A):

a) On its face, this objective conflicts with the “Maintain Reliability” objective cited in the Sustainment and Stewardship investment priority. Please explain how Toronto Hydro harmonizes these conflicting objectives when assembling its investment portfolio?

RESPONSE (A):

Toronto Hydro’s objectives for the “Sustainment and Stewardship” and “Modernization” categories address different (overlapping) time horizons and are fundamentally compatible. For Sustainment and Stewardship, the reliability objective for the lagging indicators of SAIDI/SAIFI (and in particular, SAIFI due to Defective Equipment) is to maintain current levels of performance over the 2025-2029 period by moving forward with a paced investment strategy that manages the deterioration of assets and maintains (but does not improve) overall population health through the rate period. For Modernization, Toronto Hydro is looking beyond 2029 in preparation for increasing pressures from electrification, DERs, and climate change (as discussed in Exhibit 2B, Section E2, pages 18-20). It is over this longer time horizon that Toronto Hydro is aiming to improve system reliability (and resiliency) through modernization. While these investments have a long-term focus, Toronto Hydro recognizes that there will be benefits to reliability as these technologies are gradually deployed throughout this rate period. These benefits are reflected in the SAIDI and SAIFI projections shown in Exhibit 1B, Tab 3, Schedule 1, Figures 1 and 2.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-176

Reference: Exhibit 2B, Section E2.1.1, Page 4

Preamble:

From Table 1: 2025-2029 Performance Objectives Toronto Hydro states: "Connect customers efficiently and with consideration for an increase in connections volumes due to electrification"

"Expand stations capacity to alleviate future load constraints, with consideration for increased EV uptake, decarbonization drivers, and other growth factors (digitization and redevelopment)"

QUESTION (A):

a) What analysis does Toronto Hydro undertake to evaluate the risk of temporarily or permanently stranding capital investments should the anticipated connection volume trends fail to materialize over the planning period, to align with the principle of "least regrets" investments?

RESPONSE (A):

Toronto Hydro relies on its Capacity Planning process to adequately size capacity expansion efforts to deliver reliable service and timely connections to its customers, resulting in its "least regrets" planning approach. In order to identify and minimize the risk of temporarily or permanently stranding capital investments, Toronto Hydro relies on a robust System Peak Demand Forecast methodology, that is updated annually, that integrates a number of drivers of growth. Toronto Hydro enhanced this methodology to consider additional factors ahead of preparing the 10-year forecast that informed the 2025-2029 rate period. In addition, to support its decision-making Toronto Hydro leveraged a long-term, multi-scenario growth modelling tool known as the Future Energy Scenarios ("FES") model to understand the range of possible scenarios under varying policy,

technology, and consumer behaviour. Please refer to Exhibit 2B, Section D4 for more details on Toronto Hydro's capacity planning process.
Integral to the planning process enhancements has been the integration of the use of Local Demand Response in the assessment of alternatives to traditional wires investments. This provides Toronto Hydro with the ability to monitor the realization of needs before committing to longer term investments in growing system capacity.

These approaches, along with coordinated planning with key stakeholders such as Hydro One (the transmitter) and the Independent Electricity System Operator, allow Toronto Hydro to assess capacity needs for its system carefully and minimize the risk of stranding capital investments.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-177

Reference: Exhibit 2B / Section E2.1.1 / p. 5

Preamble:

Toronto Hydro states: "In addition to setting these performance objectives, Toronto Hydro adopted top-down financial constraints to ensure that the principle of balancing price and service quality outcomes remained top of mind throughout the planning process."

"Price Limit: Toronto Hydro set an upper limit of approximately 7 percent as a cap on the average annual increase to distribution rates and charges."

QUESTION:

Please create a chart comparing historical and forecast Toronto Hydro annual rate increases against the historical and forecast annual Ontario Consumer Price Index from 2020 to 2029.

i. Please explain any significant deviations between Toronto Hydro rates and inflation.

RESPONSE:

Please see the requested chart below comparing Toronto Hydro annual rate increases against the historical and forecast (2%) annual Ontario Consumer Price Index. Taking into consideration the rate decrease in 2020 resulting from rate riders, including gains on sale of properties that were returned to customers, Toronto Hydro's rates are overall consistent with Ontario inflation over the 2020 to 2029. Material deviations over the period are observed in 2022, primarily due to the OEB's inflation factor being higher than the capital-related inflation that was embedded in rates for that year, and in 2025-2029 as the utility's must invest in the grid, its operations and workforce to address the needs and challenges identified in the evidence and deliver outcomes that are important to customers. Toronto Hydro notes that rates under Price Cap IR would presumably track closer to

Ontario inflation than its proposed rate plan. In the responses to 1B-Staff-12 and 1B-Staff-15, the utility presents the revenue deficiency and financial impacts of managing within Price Cap IR rates.

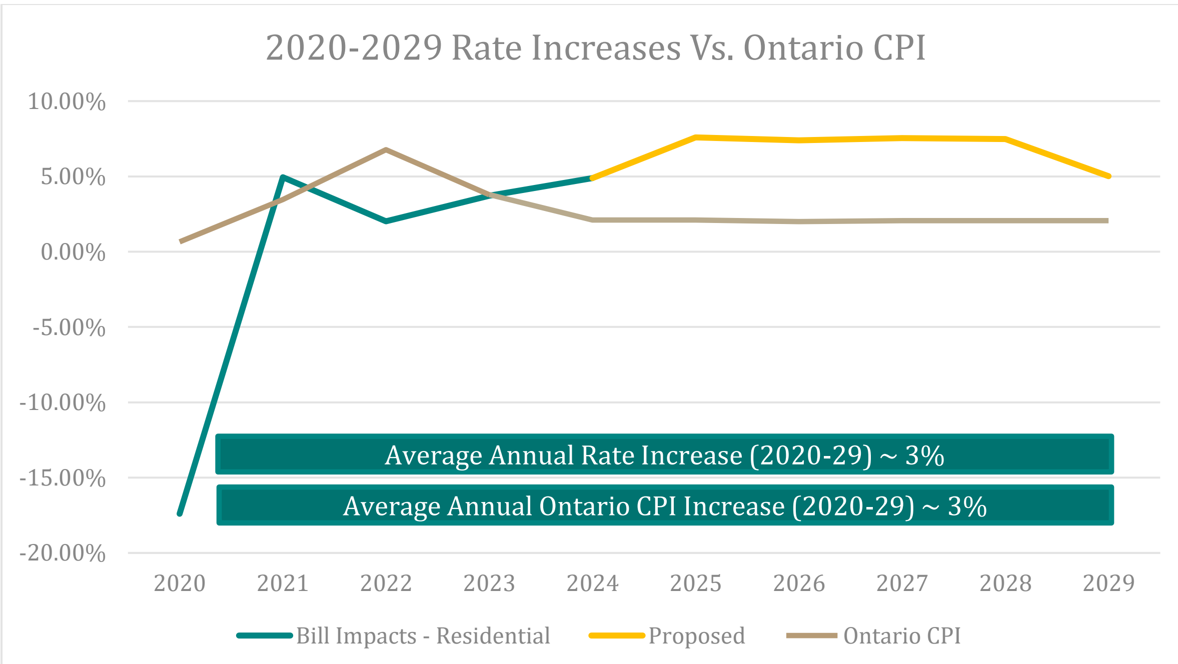


Figure 1 – 2025-2029 Rate Increases VS Ontario CPI

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-178

Reference: Exhibit 2B, Section E2, page. 7

Preamble:

Toronto Hydro states: "The utility developed initial capital program expenditure proposals with the aim of fulfilling strategic objectives in the focus areas of Growth, Sustainment, Modernization and General Plant. From this starting point, an iterative process generated multiple versions of the capital expenditure plan, eventually producing a draft plan that formed the basis of Phase 2 of Customer Engagement. The differences between the initial version of the plan - which on an aggregate basis was higher than the $4,000 upper limit on capital expenditures."

QUESTION (A):

a) How was the upper limit capital expenditure envelope size of $4 billion determined?

RESPONSE (A):

Please refer to the response to interrogatory 2B-SEC-33.

QUESTION (B) :

b) Does the resulting capital expenditure plan satisfy Toronto Hydro's acceptable risk exposure assessment?
   i) If yes, does this indicate that the initial capital expenditure plan was larger than necessary?
   ii) If no, is Toronto Hydro's position that the proposed capital expenditure plan is imprudent?

RESPONSE (B):

Yes. Through an iterative and integrated planning process, the initial capital expenditure plan was adjusted/constrained to arrive at a balance between price and outcomes that Toronto Hydro's deemed to be acceptable. Achieving this balance necessarily meant taking on some additional risk and/or reducing the pace of progress in certain areas of the plan, as explained in the evidence at Exhibit 2B, Section E2 page 7. For example, the Downtown Contingency segment of System Enhancements was substantially reduced by focusing on creating station switchgear ties between Copeland Station and Esplanade Station to manage (rather than alleviate) contingency concerns within the downtown system.

QUESTION (C):

c) Given that the capital expenditure constraints that were imposed appear to have been generated top-down, rather than using Toronto Hydro's Asset Management processes, please explain how Toronto Hydro validated that the resulting solution is optimal as per Toronto Hydro's Asset Management or Risk Management processes.

RESPONSE (C):

The capital expenditure plan is the output of an iterative planning process that centered around Toronto Hydro's Asset Management system. Leveraging the analytical tools and risk-based decision-making frameworks contained with the Asset Management system and processes described in Exhibit 2B, Section D1, along with other relevant inputs and information, Toronto Hydro was able to adjust/constrain the initial plan to arrive at a balance between price and outcomes deemed to be acceptable from a risk perspective. For example, the Cable Chamber Renewal segment within the Underground Renewal - Downtown program was reduced by approximately $25 million by scaling back the number of poor condition assets to be addressed in the next rate period. The risk associated with this reduction was deemed to be acceptable by targeting asset locations that have the highest failure consequences.

QUESTION (D):

d) Please provide documentation demonstrating that capital expenditure levels lower than the $4 billion upper limit did not satisfy Toronto Hydro's Asset Management and Risk Management processes.

RESPONSE (D):

The System Renewal evidence in Exhibit 2B, Section E6 demonstrates that the capital expenditures proposed are aligned with Toronto Hydro's Asset Management and Risk Management processes. Please refer to the Appendix A1 at page 10 filed in response to 1A-CCC-01 for a high-level summary analysis of capital expenditure levels lower than the $4 billion upper limit.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-179

Reference: Exhibit 2B, Section E4.2.6, Page 20

Preamble:

Toronto Hydro states: "Toronto Hydro is expanding inspection and maintenance activities in key areas through the Preventative and Predictive maintenance programs, resulting in an 11 percent increase between 2024 and 2025, followed by a moderate 1 percent average annual increase from 2026-2029."

QUESTION (A):

a) Toronto Hydro is significantly increasing spending in at least three areas that directly affect system reliability, i) System Renewal spending by 35%, ii) System Service - System Enhancement program spending by 473%, and iii) Preventative and Predictive maintenance program spending by 11% followed by 1% compounding, in addition to significant amount of other program spending increases that will either directly or indirectly improve system reliability. Please reconcile these parallel spending increases with Toronto Hydro's strategy of maintaining reliability in response to indicated customer preferences.

RESPONSE (A):

Toronto Hydro is investing the minimum necessary to manage asset risk and achieve the goal of maintaining system reliability as measured by SAIFI Defective Equipment. The increase in System Renewal expenditures is driven by a number of factors, including inflation. Please see Toronto Hydro's response to 2B-Staff-169 for a discussion regarding the drivers of the increase in capital expenditures within the System Renewal category.

Please see Toronto Hydro's response to 2B-Staff-175 for more details on how investments in the "Modernization" category reconcile with Toronto Hydro's objective to maintain reliability over 2025-2029.

The increases in Toronto Hydro's Preventative and Predictive maintenance programs support the utility's objective to maintain reliability and are largely complementary to System Renewal investments, and meet outcomes in other areas such as safety and environment in addition to reliability outcomes. As such, the increase in the preventative and predictive maintenance programs are not solely driven by reliability considerations. Below is a list of other factors that drive these increases:

- As discussed in Exhibit 2B, Section D3.1.1, a large majority of preventative programs are cyclical in nature in alignment with regulatory requirements.
- Inspections serve as the primary input into Toronto Hydro's Asset Condition Assessment ("ACA") methodology, which is a key input for decision-making within System Renewal programs. For example, Toronto Hydro intends to increase the maintenance schedule for wood poles from 10 years to 8 years in order to improve the collection of condition information for this asset class.
- Increases in asset populations naturally drive increases in inspection and maintenance expenditures.
- The introduction of new technologies and increased penetration of DERs on the system also drive incremental inspection and maintenance requirements.
- Inflationary pressures are expected to drive costs, especially within the Stations maintenance programs.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-180

Reference: Exhibit 2B, Section E4.2.6, Page 21

Preamble: Toronto Hydro states: “The increase in the Corrective Maintenance Program is driven by the need to address a growing backlog of P3 deficiencies within the system.”

QUESTION:

a) Is the planned 35% increase in Renewal spending expected to help address the backlog of P3 deficiencies within the system?
   i. If yes, does this mean that the Corrective Maintenance Program will be reduced in future test periods? Please explain.
   ii. If no, are P3 deficiencies not correlated with asset condition, or is the planned Renewal spending not being directed to assets with P3 deficiencies that require urgent attention? Please explain.

RESPONSE:

Toronto Hydro does not expect the planned 35 percent increase in Renewal spending to materially help address the backlog of P3 deficiencies for the following reasons:

- The Renewal spending increase is driven by a number of factors, which are discussed in Toronto Hydro’s response to interrogatory 2B-Staff-169 (a), but as noted in Exhibit 2B, Section E2.1.1 at page 3, one of the key objectives is to manage asset risk by maintaining overall health demographics of the asset population.
- As discussed in Exhibit 2B, Section D3.1.1.3, even if the increased spending did lead to materially improved health demographics, this would not necessarily lead to a corresponding reduction in the volume of deficiencies requiring corrective maintenance as younger and healthier assets with defects may be more suited to being repaired than replaced.

- Planned renewal investments may support in addressing some of the backlog of P3 deficiencies where they happen to intersect with assets or areas targeted for capital intervention. However, based on recent historical data, on average there has been less than 1 percent of P3 work cancelled due to overlap with planned projects and therefore any impact is expected to be very limited.

ii. Toronto Hydro respectfully rejects the premise of the last part of the question. P3 deficiencies can be, but are not necessarily, related to asset condition. The P3 backlog includes deficiencies, such as tripping hazards[1] and nomenclature updates, which are unrelated to the condition of an asset. In addition, as noted above, renewal expenditures are targeted to maintaining, and not improving, overall asset health demographics and as such would not be expected to impact overall P3 deficiency volumes even if there was a close correlation.

With respect to the idea of the utility's planned renewal not being directed to P3 deficiencies that require urgent attention, Toronto Hydro agrees that planned renewal is not generally being directed to P3 deficiencies and notes that it should not be, but disagrees that P3 deficiencies require urgent attention. By definition, P3 deficiencies are the lowest priority, and therefore the least urgent deficiencies requiring attention.[2] Where asset replacement (i.e. capital work) is required to address the deficiencies, these are carried out through the Reactive capital segment (Exhibit 2B, Section E6.7); otherwise, deficiencies are addressed through the Corrective Maintenance program (Tab 2, Schedule 4). Therefore, Toronto Hydro notes that the P3 backlog referenced consists of the lowest priority deficiencies, specifically to be addressed through Corrective Maintenance. Corrective maintenance allows Toronto Hydro to address repairable issues in the short term in order to maximize performance of an asset, which in turn may defer the need to replace the asset.

[1] For example tripping hazards unrelated to underlying civil asset deterioration such as unlevel ground around Toronto Hydro assets.

[2] While less urgent than P1 or P2 deficiencies, Toronto Hydro still needs to P3 deficiencies before they worsen and lead to bigger issues, unlike P4 deficiencies, which are the lowest priority identified and which require monitoring only.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-181

Reference: Exhibit 2B / Section E5.1. / p. 20

Preamble:

Toronto Hydro states it proposes to increase the Basic Connection Fee allowance for Class 1 to 5 from $1,396 to $3,059.

QUESTION (A):

Please provide the actual amounts incurred by Toronto Hydro for the basic connection fee, per year, from 2020 to the end of 2023.

RESPONSE (A):

The following table provides the annual count of new connections and the corresponding basic connection fee totals with the fee of $1,396.

	2020	2021	2022	2023	2020-2023
New Connections (count)	2,713	2,404	2,408	2,611	10,136
Basic Connection Total ($)	3,787,348	3,355,984	3,361,568	3,644,956	14,149,856

QUESTION (B):

Please provide the forecast expense for Toronto Hydro, per year, for the basic connection fee, over 2025 through 2029, at the new rate.

RESPONSE (B):

Please see the response to interrogatory 2B-SEC-62 d).

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-182

Reference: Exhibit 2B, Section E5.1.3.1, page. 3

Preamble:

Toronto Hydro states: “The energy transition is also an important driver of the Load Connections segment as customers look to the electricity grid to meet more of their energy needs.”

a) Please reconcile this statement with Toronto Hydro’s projected decrease in forecast energy sales and billable demand.

RESPONSE:

Please refer to Toronto Hydro’s response to interrogatory 1B-PP-18.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-183

References: Exhibit 2B, Section E5.1.3.1, page. 6

Preamble:

With respect to Figure 2 Historical and Forecast number of Toronto Hydro Customers.

QUESTION (A):

a) Please overlay on Figure 2 Toronto Hydro's historical and forecast annual capital spending on System Access connections.

RESPONSE (A):

The following figure overlays the historical and forecast annual net capital expenditures on customer connections, where 2012-2023 are actuals and 2024-2029 are forecasted:

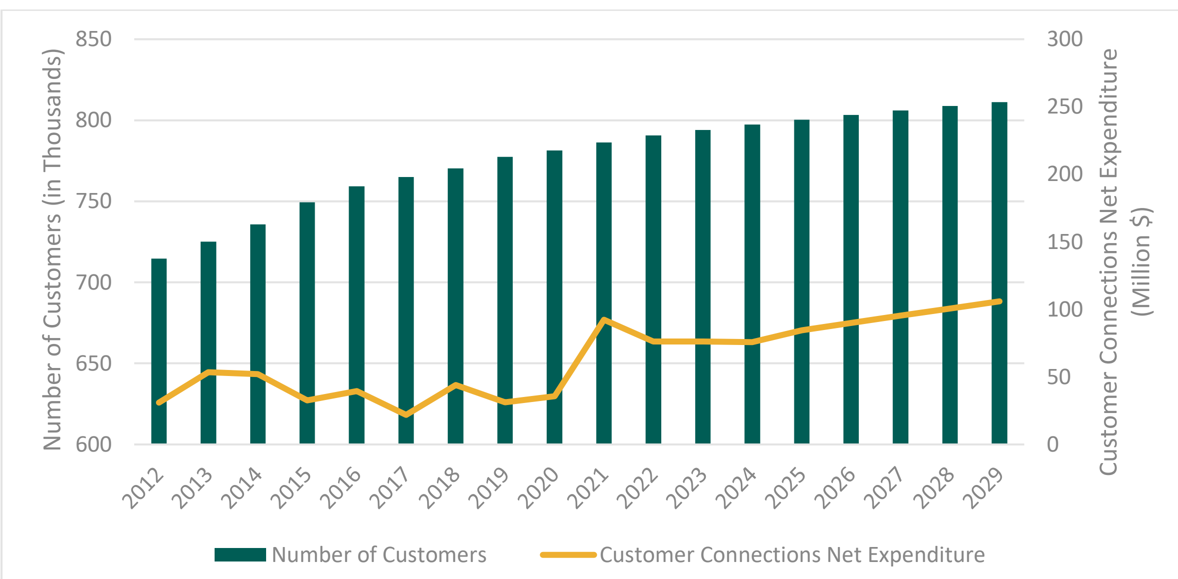


Figure 1: 2012-2029 Historical and Forecast Annual Net Customer Connections Expenditures

QUESTION (B):

b) Please provide the average growth rate for both customer count and connections spending for each of the following periods: 2012 - 2019, 2020 - 2024, 2025 - 2029.

RESPONSE (B):

The following table provides the average growth rates for Toronto Hydro's rate application periods for customer count and capital net expenditures.

Table 1: Average Growth Rates for Toronto Hydro's Rate Application Periods by Customer Count and Capital Net Expenditures

Rate Application Period	Average Customer Count Growth Rate for Period	Average Net Capital Expenditures for Customer Connections Growth Rate for Period
2012-2014	3.0%	68.1%
2015-2019	3.7%	-4.0%
2020-2024	2.0%	112.5%
2025-2029	1.4%	25.4%

QUESTION (C):

c) Please explain any discrepancies between the growth rates of connections spending and customer count.

RESPONSE (C):

Discrepancies between the observed growth rates between customer count and net capital expenditures is inherent to the data sets. It is difficult to make any meaningful comparative analysis between the two variables for reasons including:

- A single customer connection may represent a detached residence, a commercial or industrial facility, a hyperscale data centre, or a large multi-use development. Each of those will necessitate different types and levels investments to facilitate the connections. Please see Exhibit 2B, Section E5.1, page 5.

- The customer count may not fully reflect the number of customers served by Toronto Hydro. Toronto Hydro estimates that it serves approximately 340,000 end-use customers through bulk-metering and competitive sub-metering arrangements. As the sub-metering market has become more mature in Toronto over the last decade, a greater share of new multi-unit buildings opt for bulk-metering service connections. The practical effect of operating in this urban environment with a deregulated sub-metering market is a slower rate of formally reported customer growth from 2015 to 2029. Please see Exhibit 4, Tab 1, Schedule 1, pages 11-12.
- The geographical location of a customer can drive differences in required capital investments due to site location, available capacity, system constraints, design, system access configuration. Please see Exhibit 2B, Section E5.1, pages 7-10.
- Customers seeking upgraded connections would not be reflected in the customer count, despite those related costs being captured in the connection capital expenditures. Please see Exhibit 2B, Section E5.1, page 1.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-184

Reference: Exhibit 2B, Section E5.1.3.1, Page 8

<u>Preamble:</u>

With respect to Figure 3 High Voltage Connections 2020-2022

QUESTION (A):

a) Please update Figures 3, 4 and 6 to include the years 2023-2029. Please differentiate actual, estimated and forecast values.

RESPONSE (A):

The following are updates to Figures 3, 4 and 6 to include 2023 actuals. Toronto Hydro is unable to provide a forecast beyond 2023 for Figures 3, 4, and 6 as customer connections are typically based on size, required demand load, geographical location, and the available infrastructure.

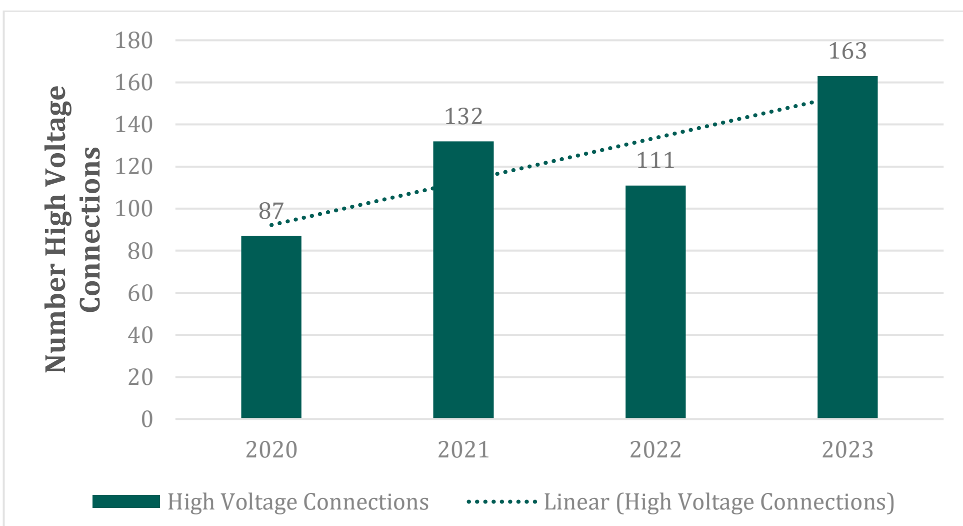


Figure 1: Updated Figure 3 - High Voltage Connections (2020-2023)

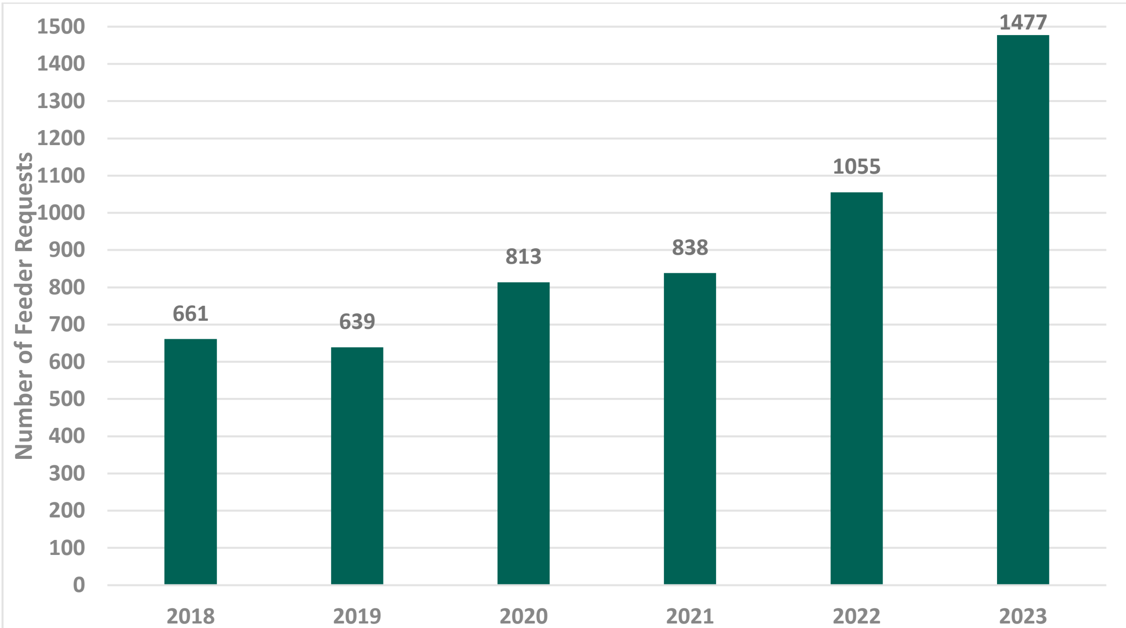


Figure 2: Updated Figure 4 - Feeder requests processed (2018-2023)

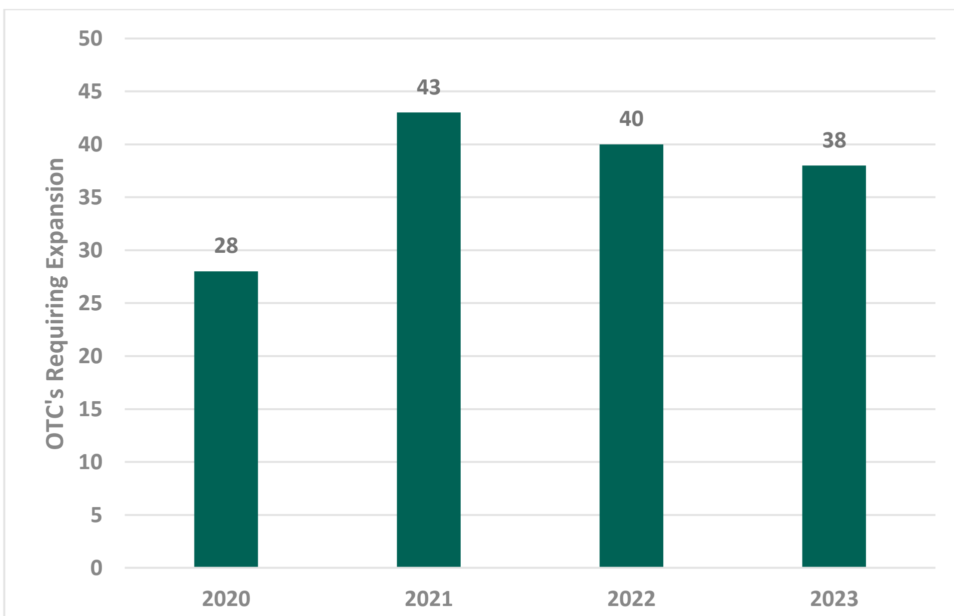


Figure 3: Updated Figure 6 - Offer to connect Requiring Expansion (2018-2023)

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-185

Reference: Exhibit 2B / Section E5.1.3.2 / p. 15

<u>Preamble:</u>

Toronto Hydro states: "Toronto Hydro forecasts over 1700 additional renewable connections (totalling over 74 MW) to the distribution system."

QUESTION(A):

a) Please explain how Toronto Hydro developed the additional renewable connections forecast and provide the confidence interval around the annual values given in Tables 6 and 7 (e.g.: +/- 5%, +10%/-25%, +/- 50%, etc.).

RESPONSE (A):

The renewable DER forecast is based on a model that uses historical data. It represents renewable DER intake in the years after the end of the Feed-In-Tariff (FIT) program. As renewable DERs and DER connections in general do not follow specific patterns and are primarily driven by customer demand, there is no confidence index associated with the analysis.

QUESTION (B):

b) The values shown in Tables 6 and 7 appear to be cumulative totals. Please provide tables showing the incremental annual additions for these same years.

RESPONSE (B):

Please see Table below.

Table 1: Annual Generation Connections (2023-2029)

Generation Type	2023	2024	2025	2026	2027	2028	2029
Renewable	227	183	227	256	322	364	404
Energy Storage	16	3	6	5	8	7	9
Non-Renewable	16	2	2	2	2	2	2
TOTAL	**259**	**188**	**235**	**263**	**332**	**373**	**415**

QUESTION (C):

c) Please describe the representative generation technologies comprising the Renewable and Non-Renewable categories shown in these tables.

RESPONSE (C):

In terms of renewable generation, solar is the dominant generation type used on the data used for forecast. Other technologies used historically are biogas and wind. For non-renewable, CHP, diesel and natural gas generator technologies comprise the technologies used.

QUESTION (D):

d) What is the forecast Energy storage volume (in MWh) in each year?

RESPONSE (D):

Battery Energy Storage is forecasted on the basis of capacity, not energy storage volume.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-186

Reference: Exhibit 2B, Section E5.1.3.2, Page 15

Preamble:

Toronto Hydro states: “Toronto Hydro forecasts over 50 additional Energy Storage connections…to the distribution system. This would increase…the total installed Energy Storage capacity to 89.5MW.”

QUESTION:

Does Toronto Hydro anticipate that the total volume of energy storage connected to its system by 2029 will materially assist in mitigating customer outage durations associated with events caused by freezing rain, windstorms or floods, i.e., similar to the events listed in the Extreme Weather and Major Event Day sections of this application (e.g. Exhibit 1B Section 2.3.4, Exhibit 2B Section C2.3)? Please explain.

RESPONSE:

No. The non-wires solutions proposed for the 2025-2029 period are outlined in detail in Exhibit 2B Section E7.2. Toronto Hydro intends to utilize DERs, including energy storage resources, as demand response in a manner that is practical and prudent given the current availability of DER capacity, and level of market maturity. At this time, Toronto Hydro is not utilizing customer-owned DERs to manage grid outages. The use of customer-owned DERs for this purpose would require specific connection arrangements and requires further study. Toronto Hydro will continue to explore such use cases and determine whether they are practical or prudent.

Toronto Hydro’s ESS program targets the enablement of REG connections and does not contemplate additional use cases to support the distribution system. Please see Exhibit 2B Section 7.2.2 for more details.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-187

Reference: **Exhibit 2B, Section E5.1.4.2, Page 24**

Preamble:

Toronto Hydro states: "Toronto Hydro does not propose any net expenditure under this Program for the years 2025 to 2029. If during the course of the project, Toronto Hydro does not use all of the fees collected from the customer to facilitate the DER connection, Toronto Hydro will refund the difference back to the customer."

QUESTIONS (A) AND (B):

a) Please identify all capital expenditures planned for 2025-2029 intended to enable the Toronto Hydro system to host new DERs connecting solely within the 2025-2029 test period.

b) Please identify all capital expenditures planned for 2025-2029 intended to enable the Toronto Hydro system to host new DERs connecting beyond the test period.

RESPONSES (A) AND (B):

Toronto Hydro intends to undertake investments in the following capital programs to enable the system to host DERs in the 2025-2029 period: (1) Generation Protection, Monitoring and Control (Exhibit 2B, Section E5.5); (2) Station Expansion – Sheppard TS (Section E7.4)[1]; and (3) Non-Wires Solutions (Section E7.2). Some of these expenditures may enable hosting capacity beyond the test period as well. In addition, Toronto Hydro is planning modernization and innovation investments to enhance the utility's ability to monitor and forecast distributed resources and facilitate and leverage DER connections. These investments will have benefits in the 2025-2029 period and beyond. Please refer to the *Grid Readiness* section of Toronto Hydro's Grid Modernization Strategy for more information (Exhibit 2B, Section D5.2.2).

[1] Updated January 29, 2024

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-188

Reference: Exhibit 2B, Section E5.2.4, Page 7

Preamble:

With respect to Table 1: Program Summary

QUESTION:

a) Toronto Hydro projects a $21.7M (40%) increase in net spending on this program, which appears to be largely driven by a $28.6M (9%) decrease in forecast Capital Contributions (i.e. a decreased in average contribution rate from 85% in the historic period to 79% in the forecast period). Please explain why Capital Contributions are expected to decrease and quantify the projects driving the bulk of the net spending increase.

RESPONSE:

The decrease in capital contributions is attributed to increased expansion work over the forecast period to meet anticipated future load growth. In particular, forecast expansion work associated with relocations under the *Building Transit Faster Act* contributes to approximately 70 percent of the proposed spending over the 2025-2029 period. Please refer to Exhibit 2B, Section E5.2.3.4, for more details on expansion work.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-189

Reference: Exhibit 2B / Section E5.3.2 / p. 2

Preamble:

With respect to the measures listed by Toronto Hydro for "Operational Effectiveness-Reliability" outcome.

QUESTION:

Although the preamble to the measures cell indicates that the Load Demand expenditures will contribute to Maintaining Toronto Hydro's System Capacity each of the four load demand measures indicate that the proposed investments are specifically intended to improve reliability. Please reconcile the apparent contradiction in corporate and program targets and quantify the proportion of spending in each element of this program that is intended to improve rather than maintain reliability.

RESPONSE:

Load Demand only invests in a small number of feeders relative to the overall feeder population, and while it improves reliability conditions on those few feeders, it is not enough on its own to overcome deterioration on other feeders over the period that cumulatively has a greater impact on overall system reliability.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-190

Reference: **Exhibit 2B / Section E5.3.3 / p. 3**

Preamble**:**

Toronto Hydro notes that "an overloaded bus is defined as reaching 95 percent of its firm capacity under normal and emergency operating conditions.".

QUESTION(A):

a) Please explain which of these conditions typically rules and why.

RESPONSE (A):

Toronto Hydro stations are rated using N-1 operating conditions. While the limited time rating (LTR) capacity refers to an unusual configuration in N-1, it is not considered an emergency condition. Please refer to Toronto Hydro's response to interrogatory 2B-Staff-256 part (d).

QUESTION (B):

b) Since these are planning limitations, are they evaluated in N-1 conditions?
    i. If yes, please explain why utilizing 95 percent of firm capacity limitation while also imposing an N-1 contingency is not an overly conservative planning criterion?

RESPONSE (B):

The N-1 condition is employed for planning station capacity. Please refer to Toronto Hydro's response to interrogatory 2B-Staff-256 part (e) for details. Additionally, the 95 percent rule is intended to ensure that there is readily available capacity for connecting customers efficiently.

QUESTION (C):

c) Does Toronto Hydro evaluate bus constraints at non-coincident bus loading peak or coincident system peak for planning purposes?

RESPONSE (C):

Toronto Hydro evaluates bus constraint at non-coincident bus peak loads.

QUESTION (D):

d) Please quantify the average annual hours where a typical bus is loaded at 95% or greater of its peak loading.

RESPONSE (D):

As noted in its response to interrogatory 2B-Staff-256 part (c), Toronto Hydro is unable to provide a response as it does not have the requested information.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-191

Reference: **Exhibit 2B / Section E5.3.3.4 / p. 16**

Preamble:

Toronto Hydro states: "Due to capacity constraints, Toronto Hydro is forced to impose summer switching restrictions during peak load conditions, such that certain feeders cannot be taken out of service during those periods. If restricted feeders are taken out of service, their corresponding standby infrastructure (standby feeders, adjacent network units) will be overloaded. This practice constrains Toronto Hydro's ability to complete new customer connections and hinders its ability to plan and execute other capital maintenance work in a timely and efficient manner."

QUESTION:

Toronto Hydro is projecting that it will change from a Summer Peaking to a Winter Peaking system. Please identify which of the proposed investments in become redundant after Toronto Hydro becomes a winter peaking utility or explain why if none of the investments will become redundant.

RESPONSE:

Based on the System Peak Demand Forecast in Exhibit 2B, Section D4, Toronto Hydro remains a summer peaking utility for this rate period, as explained in the response to 1B-Staff-153. In order to maintain service quality, Toronto Hydro must invest to manage restrictions during peak loads in both summer and winter months. Switching to a winter peak does not eliminate the summer peaks.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-192

Reference: Exhibit 2B, Section E5.3.3.4, Page 18

QUESTION (A):

a) Table 7: Summer Restrictions by year, indicates that by 2022, the number of summer feeder restrictions had dropped significantly from 2021. Table 2 indicates that Toronto Hydro plans to <u>improve</u> reliability by further reducing the number of feeder restrictions. Please reconcile this program target with the corporate goal of <u>maintaining</u> reliability.

RESPONSE (A):

The corporate goal of maintaining reliability is comprised of several components, which considers number of feeder restrictions as an input. Given that the program target only contributes to a portion of the corporate goal and due to the dynamic nature of Toronto Hydro's distribution system, the limit of the scale (i.e. level of spending) and geographic scope, a program-level goal of improving reliability is required to maintain overall system reliability.

The number of restricted feeders increases by 1 from 2021 to 2022, as indicated in Table 7 under Section E5.3.3.4. By reducing the overall number of restricted feeders and maintaining the total under 10, as specified in Section E5.3, reliability in the downtown area is expected to improve, which is one of the program measures listed in Table 2. Improving reliability at this granular level (i.e., at restricted feeders in the downtown area) will contribute to maintaining Toronto Hydro's overall reliability objectives given that there are contributing factors outside this program that also impact this objective.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-193

Reference: Exhibit 2B, Section E5.3.3.4, Page 19

<u>Preamble:</u>

Toronto Hydro states: "When certain stations are expanded or their switchgear is upgraded, Toronto Hydro must undertake supporting civil enhancement work in the egress cable chambers to enable additional capacity at the station. Table summarizes the expected station upgrades within the 2025-2029 rate period that may require civil egress rebuilds in order to optimally serve customers. These areas are shown geographically in Figure."

QUESTION:

Some of the spending in this program component appears to be intended to address existing deteriorated or obsolete civil structures, or else is driven by Renewal projects that will replace end of life substation equipment. Please explain why all such spending has not been categorized under System Renewal.

RESPONSE:

The spending in this program is not primarily to address deteriorated or obsolete civil structures, it is to alleviate emerging capacity constraints expected in Toronto Hydro's distribution system. While the civil enhancements planned as part of the program may rebuild deteriorated civil structures, it is not the primary driver behind the work. This work is driven by the capacity upgrades required in these areas. The switchgears identified in Table 8 in the Load Demand program (E5.3) are set to undergo an upgrade to increase their capacity. This means additional feeder positions and new feeders will be available and require sufficient civil infrastructure at the station egress to realize the additional capacity. Therefore, civil enhancements such as enhancing existing egress duct banks to increase the number of ducts, or building new duct structures is required to address the load growth needs of the system.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-194

References: Exhibit 2B, Section E5.4.5.1, Page 18

Preamble:

Toronto Hydro states that: "Toronto Hydro will not be able to capture the entire benefits of AMI 2.0 meters until the majority of the current meters are replaced."

Question (A):

a) In a table, please enumerate the benefits that the AMI 2.0 meters are providing and classify which of those benefits can or cannot be achieved until a majority of the current meters are replaced. In this table indicate the proportion of benefits achieved at 25%, 50%, 75% and 100% replacement penetrations.

RESPONSE (A):

Table 1: AMI 2.0 Benefits

AMI 2.0 Benefits	Can be Achieved Before Majority Replacement	AMI Replacement Penetration Level			
		~25%	~50%	~75%	~100%
		Proportion of Benefits Achieved			
Bi-Directional Metering	Yes	Medium	Medium	High	Full
Remote Connection/Disconnection	Yes	Medium	Medium	High	Full
Improved Bill Accuracy	No	None	None	Low	Full
Enhanced Outage Detection	No	None	None	Low	Full
Voltage Monitoring	No	None	None	Low	Full
System Planning and Load Forecasts	Partially	None	Low	Medium	Full
Improved Reliability and Power Quality	Partially	Low	Medium	High	Full
Data Analytics and Grid Modernization Enablement	No	None	None	Low	Full

AMI 2.0 Benefits	**Can be Achieved Before Majority Replacement**	**AMI Replacement Penetration Level**			
		~25%	**~50%**	**~75%**	**~100%**
		Proportion of Benefits Achieved			
Load Disaggregation and EV Detection	No	None	None	Low	Full
Customer Specific Technology Enablement	No	None	None	Low	Full

Proportion	**Explanation**
None	The benefit cannot be achieved at the specified penetration levels, due to a combination of lack of critical mass of penetration of meters or obsolete meters acting as a barrier.
Low	Minimal or very limited benefits achievable at the specified penetration levels, due to a combination of lack of critical mass of penetration of meters or obsolete meters acting as a barrier. Any benefits require a manual data extract and analysis and may have very limited benefits due to the amount of data flowing through.
Medium	Moderate benefits achievable at the specified penetration levels. Capabilities are limited by the penetration of meters and requires manual data extracts. This category represents a slightly improved benefit realization compared to low as some simple out of the box use cases can be operationalized.
High	Substantial benefits achievable at the specified penetration levels. Capabilities have increased as some geographical areas can utilize the full features of AMI 2.0 but processes remain manual as full penetration of AMI 2.0 meters is not realized.
Full	Benefit can be fully achieved at the specified penetration levels.

Notes: “Can be Achieved Before Majority Replacement" indicates whether a benefit can start being realized before the majority of meters are replaced.

For further detail on AMI 2.0 benefits as they pertain to modernizing the grid, please see Exhibit 2B, Section D5, subsection D5.3.1[1] and Section E5.4.[2]

[1] At p. 57-61.
[2] At p. 10-13.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-195

References: Exhibit 2B, Section E5.4.5.1, p. 19

Preamble:

Toronto Hydro states "Option 4 is selected based on the following criteria as summarized in Table 7."

QUESTION (A):

a) Has Toronto Hydro conducted a quantified risk assessment of each of the listed options?
   i. If yes, please provide documentation.
   ii. If no, please explain why not.

RESPONSE (A):

Toronto Hydro did not quantify the risks associated with the listed options since either the risk elements under consideration are not quantifiable, quantification would not materially improve the decision-making process, or the effort to quantify them would unreasonably delay benefits realization.

QUESTION (B):

b) What is the typical annual probability of failure of a meter that has reached age-derived EOL but whose seal has not yet expired?

RESPONSE (B):

For the annual probability of failure of a meter, please refer to page 5-177 of Concentric Advisors' 2022 Depreciation Study in Appendix D to Exhibit 2A, Tab 2, Schedule 1. The seal duration of the meter focuses on the accuracy of the metrology and is typically unrelated to other modes of meter failure or obsolescence.

QUESTION (C):

c) Does Measurement Canada allow re-sealing of meters that have a material likelihood of failing prior to the seal expiry? Please explain.

RESPONSE (C):

In Toronto Hydro's interpretation, Measurement Canada re-sealing requirements focus on meter accuracy, but do not include an evaluation of the likelihood of other meter failure modes, such as the failure of electronics, display, or communication components.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-196

REFERENCE: Exhibit 2B / Section E5.5.1 / p. 1

Preamble:

Toronto Hydro states "Installation of 315 monitoring and control systems ("MCS") for renewable DER facilities greater than 50 kW to provide situational awareness and control of DER facilities on the distribution system."

QUESTION:

Are DERs and Energy Storage projects responsible for the costs of providing adequate operational visibility to Toronto Hydro to enable safe operation of its system?

a. If not, please explain why not.

RESPONSE:

In accordance with section 3.3 of the Distribution System Code, non-renewable DERs and Energy Storage projects are responsible for the enhancements costs referenced. As a result, costs for these projects do not form part of the Generation Protection, Monitoring and Control (GPMC) program (Exhibit 2B Section E5.5).

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-197

References: Exhibit 2B, Section E5.5.3.3, Page 10

<u>Preamble:</u>

Toronto Hydro states: "With the proliferation of DER in Toronto in recent years, several feeder circuits have already surpassed the generation to minimum load ratio of one-third. A total of eleven distribution feeders have ratios ranging from 0.30 to 11.51 (refer to Table 6: Existing Feeders with Generation to Load Ratio Greater Than One-Third below). These feeders currently present an increased risk of unintentional islanding conditions to the distribution system."

QUESTION (A):

a) Does Toronto Hydro calculate the expected output of DERs at the time of minimum feeder loading, or does Toronto Hydro use nameplate DER rating in its feeder analysis?
   i. If yes, does this mean that solar DERs, which can be expected to have zero production at the time of minimum feeder loading (typically during nighttime light load hours), are being overcounted in Toronto Hydro's analysis? Please explain.

RESPONSE (A):

Toronto Hydro currently uses the nameplate DER system rating in its feeder analysis irrespective of time day intervals. The utility does not have control over when exactly the minimum feeder load condition will occur, and therefore to mitigate risk to the system, Toronto Hydro seeks to comply with the IEEE 1547 requirement for anti-islanding which states that aggregate DER capacity is to be less than one-third of the minimum load. This is further detailed in Exhibit 2B, Section E5.5, page 10. Modification of this approach will be considered as more tools are developed to interface with DER's in a dynamic operational environment.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-198

References: Exhibit 2B, Section DE6.1.1, Page 1, Table 1: Program Summary

QUESTION (A):

a) Rear Lot conversion spending is forecast to increase by $58.7M (95%) relative to historical. Considering that Toronto Hydro has been implementing this conversion program for some time, and presumably the most problematic segments have been addressed first, what has changed to drive this sudden doubling in planned program spending?

RESPONSE (A):

The Rear Lot segment for the 2025-2029 period has increased by 6 percent compared to what Toronto Hydro proposed in the 2020 CIR application for 2020-2024. This increase is driven by inflationary pressures and not pacing, which is consistent with the 2020-2024 proposal. The reduced pace relative to what was proposed for 2020-2024 (in accordance with the OEB's decision) has contributed to increased need for investment in rear lot areas, which continue to deteriorate with new areas starting to experience worsening reliability. Therefore, if anything, the proposed pace of investment over 2025-2029 is conservative and Toronto Hydro expects that, beyond 2029, it will need to maintain this pace or even increase it as these areas continue to age and deteriorate (see Figure 3 in Exhibit 2B, Section E6.1 at page 6).

QUESTION (B):

b) Do any of the feeders being improved via the Rear Lot program also appear on the worst performing feeder list?

    i. If yes, does Toronto Hydro intend to offset the proposed increase in Rear Lot spending by commensurately reducing spending on the Worst Performing Feeders program?

RESPONSE (B):

The Rear Lot program feeders don't overlap with feeders addressed by the Worst Performing Feeder program. While the Worst Performing Feeder target those with higher frequency of outages, the rear lot feeders are targeted based on the duration of the outages and the challenges they pose due to legacy equipment and safety concerns.

QUESTION (C):

c) Does Toronto Hydro anticipate that completion of the Rear Lot program will improve or maintain its overall reliability performance?

RESPONSE (C):

Rear Lot conversion is expected to eliminate tree contacts and reduce outage duration on those areas converted and therefore, improve reliability for customers in those areas, who tend to experience below-average reliability. The completion of the Rear Lot Conversion program will take decades and if viewed in the long-term (i.e., by comparing reliability in the 2020s versus 2050s post completion), may see some improvements that could be attributed to the conversions (and which may be offset by other factors). However, for 2025-2029, Toronto Hydro expects rear lot conversions to contribute to maintaining its overall reliability performance.

QUESTION (D):

d) Please provide the total contribution of Rear Lot outages to Toronto Hydro's SAIDI and SAIFI results for 2012-2022.

RESPONSE (D):

Rear Lot outages contributed to 4 percent to Toronto Hydro's SAIDI performance and 2 percent to SAIFI performance over 2012-2022.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-199

References: Exhibit 2B, Section E6.1.1, Page 10

<u>Preamble:</u>

Toronto Hydro states: "64 percent of the poles with available asset condition assessment information are showing moderate to material deterioration."

QUESTION (A):

a) What is the expected annual failure probability for poles in HI3 and HI4 condition?

RESPONSE (A):

Toronto Hydro does not have probability of failure data specific to rear lot poles. Please see Toronto Hydro's response to interrogatory 2B-Staff-151 part (c) for the general probability of failures for wood poles.

QUESTION (B):

b) What is the typical failure mode of Rear Lot Poles and what is the typical triggering event?

RESPONSE (B):

The failure modes for rear lot poles are largely identical to the general failure modes for wood poles, which are provided in Exhibit 2B, Section D2.2.1.2, Table 2. Rear lot poles are subject to the same typical condition-based failures, but due to the location of the poles, there is reduced risk from vehicle damage.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-200

References: Exhibit 2B, Section E6.1.3.1, Page 18

QUESTION (A):

a) What is the useful life of primary overhead conductors?

RESPONSE (A):

The useful life of primary overhead conductors is 60 years.

QUESTION (B):

b) What is the annual probability of failure per km of primary overhead conductor that is past its useful life?

RESPONSE (B):

Please see Figure 1 below.

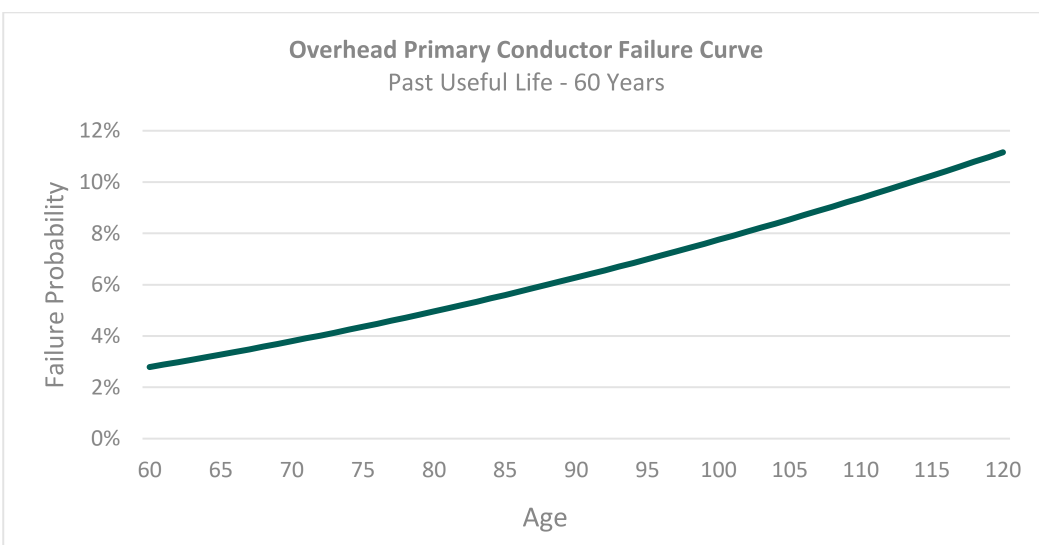


Figure 1: Overhead Primary Conductor Failure Curve (Past Useful Life)

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-201

Reference: Exhibit 2B, Section E6.1, Page 24

Preamble:

Toronto Hydro states that for the 2020-2024 period, "cost variance is driven by changes to the project schedule, including a number of projects that carried over from the 2015 - 2019 rate period."

QUESTION (A):

a) Does Toronto Hydro anticipate that any projects scheduled for completion in the 2020-2024 period will carry on to this test period. If yes, please provide a list of these projects, the expenditures that will occur in this test period, and the reason for the schedule change.

RESPONSE (A):

The Box Construction Conversion segment contains projects that involve work on a legacy system and the last projects to be completed in this segment are the most complex. There are a number of challenges that can impact the execution timelines of projects in this segment, including congestion and clearance issues for new asset installations, coordination issues with third parties (Ontario Line, Metrolinx, TTC, other developments, City of Toronto, Hydro One, etc.), coordination issues related to work zone, traffic, and pedestrian management. This can result in work being carried over from 2024 to the test period or work being advanced to take advantage of synergies with third parties. Please see Table 1 below for the list of projects along with the reasons and expenditures that are expected to be carried over from 2024 to the test period. Note that only the completion of "Danforth" has shifted from 2024 to the test period. The remaining projects listed in Table 1 only have a relatively small portion of total planned expenditures shifted into the test period from 2020-2024, and Toronto Hydro expects the overall projects will be completed in the 2025-2029 period as per the original plan.

Table 1: Box Construction Conversion Expenditure Carry-Over into 2025-2029 Period

Project	Expenditures Shifted into 2025-2029 ($M)	Reason for Schedule Change	Plan Construction Attainment
Danforth	2.54	Resource reprioritization	2025
Defoe-Strachan	0.34	Clearance, access and congestion issues	2026
Sherbourne	0.85	Clearance issues	2026
Highlevel	1.37	Supply chain and coordination issues	2029
University	3.04	Work zone coordination	2029

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-202

Reference: Exhibit 2B, Section E6.2.1, Pages 2, 15

Preamble:

Toronto Hydro states "As of 2022, there are 286 circuit-kilometers of direct-buried cable in dirt."

QUESTION (A):

a) What would be the expected impact on Toronto Hydro's SAIDI and SAIFI if the underground cable replacement program focused upon replacing the cables that are buried in dirt for the period 2025-29? In your answer, discuss Toronto Hydro's claim that XLPE cables installed in PVC ducts have expected service lives double those of XLPE cables directly buried in dirt.

RESPONSE (A):

In a hypothetical scenario where Toronto Hydro replaces only the remaining population of direct-buried cable in dirt (286 circuit-kilometers) during the 2025-2029 rate period, it anticipates that the cumulative impact on SAIFI and SAIDI for Defective Equipment interruptions would deteriorate by 6% and 5%, respectively, by the end of 2029, compared to Toronto Hydro's proposed 2025-2029 investment plan. This scenario does not replace any cables in PVC conduit or concrete-encased ducts. Due to the contiguous and integrated nature of Horseshoe distribution assets, this scenario is unrealistic. Toronto Hydro will inevitably need to replace some minimum amount of cable in PVC conduit and concrete-encased ducts as part of larger rebuild projects and in conjunction with other asset types. Furthermore, Toronto Hydro has included cables in PVC conduit and concrete-encased duct for replacement because these asset populations include aging cables at risk of failure, which should be addressed as part of a balanced underground renewal program.

Direct-buried cable in dirt has a useful life of 20 years, whereas cable in PVC conduit has a useful life of 50 years. The longer useful life for PVC Conduit is due to its enhanced protection against environmental conditions and mechanical stresses. For information on how Toronto Hydro determines its asset useful lives, please see response to 2B-Staff-131, part (a). Regardless of the different useful life values, failures can and do occur for cables in PVC conduit due to aging and a multitude of other factors, including insulation breakdown, moisture ingress, and overload.

QUESTION (B):

b) What is the annual expected failure rate per km for XLPE cables that are buried in dirt and for cables installed in PVC ducts?

RESPONSE (B):

Toronto Hydro estimates the historical failure rate (system interruptions per km) for direct-buried cable in dirt to be 0.11 and for cable in PVC conduit to be 0.12.

QUESTION (C):

c) What is causing the PVC ducts to become clogged with dirt?

RESPONSE (C):

PVC ducts can become clogged with dirt due to the following reasons:

- Some vintages of PVC ducts that have been installed in the past are of inferior quality and are prone to breakage
- Improper installation or ducts not being connected in a closed loop
- Unused ducts that are not properly sealed can experience dirt ingress; the dirt can be pushed further into the duct by ground water or local flooding events

QUESTION (D):

d) What mitigation alternatives are there to clear the dirt from these PVC ducts other than replacing the cables?

i. For the mitigation alternatives please provide comparative unit costing relative to cable replacement.

RESPONSE (D):

Toronto Hydro does not clear dirt from PVC ducts while the cable is in place. If the cable is functioning as required and there is a problem with the duct (clogged or damaged), Toronto Hydro will leave the cable until it needs to be replaced due to failure or a change in service, or until planned replacement can be carried out at the appropriate time. At the time a cable is being replaced, non-intrusive (plastic) mandrels are used to clear PVC ducts, provided there is space to fit a mandrel. Should the mandrel prove insufficient, alternative solutions, including installing new ducts or cleaning them out via power wash are considered.

Due to a drafting error, the explanation provided in Exhibit 2B, Section E6.2 incorrectly suggests that the issue of PVC ducts filling with dirt is a new or emerging issue driving incremental replacement. Toronto Hydro would like to clarify that this is not the case. The existing underground cable population in the Horseshoe consists of three predominant types, two of which (direct-buried cable in dirt and cable in PVC conduit) are legacy, obsolete standards. Cables in all three construction types (including concrete-encased ducts) experience failures and are addressed in different proportions by the planned investments in the Underground System Renewal – Horseshoe program. The utility expects that as the direct-buried cable population reduces through replacement, and cables in PVC conduit continue to age, cables in PVC conduit will become an increasing focus of the program.

QUESTION (E):

e) Please explain the scope of Toronto Hydro’s plans to “install new TRXLPE cable in concrete-encased ducts instead of burying cable directly into the soil or in PVC duct” throughout the horseshoe area. For example, is the concrete-encasement for road crossings only, or road crossings and industrial locations.

i. If the ducts are to be concrete encased in residential neighbourhoods, please provide the business case for the incremental costs and any examples of other jurisdictions that have similar construction standards.

RESPONSE (E):

Toronto Hydro's long-established policy for rebuilding underground areas is to install underground cable in concrete-encased duct up to the lot-line. The issue of concrete-encasement and alternatives was adjudicated by the Ontario Energy Board in Toronto Hydro's 2012-2014 Incremental Capital Module application (EB-2012-0064). As written in the Board's Partial Decision and Order (April 2, 2013):

> "While no party challenged THESL's assessment of the need to replace this cable, Energy Probe cross-examined THESL's witnesses extensively on possible alternatives to THESL's plan to replace this cable with concrete encased ducts. THESL's uncontradicted evidence was that the suggested alternatives were unsuitable in the situations encountered by THESL and that its approach was the most cost effective over the long term. Energy Probe argued that a reduction of $10 million should be made to reflect the fact that THESL's proposal for concrete encased duct banks is not justified from a reliability standpoint and that alternatives such as direct boring and flexible conduit or direct burying are acceptable alternatives and much more cost effective. THESL argued that Energy Probe's position should be rejected by the Board since initial installation cost is not the only cost and THESL's evidence had presented substantial information on the repair cost advantages for cable in concrete encased ducts which had been ignored by Energy Probe. THESL also stated that its evidence had clearly explained that concrete encased ducts offer the longest life and greatest reliability and facilitate future repair and replacement." (pg. 22-23)

> "The Board accepts THESL's evidence that the most effective way to replace the direct buried cable is with concrete encased ducts, and that the project is prudent and nondiscretionary. There was no credible evidence to support the alternatives or reductions

sought by the intervenors. Having found that the work is required and prudent, any reduction to the program is arbitrary and not supported by any evidence." (pg. 24)

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-203

Reference: Exhibit 2B, Section E6.2.1, Page 2

<u>Preamble:</u>

Toronto Hydro states "As of 2022, there are 286 circuit-kilometers of direct-buried cable in dirt."

QUESTION (A):

a) Please provide the historical actual and forecast all in per km costs for the periods 2020-2024, and 2025-2029 for the following activities:
   i. New XLPE underground cable in concrete duct.
   ii. Removal of existing XLPE underground cable in concrete duct with new XLPE.
   iii. New XLPE underground cable in PVC duct.
   iv. Removal of existing XLPE underground cable in PVC duct with new XLPE in concrete duct.
   v. New XLPE underground cable direct buried in dirt.
   vi. Removal of existing XLPE underground cable direct buried in direct with new XLPE in concrete duct.
   vii. Removal of existing PILC/AILC in duct and replacement with new XLPE.
   viii. Removal of existing PILC/AILC direct buried in dirt and replacement with new XLPE in concrete duct.

RESPONSE (A):

i. Table 1 shows actual historical unit costs for installing new primary cable in concrete encased ducts and concrete encased duct banks in the 2020-2023 period, and the forecast unit costs for new cable in concrete encased ducts.[1] Note that there are additional civil

[1] For primary cable installations in the Horseshoe region, Toronto Hydro uses TRXLPE cable.

costs not reflected in these units (e.g., cable chambers and splice boxes). Toronto Hydro does not develop long-term program forecasts for underground civil infrastructure on the basis of unit costs. This is because civil costs (and volumes) are highly dependent on the specific placement of ducts and associated restoration costs. Toronto Hydro estimates the civil portion of the underground program by applying a historical ratio of civil to electrical costs.

Table 1: Historical and Forecasted Costs for Primary Cable Installation

	Actual ($)				Forecast ($)					
	2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
New primary UG Cable in Concrete Encased PVC Duct (per m)	172	180	253	329	248	255	262	267	275	282
Install of duct bank (per m)	906	987	933	1,153	-	-	-	-	-	-

ii. Table 2 below shows the cost per m of removing existing primary cable in the Horseshoe from concrete encased ducts. The response in the first row ("New primary UG cable in concrete encased PVC duct (per m)" of part "a." provides costs of installing new cable in concrete encased duct.

Table 2: Cost per m to Remove Existing Primary Cable from Concrete Encased Ducts in Horseshoe

	Actual ($)				Forecast ($)					
	2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Removal of existing primary underground cable (excl. PILC) in concrete encased PVC duct (per m)	64	60	67	73	75	77	79	81	83	85

iii. Toronto Hydro does not install XLPE cable in direct buried PVC ducts (this is an obsolete legacy standard) and therefore does not have unit cost information. Please see response to 2B-Staff-202, part (e) for more information.

iv. Assuming the cable can be removed from the duct, removal costs are equivalent to those provided have been provided in (ii) and installation costs have been provided in (i) above. If the cable cannot be removed, it is retired in place.

v. Toronto Hydro does not install underground cable direct-buried in dirt.

vi. Toronto Hydro does not remove underground cable direct buried in dirt. Instead, the cable is retired in place. The cost for installing new cable has been provided in (i) above.

vii. Please see Table 3.

Table 3: Cost of Removal of Existing PILC and AILC in Duct

	Actual ($)				Forecast ($)					
	2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Removal of existing PILC in duct and replacement with new TRXLPE[2] (per circuit m)	3880	1520	880	1030	1240	1500	1520	1540	1600	1630
Removal of existing AILC in duct and replacement with new XLPE (per circuit m)	N/A	520	220	300	250	570	590	610	650	670

[2] PILC and AILC are not part of the referenced Underground System Renewal – Horseshoe program. These unit costs include cable and all related civil infrastructure (ducts and cable chambers) and cannot be compared to the costs provided in response to parts (i) and (ii).

viii. The population of PILC/AILC direct-buried in dirt is exceeding small and Toronto Hydro has not performed this type of work in recent history. Therefore, the utility cannot provide any recorded unit cost.

QUESTION (B):

b) Please identify if there was no significant activity in any of the above categories.

RESPONSE (B):

The following categories of primary cable (and AILC) replacement/installation activities had no significant activity in 2020-2023:

i. New XLPE underground cable in PVC duct.
ii. New XLPE underground cable direct buried in dirt.
iii. Removal of existing PILC/AILC direct buried in dirt and replacement with new TRXLPE and XLPE in concrete duct.

QUESTION (C):

c) Please identify if there was significant activity in a category not listed above.

RESPONSE (C):

There are no additional categories of primary cable replacement/installation where significant activities were carried out.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-204

Reference: Exhibit 2B, Section E6.2.1, Page 2

Preamble:

Other distributors are undertaking extensive programs using cable injection remediation for earlier generation XLPE cables to mitigate water tree damage, as the per km costs are significantly lower than complete cable replacement.

QUESTION:

a) Has Toronto Hydro evaluated the costs and benefits of undertaking a cable injection program as an alternative to cable replacement?
   i) If yes, please provide benefit-cost analysis of the evaluation and explain why cable injection is not considered to be an economically viable solution to mitigate at least some of Toronto Hydro’s underground XLPE cable deficiencies.
   ii. If no, please explain why not.

RESPONSE:

Toronto Hydro piloted cable injection in 2008 and found it to be unsuitable for use on its cable population. The 2008 pilot did not produce satisfactory results, with many cables failing within a year of injection. The utility reviewed updates to procedures for cable injection in 2015 and reconfirmed that cable injection was not compatible for Toronto Hydro’s system. For cable injection to be effective, the conductors cannot be solid or strand-blocked (strand-filled), and connectors need to be “flow through” (not solid stop). This is generally not the case with Toronto Hydro’s cable population.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-205

Reference: Exhibit 2B, Section E6.2.3, Page 8

QUESTION (A)

a) Please provide the ratio of Underground System Contribution to Overall System Customer Hours Interrupted for the 5-year period 2013-2017 vs. the 5-year period 2018-2022.

RESPONSE (A):

The normalized ratio is 31:30.[1]

QUESTION (B):

b) Please provide the ratio of Overall System Customer Hours Interrupted for the period 2013-2017 vs. the period 2018-2022.

RESPONSE (B):

The normalized ratio is 127:100.

QUESTION (C):

c) Please provide Toronto Hydro's total average customer count for the period 2013-2017 and the period 2018-2022

RESPONSE (C):

Toronto Hydro's total average customer count was 741,180 in the 2013-2017 period and 771,103 for the 2018-2022 period.

[1] Note that the statistics in all parts of this response are for the entire Toronto Hydro distribution system.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-206

Reference: **Exhibit 2B, Section E6.2.3.2, Page 18**

QUESTION (A):

a) Per Figure 14, 2022 appears to represent an outlier year versus the improving trend from 2017 to 2021. What occurred in 2022 to cause such a significant single year deterioration in performance?
   i. Did a large number of underground transformers suddenly deteriorate from acceptable to non-acceptable condition or were there other factors? Please explain.

RESPONSE (A):

Toronto Hydro disagrees with the characterization of 2022 as being a performance outlier. A review of the Figures 13-15, updated with 2023 results (see 2B-SEC-66), shows that this is not the case. In fact, a reasonable conclusion to draw from the 2013-2023 results is that 2021 performance was unusually good.

QUESTION (B):

b) Please plot the actual or estimated annual results for 2023 on Figure 14 and discuss the resulting trend implications.

RESPONSE (B):

Please see 2B-SEC-66 for an updated Figure 14 and 2B-Staff-207 for a discussion of the results.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-207

Reference: **Exhibit 2B, Section E6.2.3.2, Page 18**

QUESTION (A):

a) Per Figure 15, explain why despite there being more Customer Hours Interrupted in 2022 than in 2021, the 2022 results are significantly better than the results for the period 2013-2019.

RESPONSE (A):

2021 was an exceptionally good year for the number of outages caused by defective underground transformers and the impact of those outages on customers. Please see response to 2B-SEC-66, where the updated Figures 13-15 show a trend of performance deterioration between 2021 and 2023, with 2023 being the worst year for Customers Interrupted (CI) since the peak of 2017.

QUESTION (B):

b) Do the 2022 results indicate that Toronto Hydro maintained or improved the reliability performance of its Underground Transformer portfolio?

RESPONSE (B):

Due to the inherent volatility of annual reliability metrics, it is generally best to examine performance over longer time horizons and by leveraging rolling, multi-year averages. The following table compares the five-year averages for CIs and CHIs for underground transformers.

Table 1: 2013-2017 Avg. vs 2018-2022 Avg. CIs and CHIs for Underground Transformers

Measure	2013-2017 Avg.	2018-2022 Avg.
Customer Interruptions ('000s)	23	24
Customer Hours Interrupted ('000s)	22	13

The table shows that customer interruption performance has remained consistent, and customer hours interrupted have improved. This improvement may be partially due to Toronto Hydro's targeted and accelerated replacement of submersible transformers in poor condition during 2017-2018, aimed at addressing frequent oil leaks that had been observed in the population. However, identifying the exact factors behind this trend remains difficult due to the inherently unpredictable nature of reliability performance.

As discussed in part (a), 2023 results show a deteriorating trend in performance over the 2021-2023 period.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-208

Reference: Exhibit 2B, Section E6.2.3.2, Page 19

QUESTION (A):

a) Please provide the tabular data for Figure 16.

RESPONSE (A):

Please see Table 1 below.

Table 1: Number of Externally-Reported Oil Spills on Underground Transformers (padmount, submersible, and vault transformers)[1]

Year	Number of Spills*
2013	2
2014	24
2015	41
2016	65
2017	66
2018	135
2019	204
2020	133
2021	40
2022	26

QUESTION (B):

[1] Data from 2013 to 2017 may include +/- 1-2 spill(s) variance, annually

b) Please update Figure 16 to show data from 2013-2022 and include a trend line for externally reported oil spills from 2013-2022.

RESPONSE (B):

Please see Figure below. There was an error in the caption Figure 16 which has now been corrected to include number of spills on padmount, submersible and vault transformers across the entire system.

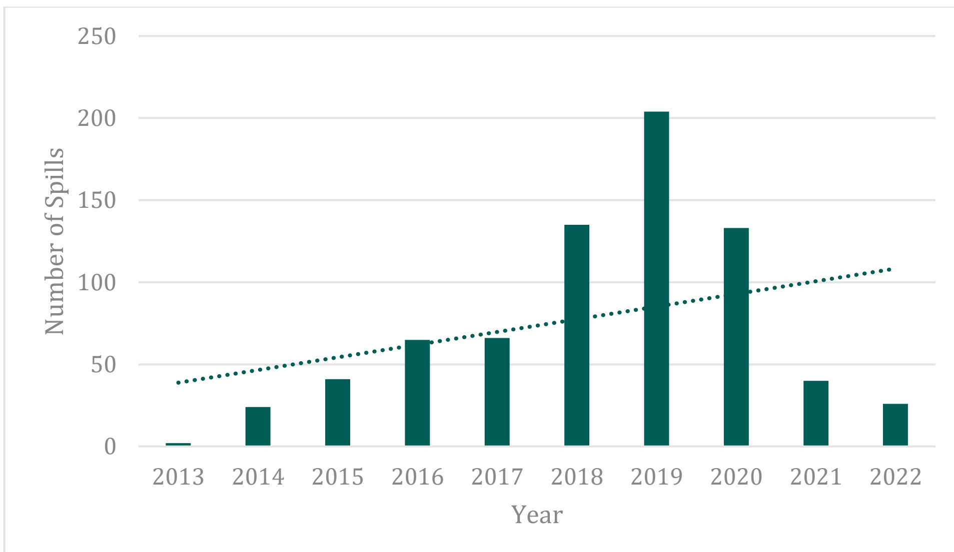


Figure 1: Number of Externally-Reported Oil Spills on Underground Transformers (padmount, submersible, and vault transformers) (Updated Figure 16)

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-209

References: Exhibit 2B, Section E6.2.3. 2, p. 21

<u>Preamble:</u>

Toronto Hydro states: "As of 2022, 26 percent of underground transformers in the Horseshoe area (i.e. 6,727 units) were at or beyond useful life (i.e. 30 years for padmount, submersible, and vault transformers)."

QUESTION (A):

a) Please explain how Toronto Hydro determined that the useful life for padmount, submersible and vault transformers should be set at 30 years, given that in 2022 6,727 of these transformers had been in service for more than 30 years, and in some cases significantly more than 30 years. In your response consider the information shown in Table 5 indicating that just 79 units out of the entire fleet of 25,209 units were assessed as being in HI5 - End of Serviceable Life condition in 2022, despite 6,727 of the units age-categorized as being beyond useful life.

RESPONSE (A):

The useful life of 30 years was adopted based on a review of the Depreciation Study completed by Concentric Inc., filed in Exhibit 2A, Tab 2, Schedule 1, Appendix D. Please see response to 2B-Staff-131, part (a), for a discussion regarding Toronto Hydro's useful lives and the extent to which they play a role in investment planning decisions. Please also see the response to 2B-SEC-44 for a comprehensive discussion regarding expected changes in asset demographics over the 2025-2029 period with investment.

Regarding Table 5 in Exhibit 2B, Section E6.2, the relatively small number of transformers in the worst condition band (HI5) as of 2022 is a positive indication as to the effectiveness of Toronto

Hydro's prioritization of the worst condition assets in investment planning. The fact that there were approximately 640 transformers in HI4 and HI5 condition in 2022 while over 6,500 units were operating beyond useful life underscores the benefits of having a robust condition model, which allows Toronto Hydro to focus more narrowly on replacing assets and rebuilding areas of the system that are most in need of investment.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-210

Reference: Exhibit 2B, Section E6.2.3.3, Pages 25-26

a) What occurred in 2021 to create the outlier results shown in Figures 22, 23 and 24?

RESPONSE:

Year-to-year variations in reliability for a given asset class are subject to a certain level of randomness, both in terms of frequency and impact of outages. There was a total of 23 outages that occurred in 2021 due to defective padmount switches. This is seven outages higher than the five-year average from 2016-2020 and three outages more than the worst year in that time period (i.e., 20 outages in 2016).

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-211

Reference: Exhibit 2B, Section E6.2.4, Page 29

QUESTION (A):

a) Toronto Hydro plans to increase Horseshoe Underground System Renewal spending by $115.9M (32%) in 2025-2029 relative to 2020-2024. Please explain the spending increase in the context of Toronto Hydro's stated corporate goal of maintaining reliability performance and the improving reliability performance outcomes achieved for these assets at historical expenditure levels.

RESPONSE (A):

Exhibit 2B, Section E6.2 provides detailed analysis on the drivers and key assumptions behind the level of proposed expenditures in the Underground System Renewal – Horseshoe program. Toronto Hydro has proposed the minimum expenditures necessary to maintain reliability on this part of the system during the 2025-2029 period. The proposed investments are reflected in the SAIDI and SAIFI forecasts presented in Exhibit 1B, Tab 3, Schedule 1.

The reliability improvement trend that persisted between 2015-2019 was the result of significant capital investment in the replacement of direct-buried cable and associated assets beginning in the previous "ICM" period (circa. 2013), including an investment level of $115.5 million achieved in the year 2015. The pace of investment in this program dropped to around $70 million per year in 2018 and 2019. While the link between investments in one year and reliability performance in the next is clouded by the unpredictability of asset failure rates, Toronto Hydro notes that the previously positive reliability trend became a negative trend beginning in 2020. As further discussed in Section E6.2: "Through prioritized neighbourhood rebuild projects focused on replacement of high-risk direct-buried cross-linked polyethylene ("XLPE") cables, Toronto Hydro previously had success reducing the number of customer interruptions due to cable failure, from over 200,000 per year in

2013 to approximately 105,000 in 2019. However, more recently Toronto Hydro shifted focus away from rebuild projects addressing direct-buried cables in order to address the urgent environmental risk associated with PCBs. As a result, customer interruptions (and other reliability indicators) have started trending back up, reaching 199,000 in 2022."

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-212

Reference: **Exhibit 2B, Section E6.2, Page 30**

<u>Preamble:</u>

Table 8 provided by Toronto Hydro on Underground Circuit Renewal Horseshoe Program.

QUESTION (A):

a) In the last test period for the asset classes indicated in Table 8 what were the placeholder planning unit costs to determine program estimates and what were the actual unit costs incurred at program completion.

RESPONSE (A):

The following table shows the base unit costs that were assumed for estimating the 2020-2024 Distribution System Plan ("DSP"). Note that these unit costs do not include indirect engineering and administration costs, nor do they include the inflationary assumptions that were applied in the DSP. Both of these elements were layered on to the total estimated program cost as a final step.

Table 1: 2020-2024 Planning Assumptions

Asset Class	Planning Unit Cost				
	2020	2021	2022	2023	2024
UG Cable (per m)	$241	$241	$241	$241	$241
UG Transformers	$22,767	$22,767	$22,767	$22,767	$22,767
UG Switches	$87,333	$87,333	$87,333	$87,333	$87,333

The following table shows the actual unit costs. These unit costs are derived from in-service additions data and are therefore fully burdened.

Table 2: 2020-2023 Actual Costs

Asset Class	Actual Unit Cost			
	2020	**2021**	**2022**	**2023**
UG Cable (per m)	$172.4	$180.2	$253	$328.5
UG Transformers	$25,738	$40,002	$27,035	$37,806
UG Switches	$136,113	$147,194	$124,029	$144,211

The primary driver of cost increases across all asset classes during this period was price inflation. This is reflected in the commodity costs from the period, during which copper prices increased 88%, aluminum prices 142%, and steel 232%. Fluctuations in unit costs can also be attributed to annual variations in the mix of asset types being replaced (e.g., padmount vs. vault transformers; aluminum vs. copper conductors).

QUESTION (B) AND (C):

b) What percentage of the planned costs for this program for the period 2020-2022 were spent by the end of 2022?

c) What percentage of the planned costs for this program for the period 2020-2024 are forecast to be spent by the end of 2024?

RESPONSE (B) AND (C):

Toronto Hydro adjusts its plans on an annual basis as part of the Investment Planning & Portfolio Reporting process. For the Underground System Renewal – Horseshoe program, the 2020-2022 planning cycles resulted in an updated plan of $359.8 million for the 2020-2024 period (as show in Exhibit 2B, Section E6.2). As of the end of 2022, $188.8 million had been invested, equivalent to 52% of the updated plan. Toronto Hydro's latest reforecast, based on 2023 actuals (see response to 2B-Staff-104), is for a total of $363.1 million by the end of 2024, equivalent to 101% of the updated plan in Exhibit 2B, Section E6.2.

Compared to Toronto Hydro's original 2020-2024 DSP forecast of $460.3 million, the updated outlook of $363.1 million is a 21% reduction in spending. The reasons for constraining expenditures in the 2020-2024 period are summarized in Exhibit 2B, Section E4.1 and further discussed in Section E2.2.1.1 and Section E6.2.4.1.

QUESTION (D) AND (E):

d) What percentage of the program scope that was planned to be completed for the period 2020-2022 was completed?

   i. If less than 100%, what actions has Toronto Hydro taken to improve its execution effectiveness?

e) What percentage of the program scope that was planned to be completed for the period 2020-2024 is forecast to be completed by end of 2024?

RESPONSE (D) AND (E):

As discussed in response to part (b), Toronto Hydro adjusts its plans on an annual basis as part of the Investment Planning & Portfolio Reporting process. The following table corresponds to the expenditure figures provided in part (b). Specifically, column A corresponds to the $359.8 million forecast for 2020-2024 from Exhibit 2B, Section E6.2, while column D corresponds to the latest $363.1 million outlook for the program. (The figures in this table reflect corrections made 2B-SEC-66.)

	A	B	C	D	E
Asset Class	**2020-2024 Planned**	**2020-2022 Actual**	**2020-2022 % Completion**	**2020-2024 Forecast**	**2020-2024 % Completion**
Total Cable (in circuit km)	196	129	66%	184	94%
Transformers	1,941	792	41%	1,999	103%
Switches	231	127	55%	144	62%

Toronto Hydro has also provided a comparison of the latest 2020-2024 outlook for volumes of work to the original 2020-2024 DSP forecast volumes (corresponding to the original $460.3 million expenditure plan) in response to 2B-PWU-3, part (a). To the extent that volumes of work for certain asset classes have been reduced by an amount greater than the 21% reduction in expenditures, this can be attributed to a few major drivers: (1) volume and cost variances that occur as projects move from high-level estimates through detailed design and construction; (2) changes in the mix of assets addressed due to evolving program needs and constraints; and (3) significant inflationary pressures and supply-chain issues in the 2020-2023 period.

Toronto Hydro is committed to continuous improvement in its execution practices. Please refer to 2B-SEC-37 and 2B-AMPCO-29 for more information on Toronto Hydro's work program execution processes and the management of project variances.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2-STAFF-213

References: **Exhibit 2B, Section E6.3, Page 20**
Scorecard - Toronto Hydro-Electric System Limited, 2020
Scorecard - Toronto Hydro-Electric System Limited, 2021
Scorecard - Toronto Hydro-Electric System Limited, 2022

QUESTION (A) – (C):

a) Figure 15: Number of Lid Incidents in reference 1 shows that there were 9 lid incidents in 2020. Page 5 of the 2020 Scorecard MD&A states that of the 24 serious electrical incidents, "four involved lid ejections as a result of underground cable failures". Please reconcile the inconsistencies between these reports.

b) Figure 15: Number of Lid Incidents in reference 1 shows that there were 3 lid incidents in 2021. Page 5 of the 2021 Scorecard MD&A states that of the 22 serious electrical incidents, "four involved lid ejections due to underground cable failures". Please reconcile the inconsistencies between these reports.

c) Figure 15: Number of Lid Incidents in reference 1 shows that there were 5 lid incidents in 2022. Page 5 of the 2022 Scorecard MD&A states that of the 29 serious electrical incidents, "one (1) involved lid ejections due to underground cable failure". Please reconcile the inconsistencies between these reports.

RESPONSE (A) – (C):

Toronto Hydro notes that there is a one-year lag in reporting of serious electrical incidents ("SEI") in the scorecards, for example the 2022 Scorecard MD&A reports on incidents occurring in 2021 incidents not 2022.[1] Table 1 below compares the Scorecard MDMA lid ejection incidents with those reported in Figure 15 of Exhibit 2B, Section E6.3, considering this lag.

[1] The Scorecard relies on Electrical Safety Authority reporting for the SEI metric, which has on a one-year lag.

Table 1: Annual Comparison of Cable Chamber Lid Ejections

	Number of Lid Ejection Incidents	
	Scorecard MDMA	**Figure 15**
2019	4	4
2020	4	9
2021	1	3

The discrepancy noted in the table above is a result of the utilization of a predominantly manual process for reporting and recording data, which unfortunately led to unintentional omissions of certain incidents in the utility's reporting. During the data preparation phase for the application, Toronto Hydro took proactive measures to meticulously compile the numbers of lid ejections within the system, capturing some incidents which were inadvertently overlooked in ESA reporting.

In response to this oversight, Toronto Hydro has taken steps to enhance reporting procedures, provide comprehensive training to our staff, and bolster communication channels with the ESA. These measures have been implemented to mitigate the likelihood of similar discrepancies occurring in the future.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-214

References: EB-2018-0165, Exhibit 2B, Section E6.3, Page 18

Exhibit 2B, Section E6.3, Page 19

Preamble:

In reference 1, Toronto Hydro's 2020-2024 DSP, Toronto Hydro stated it planned to replace 252 cable chamber lids by the end of 2019 and 200 per year going forward.

In reference 2 Toronto Hydro states it has replaced 470 cable chamber lids since 2020, and plans to replace another 2,800 lids over 2025-2029, and that the increased pace is required to address the risk.

QUESTION (A):

a) Please confirm how many cable chamber lids Toronto Hydro replaced per year in the period 2020 through the end of 2023, and the cost per year.

RESPONSE (A):

Please see Table 1 below for cable chamber lid replacements and costs per year.[1]

Table 1: Cable Chamber Lid Replacements and Costs 2020-2023

	2020	2021	2022	2023
Lid Replacements	105	162	192	852
Cost ($M)	1.2	1.8	2.8	14.3

[1] Toronto Hydro notes that it incorrectly stated that it had replaced 470 lids on page 18 of Exhibit 2B, Section E6.3. The correct number is 459 as shown on pages 39 and 40 (Table 9) in Exhibit 2B, Section E6.3 and as shown in Table 1.

QUESTION (B):

b) How many chamber lids does Toronto Hydro forecast replacing in 2024?

RESPONSE (B):

Toronto Hydro forecasts replacing 180 cable chamber lids in 2024.

QUESTION (C):

c) If the total number of lids replaced from 2020 through 2024 is less than 1,000 (i.e. 5 x 200) please explain the reason for the reduction in scope to this program.

RESPONSE (C):

Toronto Hydro forecasts replacing more than 1,000 (1,491) cable chamber lids between 2020 and 2024. As shown in Exhibit 2B Section E6.3 Figure 15, in 2020, there was an increase in the number of lid ejections and, as a result, Toronto Hydro increased the pace of replacement of cable chamber lids between 2020 and 2024.

QUESTION (D):

d) After the 2024 program is complete, how many cable chamber lids remain that require replacement to mitigate the ejection risk?

RESPONSE (D):

The total number of chambers in the system is 10,500 and with the expected completion of 1,491 units by the end of 2024, Toronto Hydro forecasts that there will be 8,794 cable chamber lids remaining after 2024 and all of these require replacement to mitigate the lid ejection risk. Toronto Hydro has planned for an achievable pace of 2,800 cable chamber lids over the 2025-2029 period, prioritizing locations by relative risk.

QUESTION (E):

e) Have there been any injuries to workers or members of the public since 2020 due to the manhole lid ejection issue?

RESPONSE (E):

Toronto Hydro is not aware of any injuries to workers or members of the public since 2020 due to the manhole lid ejection incidents.

QUESTION (F):

f) Does the replacement of the cable chamber lids involve replacing the frame and cover, or replacing only the cover?

RESPONSE (F):

The replacement of cable chamber lids includes both the frame and the cover.

QUESTION (G):

g) Are the new cable chamber lids installed in new and rebuilt locations, or is another method used to mitigate the risk, such as arc proof tape?

RESPONSE (G):

Toronto Hydro installs new cable chamber lids on new and rebuilt cable chamber locations. Concurrently, Toronto Hydro has a cable testing program, which can help to identify potential issues with cables that may lead to cable chamber lid ejections. Currently, no alternative methods are employed. While arc proof tapes are typically utilized to safeguard cables from heat and flames resulting from nearby failures, their practical application within Toronto Hydro's system is limited due to the congestion in the cable chambers, where secondary distribution networks coexist with primary cables and other assets like communications equipment and street lighting.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-215

References: **Exhibit 2B, Section E6.3.3.2, Page 16**
Exhibit 2B, Section E6.4.3.2, Page 8

QUESTION:

a) For both of these programs (cable chamber renewal and network vault renewal) please confirm that all associated costs driven by replacement of the deteriorated civil works (e.g., electrical equipment replacements and/or cable replacements) are included in the civil works program spending.
   i. If not confirmed, please quantify the equipment and cable replacement costs primarily driven by civil remediations.
   ii. If not confirmed, please identify where the associated equipment and cable replacement costs are found in this application.

RESPONSE:

Confirmed. Toronto Hydro includes all associated costs driven by the planned replacement of the deteriorated civil works in the Cable Chamber Renewal and Network Vault Renewal segment spending.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-216

References: Exhibit 2B, Section E6.3.1, Page 2

Preamble:

Toronto Hydro states: "Replacement of legacy PILC and AILC cables will allow Toronto Hydro to maintain reliability performance by proactive replacement of high risk cables. This will also decrease the presence of designated substances (i.e. lead and asbestos) on the grid."

QUESTION (A):

a) Please describe and quantify the "designated substances" risks associated with leaving PILC and AILC cables in use vs. removing these cables.

RESPONSE (A):

PILC and AILC pose relatively low health risk to workers when left in the system undisturbed. However, any disturbance to the cable system due to cable faults, customer connection or planned renewal work would expose workers (e.g., via inhalation/ingestion) to the health hazards associated with designated substances such as lead or asbestos.

Proactive removal of these cables would decrease the overall frequency of exposure to these designated substances when working on or around them in the underground system. Eliminating the hazard (i.e., the designated substances) through removal of the cables is a more effective control to protect the health and safety of the workers as opposed to relying on less reliable administrative controls or personal protective equipment (e.g., respirators) to mitigate the exposure.

QUESTION (B):

b) How does Toronto hydro dispose of these cables following removal?

RESPONSE (B):

Toronto Hydro safely handles and disposes of asbestos and lead as prescribed in the *Ontario Occupational Health and Safety Act* (Reg. 8338), R.S.O. 1990 and the *Canadian Environmental Protection Act*, 1999.

Following the removal of lead or asbestos waste, smaller sections are wrapped up and sealed in plastic bags or sheeting and transported to designated bins. Cables removed on reels will have damaged or exposed ends of cables capped or tapped to prevent the release of the designated substance. Waste is removed from Toronto Hydro facilities by an appropriately licensed waste hauler vendor.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-217

Reference: Exhibit 2B, Section E6.3.3.3, Page 22

Preamble**:**

Toronto Hydro states "Defective equipment was the largest contributor to annual customer reliability representing about 70 percent and 80 percent of Customers Interrupted (CI) and Customers Hours Interrupted (CHI), respectively."

QUESTION (A):

a) The trend shown in Figure 18 indicates that defective equipment failures trended down significantly from 2018 to 2022, and failures from other causes trended up significantly. Please discuss the reasons for these apparent performance trends.

RESPONSE (A):

The Underground Residential Distribution system ("URD") serves a small portion of Toronto Hydro's distribution system, therefore the year over year reliability measures are substantially affected by individual outage incidents. URD equipment failures from 2018-2022 have generally dropped. Prior to 2020, Toronto Hydro managed these assets reactively and introduced as part of its 2020-2024 rate application a proactive renewal plan to address deteriorating URD assets.[1] Since 2020, these investments have resulted in improved reliability of the URD assets, and therefore, the apparent relative increase in interruptions is due to all other causes. The majority of these interruptions are generally beyond Toronto Hydro's control. As such, no concrete trends or conclusions related to the other causes of reliability performance should be inferred.

[1] EB-2018-0165, Exhibit 2B, Section E6.3.

QUESTION (B):

b) How many customers are supplied by this system?

RESPONSE (B):

Approximately 14,900 customers were supplied by the URD system as of February 2024.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-218

Reference: Exhibit 2B, Section E6.3.3.3, Page 22

Preamble:

Many Ontario distributors, as well as utilities in other Provinces, utilize a run-to-fail asset management strategy for pole-top transformers, to maximize the value extracted by customers from these assets, since they are relatively low-cost, quick to replace and economical warehoused in a range of standard sizes. Furthermore, because they have long service lives and can be replaced quickly upon failure, the net reliability impact of unit failure upon the customers connected to it is minimal over the longer term. Each unit failure interrupts customers for at most a few hours over a multiple decade reliable service life.

QUESTION (A):

a) Please provide a Benefit Cost Analysis supporting Toronto Hydro's decision to follow a proactive lifecycle management strategy for pole-top transformers.

RESPONSE (A):

Please see Table 2 on page 18 of Exhibit 2B, Section D3 which speaks to the approach for replacing pole top transformers.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-219

Reference: Exhibit 2B, Section E6.5.3.1. pages 7-8

Preamble:

Figure 1 indicates that less than a quarter of overhead system outages are caused by defective equipment, yet Toronto Hydro is accelerating its overhead system renewal expenditures by $139.5M (64%).

QUESTION (A):

a) Please explain why Toronto Hydro is increasing spending by 64% above historical levels to address a situation that is only responsible for 24% of historic overhead system outages.

RESPONSE (A):

The increase in this program does not represent an "acceleration" of investments.

The proposed Overhead System Renewal budget for the 2025-2029 period is higher than the 2020-2024 expenditures due primarily to the following reasons:

- the addition of the Overhead Infrastructure Resiliency segment ($85.9 million), which is a reintroduction and expansion of the work done through the Overhead Infrastructure Relocation program in Toronto Hydro's 2015-2019 Distribution System Plan;
- the deferral of work in the Overhead System Renewal segment from the 2020-2024 period into the 2025-2029 period, which was done to manage pressures across the broader capital expenditure plan; and
- inflationary increases.

Note that the proposed expenditure for the Overhead System Renewal segment (i.e. excluding the Overhead Infrastructure Resiliency segment) for the 2025-2029 period is $272.8 million. This is aligned with the original plan of $265.7 million in the 2020-2024 DSP (and would in fact represent a reduction in spending after accounting for inflation).

QUESTION (B):

b) Please discuss what Toronto Hydro is doing to address the other 75% of outages and relevant costs.

RESPONSE (B):

While the Overhead System Renewal program is aimed at reducing the failure risk of overhead equipment, these investments may contribute to other reliability improvements, such as:

- A reduction of tree-contact outages by replacing bare conductors with tree-proof conductors or relocating existing pole lines away from high vegetation areas,
- A reduction of foreign interference outages by relocating poles lines in high traffic areas,
- A reduction of unknown outages caused by tree contacts, animal contacts and incorrect fuse protection settings by replacing existing overhead assets with new assets that meet current standards.

Toronto Hydro also manages overhead reliability performance through the Area Conversions (Section E6.1), Reactive and Corrective Capital (Section E6.7), System Enhancements (Section E7.1), Preventative and Predictive Maintenance (Exhibit 4, Tab 2, Schedule 1) and Corrective Maintenance (Exhibit 4, Tab 2, Schedule 4) programs.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-220

Reference: Exhibit 2B, Section E6.5.3.1, p. 10

Preamble:

Toronto Hydro states: "Through the Overhead System Renewal segment, Toronto Hydro replaces overhead transformers beyond useful life, which are at risk of failing and potentially posing an environmental risk due to oil leaks that may contain PCBs"

QUESTION (A):

a) What percentage of the transformers planned for replacement in 2025-2029 are suspected to contain PCBs.

RESPONSE (A):

With respect to the population of assets relevant to the referenced Overhead System Renewal program: Toronto Hydro expects to have an estimated remaining population of 618 overhead transformers at risk of containing PCBs as of the beginning of 2025. This number represents 13% of the overhead transformers planned for replacement in the 2025-2029 period. Note that this figure could increase or decrease slightly depending on 2024 work program execution and other updates (e.g., field inspections).

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-221

References: Exhibit 2B, Section E6.5.3.1, pp. 11-12
Exhibit 2B, Section E6.5.1, p. 1

QUESTION (A):

a) Please reconcile the results shown in Figures 6, 7 and 8 with the statement made on lines 17-20 of Reference 2 that:

"Toronto Hydro has reduced the number of transformer related customers interrupted and customer hours interrupted from over 10,000 customers interrupted and 6,000 customer hours interrupted and per year on average to 4,133 customers and 4,360 customer-hours interrupted per year on average over the last five years (2018-2022)."

RESPONSE (A):

On average, Toronto Hydro saw over 10,000 customers interrupted and over 6,000 customer hours interrupted per year due to pole top transformers between 2013 and 2017. By contrast, on average, Toronto Hydro saw 4,133 customers interrupted and 4,360 customer-hours interrupted per year due to pole top transformers between 2018 and 2022.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-222

Reference: Exhibit 2B, Section E6.5.3.1, Page 12

QUESTION (A):

a) What drove the outlier results in 2022 shown in Figures 7: Customers Interrupted ("CI") for Pole-top Transformers and Figure 8: Customers Hours Interrupted ("CHI") for Pole-top Transformers?

RESPONSE (A):

There was one outage that contributed to an abnormal number of customers (CI) and a different outage that contributed to abnormal number of customer hours interrupted (CHI). Below are the details on each of those outages:

- F-2022-1213 on 34M2 (LEASIDE TS) with a CI of 3,177 (41.6% of 2022 CI)
- F-2022-978 on XJF2 (ELLESMERE MS) with a CHI of 3,340 (38.9% of 2022 CHI)

QUESTION (B):

b) Please update Figures 7 and 8 to show results from 2013-2022.

RESPONSE (B):

Please refer to Toronto Hydro's response to interrogatory 2B-SEC-69.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-223

Reference: Exhibit 2B, Section E6.5.3.1, Page 14

a) Please explain why failures due to External Factors, Other and Unknown appear to significantly diminish for transformers older than 35 years relative to transformers that are younger than 35 years as indicated in Figure 11: Age and Cause Distribution for Failed Overhead Transformers 2018-2022.

RESPONSE:

Equipment failures result from a mix of cumulative (long-term) degradation factors and immediate degradation factors. Premature failures are typically linked to direct causes, while assets failing due to cumulative impacts over their lifespan are often considered end-of-life failures. For instance, a five-year-old transformer that starts leaking oil is attributed to a supplier quality paint issue. On the other hand, similar issues with a 40-year-old transformer would not likely be attributed to a supplier quality problem. Instead, such a failure would likely be categorized as an end-of-life failure, resulting from the cumulative impacts of environmental conditions or the natural degradation of the tank enclosure.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-224

Reference: Exhibit 2B, Section E6.5.3.1, Page 17

Preamble:

Toronto Hydro states: "Figure 15 illustrates that, despite ongoing renewal, approximately 287 poles on average had to be replaced reactively per year between 2019 and 2022."

QUESTION (A):

a) What are the primary failure modes of wood poles that require reactive replacement, and what are the most common triggering events?

RESPONSE (A):

Primary failure modes of wood poles are explained in Exhibit 4, Tab 2, Schedule 1 at pages 13-14 and Exhibit 2B, Section D2.2.1.2: Overhead Assets Failure Characteristics.

In summary, rot and decay are the most common and primary reasons for condemning a pole for replacement as they can weaken the mechanical strength and structure of the pole, which is the primary indicator of its health and remaining life. Ground rot at the base of the pole in particular is the worst location for rot to be in as the base is the most vulnerable to environmental degradation. Signs of mechanical damage such as holes or cracks and insect infestation, which can compromise the structure are another trigger for replacement.

QUESTION (B):

b) On average, how many poles per year does Toronto Hydro replace (or retire) under all of its capital and operating programs and projects; for example, road moves and widenings, reactive capital (storms, vehicle accidents, treefalls), Back Lot program, Box Frame program, voltage upgrades, underground conversions, and overhead system renewal?

RESPONSE (B):

On average, Toronto Hydro replaces approximately 4,100 poles per year under of all its programs.

QUESTION (C):

c) What is the ratio of poles replaced under the overhead renewal program to the poles replaced or retired under all other programs and projects?

RESPONSE (C):

The average ratio of poles replaced under the overhead renewal program to the poles replaced or retired under all other programs is approximately 35 percent. This number increases to 45 percent if the poles replaced under the externally driven programs are excluded, which is another significant contributor of pole replacements but is not driven by failure risk.

QUESTION (D):

d) Does Toronto Hydro consider all the pole replacements or retirements it is doing under these other programs or projects when evaluating the need to replace poles under the overhead system renewal program?

RESPONSE (D):

Yes, Toronto Hydro considers pole replacements under other programs when evaluating need under the Overhead System Renewal program. Please refer to 2B-SEC-44 for a discussion regarding expectations for wood pole replacements and demographic changes in the 2025-2029 period.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-225

Reference: Exhibit 2B, Section E6.5.4.1, page. 35

a) Does Toronto Hydro typically replace overhead conductors due to the condition of the conductors, or only when it is replacing a line segment for other reasons?

RESPONSE:

As a result of overhead line patrols, which are conducted every three years, and infrared scans of overhead primary lines, which are conducted annually, Toronto Hydro may determine that it is necessary to reactively replace defective or failed overhead conductors exhibiting deficiencies such as fraying or bird caging, excessive sag or low clearances, or the presence of thermal anomalies. In addition, Toronto Hydro will replace conductors as part of rebuilds and voltage conversion projects. Please refer to Section D3.1.2 of Exhibit 2B for more information regarding asset replacement practices.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-226

References: **Exhibit 2B, Section E6.5, Page 35**
Exhibit 2B, Section D3, Appendix A, Pages 4 and 6
Exhibit 2B, Section D3, Appendix B, Page 8

Preamble:

Over the planning period Toronto Hydro plans to replace 8,337 poles over 4 years which yields an average annual replacement rate of 2,084 poles per year. The condition assessment tables indicate that the number of wood poles in Hi4 and Hi5 will increase by 9,459 in 2022 and 32,158 in 2029. If Toronto Hydro was to maintain Hi4 and Hi5 at 2022 levels 22,699 poles would need to replaced between 2022 and 2029, yielding an annual replace rate of 3,242 poles per year.

QUESTION (A):

a) Toronto Hydro owns approximately 183,620 poles and approximately 107,000 wood poles were evaluated for asset condition between 2018-2022. Please explain why approximately 76,620 poles were not evaluated for condition assessment.

RESPONSE (A):

The total count of 183,620 poles mentioned in Exhibit 2B – Section A encompasses both streetlighting and distribution poles within the system. Among these, distribution poles consist of approximately 107,000 wood poles, 30,000 concrete poles, and 3,600 steel poles. Toronto Hydro's Asset Condition Assessment methodology specifically focuses on distribution wood poles as they are subject to a dedicated pole inspection program enabling the calculation of condition-based Health Scores. The condition of the remaining poles (concrete and steel) has not been assessed due to the lack of both a regular inspection program and an ACA methodology. Once inspections of these poles commence, ACA methodology and condition-based Health Scores will be established.

Please refer to Exhibit 4, Tab 2, Schedule 1, Segment 5 for details regarding overhead line patrols and pole inspections.

QUESTION (B):

b) Comparing the planned annual average replacement for wood poles of 2,084 per year to a condition replacement rate of 3,242, a shortfall of 1,158 assets appears to exist. Please explain how Toronto Hydro is achieving asset demographics, for example are there Hi4 and Hi5 pole replacements occurring in other spending categories that close the observed shortfall.

   i. Do the wood pole health indices for 2029 overstate the projected decay in wood pole asset condition, given that Toronto Hydro's consultant has indicated a potential miscalculation of wood pole useful life.

RESPONSE (B):

To clarify, the Overhead System Renewal program plans to replace 8,337 poles over five years, which is an annual replacement of 1,667 poles per year from 2025-2029. If no investment or pole replacement were done from 2022 till 2029, 32,158 poles are expected to reach HI4 and HI5 condition in 2029. Please see response to 2B-SEC-44 for a comprehensive overview of expected changes in asset demographics over the 2025-2029 period with investment, including a discussion regarding the utility's decision to restrain the pace of pole replacements.

i. In Toronto Hydro's experience, wood poles have proven to be a uniquely challenging asset to track and model from an ACA perspective. This is due primarily to the fact that inspections occur only once every 10 years, meaning that the model is in many cases relying on data that is upwards of nine years old. This, in Toronto Hydro's view, is the most significant factor in the comparatively high rate of deterioration seen in the Future Health Score model outputs (since the model is having to age the assets over a longer period of time, amplifying its effects). As discussed in Ex.2B, Section D3, App A, Toronto Hydro's assessment of the wood pole ACA model since its implementation in 2017 has led to reasonable adjustments that better align model outputs with observed reality. Toronto Hydro aims to further mitigate this issue through its proposed reduction of inspection to an 8-year cycle and by introducing targeted wood pole inspections based on the asset condition assessment (see 2B-PWU-10).

Regarding the Normal Expected Life for assets, please refer to 2B-Staff-146.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-227

References: **Exhibit 2B, Section E6.5, Page 35**
Exhibit 2B, Section D3, Appendix A, Pages 4, 6

QUESTION (A):

a) Please update the following 3 tables to show pole top transformers.
   i. Table 3: Summary of Health Index Distribution as of year end 2017
   ii. Table 4: Summary of Health Index Distribution as of year end 2022
   iii. Table 5: Summary of Health Index Distribution as of year end 2029

RESPONSE (A):

Due to the lack of a feasible and cost-effective method for collecting sufficiently detailed condition information in the field, there is no health score calculation methodology for pole top transformers.

QUESTION (B):

b) Provide an estimation of the pole top transformer asset condition assessment that are solely or primarily based on age.

RESPONSE (B):

Please see response to part (a).

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-228

Reference: Exhibit 2B, Section E6.6, Pages 1-3

Preamble:

Toronto Hydro states that: "Toronto Hydro plans to invest $282.7 million in the Stations Renewal Program in 2025-2029, which is a $107.3 million or 61 percent increase over the projected 2020-2024 spending in the Program." From the previous application the projected station renewal program was $141.6M rather than $175.4M that is forecast above in the current application.

Source: EB-2018-01652B -DSP Section E6.6 Stations Renewal pp. 1-2	**Source: EB-2023-0195 2B-E6.6 Section E6.6 Stations Renewal pp. 1-2**
Transformer Stations 5 TS Switchgear 9 TS Outdoor Breakers 61 TS Outdoor switches **$74.5M**	**Transformer Stations** 3 TS Switchgear Complete four TS from the 2020-2024 period. 12 TS Outdoor Breakers 63 TS Outdoor Switches Refurbish one station building in preparation for switchgear replacements required over the 2030-2034 period. **$134M**
Municipal Stations 12 MS Switchgear 10 Power Transformers 10 Primary Disconnect Switches 1 MS Primary Breaker **$37.7M**	**Municipal Stations** 12 MS Switchgear 15 Power Transformers 1 MS Primary Supply **$70.3M**
Control and Monitoring 6 new RTU Renew 39 RTUs Upgrade Protections a 5 Pilot-Wire Locations Replace 45km Cu Control Cable **$22.1M**	**Control and Monitoring** 33 RTU Renew 251 Obsolete Relays **$64.7M**
Battery and Ancillary Systems 3 Sump Pumps 67 Battery and Charger Systems 6 Station Service Transformers 2 Air Compressors **$7.3M**	**Battery and Ancillary Systems** 55 Batteries 8 Charger Systems 3 Station Service Tx 5 Station AC Service Panels 3 Sump Pumps **$13.6M**
Plans to invest $141.6M	**Plans to invest $282.7M**

QUESTIONS (A) – (D):

a) Please reconcile the discrepancy between $141.6M detailed in the station renewals in the 2020-2024 period from the previous application and the $175.4M detailed in the 2025-2029 application.
b) For each grouping in the table above for the period of 2020-2024 provide the planned scope of work, and what scope was completed. The scope descriptions should include a count of the items planned and completed.
c) For each grouping in the table above for the period of 2020-2024 provide the planned expenditures and actual expenditure.
d) Please explain the basis for the forecasts for the scope of work for 2025-2029.
    i. Please provide the detailed estimates.

RESPONSES (A) – (D):

Please refer to the expenditure plan in Exhibit 2B, Section E6.6.4 for a detailed variance analysis of 2020-2024 capital expenditures and the 2025-2029 forecast.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-229

Reference: Exhibit 2B, Section E6.6.3.1, Page 13

Preamble:

Toronto Hydro states: “The failure risk of KSO circuit breakers is high and the impact of failure is significant.”

QUESTION (A):

a) Figure 9 indicates that all KSO breakers are in asset condition HI2 or HI3. What is the annual probability of failure of breakers in each of these categories?

RESPONSE (A):

KSO circuit breakers represent approximately 1 percent of all circuit breakers and are actively being removed from the system. Therefore, the sample size is too small to generate a representative probability of failure.

QUESTION (B):

b) Risk is the product of probability x consequence. Is the consequence of failure of these breakers so high that even with a low failure probability they represent an unacceptable risk to Toronto Hydro? Please quantify and discuss any associated risk analysis that has been undertaken.

RESPONSE (B):

As described in Exhibit 2B, Section E6.6.3.1.2, KSO breakers supply large amounts of load therefore when they fail they have the potential to disrupt thousands of customers. Replacing these assets requires long lead times and maintaining the system in contingency while these replacements are being completed can pose significant risks due to the added load on the surrounding parts of the system.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-230

References: Exhibit 2B, Section E6.6.3.2, Page 18

Preamble:

Toronto Hydro states: "Toronto Hydro's MS supply power to Toronto's suburban areas consist largely of residential and a few small general service customers (<1 MW). Major MS assets include switchgear, power transformers, and MS primary supplies composed of disconnect switches and power cable. A large portion of these assets are operating well beyond their useful life and are consequently at a heightened risk of failure."

QUESTION (A):

a) When Toronto Hydro states throughout this application that assets operating beyond their useful lives are at a heightened risk of failure, does Toronto Hydro actually mean that such assets exhibit a heightened probability of failure?

RESPONSE (A):

Toronto Hydro confirms that it expects assets operating beyond their useful life to have a higher probability of failure (on average, and before considering observed condition) than assets that are not as old. Toronto Hydro would like to further clarify that, in general, when it refers to assets operating beyond their useful lives as being a concern, this is meant to communicate the observation that there is a certain population of assets that are operating at an age where probability of failure is expected to increase at an accelerating rate, and that this population warrants consideration in asset management planning. Toronto Hydro does not replace assets simply because they have crossed the "useful life" threshold, and in fact runs many thousands of assets well beyond useful life.

QUESTION (B):

b) Where ACAs are not solely based on age, confirm that probability of failure should be determined based on the assessed ACA rather than asset age, since some older assets may be in good condition, and some relatively new assets may be in unsatisfactory condition.

    i. If not confirmed, why not?

RESPONSE (B):

Toronto Hydro confirms that for asset classes where condition information is available, the probability of failure should be assessed based on condition, where feasible (i.e., failure data exists).

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-231

Reference: Exhibit 2B, Section E6.6.3.2, Page 21

Preamble:

Toronto Hydro states: "The useful life of a power transformer is 45 years."

QUESTION (A):

a) Would the same useful life apply to a transformer in a winter peaking system?

RESPONSE (A):

Toronto Hydro has not specifically assessed the impact of summer vs. winter peak on the useful life of transformers. Based on the System Peak Demand Forecast in Exhibit 2B, Section D4 (updated January 29, 2024), Toronto Hydro remains a summer peaking utility for this rate period.

QUESTION (B):

b) Toronto Hydro forecasts that it will become a winter peaking system. Should it be modifying the planning criteria it applies to make station asset investment decisions, since most station asset types will have higher capacity ratings in winter peak ambient temperature conditions than they will in summer peak ambient temperature conditions.

RESPONSE (B):

As noted in the response to part (a), Toronto Hydro remains a summer peaking utility for this rate period. The planning criteria used assesses the maximum ratio of load to transformer capacity, and considers all seasons. If and when Toronto Hydro's system evolves to a winter-peaking system, this criteria will not be affected.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-232

Reference: Exhibit 2B / Section E6.6.3.2 / p. 22

<u>Preamble:</u>

Toronto Hydro states: "Toronto Hydro has revised its target maximum age for its power transformers down from 70 to 65 years, in alignment with previous rate applications."

a) Please explain why this revised target maximum age remains appropriate since Toronto Hydro is becoming a winter peaking utility.

RESPONSE:

Please refer to Toronto Hydro's response to interrogatory 2B-Staff-231 part (a).

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-233

Reference: **Exhibit 2B / Section E6.6.3.2 / p. 23**

<u>Preamble:</u>

Regarding Table11: Power Transformers Proposed for Replacement

QUESTION (A):

a) Please confirm Dunsany MS Power Transformer 2408, Centennial MS Power Transformer 2412 are all scheduled for replacement solely due to age and not because of additional concerns.
   i. If not confirmed, please explain why not.

RESPONSE (A):

Power transformers replacements are not prioritized solely based on age. As described in Exhibit 2B, Section E6.6.4.2, Table 42 at page 56, Toronto Hydro considers the impact of failure, such as customer count, loading, degradation of oil, resiliency of operation, and voltage conversion plan in addition to age when prioritizing the replacement these assets. On average, the average Municipal Station ("MS") supplies approximately 500 customers. However, Centennial MS and Dunsany MS supply around 700 and 750 customers, respectively which represent 39 and 49 percent more than the average number of customers. As such, they are assigned a higher priority for replacement.

QUESTION (B):

b) Explain why Belfield MS Power Transformer 2504 is scheduled for replacement in 2029 at an age of 60 years despite exhibiting no concerns other than age, even though it will still be 5 years younger than Toronto Hydro's reduced maximum target age of 65 for Power Transformers in 2029.

RESPONSE (B):

Belfield Municipal Station consists of two Power Transformers (TR1 2503 and TR2 2504). As shown in Table 42 in Exhibit 2B, Section E6.6.4.2 at page 56, the need to replace Belfield MS Power Transformer 2504 is not solely based on age but due to the combination of age with the following:

- TR1 2503 will be 69 years old at the time of the project and has a high-power factor;
- A loading analysis of the area identified the need for only one power transformer, therefore resulting in the removal of TR2 2504 and replacement of TR1 2503;
- The primary supply to the MS also requires replacement due to the high risk of failure of direct buried ingress; and
- Belfield MS Switchgear is planned to be replaced in 2029. Coordination of the replacement in conjunction with the aforementioned work is a cost-effective alternative.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-234

Reference: Exhibit 2B, Section E6.6.3.3, Page 29

<u>Preamble:</u>

Toronto Hydro is planning to increase its Stations Control and Monitoring Renewal spending by $36.6M (130%).

QUESTION (A) AND (B):

a) What is the annual probability of failure of any of the existing electromechanical relays?
b) Are electromechanical relay failures trending up significantly?
    i. If yes, please provide documentation showing the increasing failure trends.

RESPONSE (A) AND (B):

Protection relay systems have built in redundancies that allow back-up systems to operate in the event of a single relay failure; and are inspected as part of a robust maintenance cycle. As such, Toronto Hydro does not track individual relay failures and is unable to provide their probability of failure or an indication whether electrotechnical relay failures are trending up

QUESTION (C):

c) Is adherence to Toronto Hydro's Grid Modernization Roadmap a major driver of the significantly increased planned spending on relay replacements relative to the historical period? Please discuss.

RESPONSE (C):

Confirmed. Toronto Hydro's planned investments in relays over the 2025-2029 period are driven by a combination of system observability, equipment obsolescence and improved fault location and protection equipment coordination. Modernizing old electromechanical relays to digital relays have other benefits for the system that reduces maintenance costs, improves reliability, and enhances grid observability. For more detail, please refer to Control and Monitoring drivers at Exhibit 2B, Section E6.6.3.3 and Grid Modernization Section D5.1.

QUESTION (D):

d) What percentage of the electromechanical relays targeted for replacement operate obsolete or poor condition breakers or switchgear?

RESPONSE (D):

As the monitoring and control work is carried out on a programmatic basis, Toronto Hydro cannot readily identify which relays are specifically linked to obsolete and poor condition breakers and switchgear outside of specific assets identified in project scopes and details.

To clarify, Toronto Hydro replaces electromechanical relays either through targeted renewal or as part of a switchgear/breaker replacement.[1] As described in response to part (c), the proposed investments are driven by station modernization to enhance system and station observability and improve fault location. The latter is done in conjunction with switchgear and breaker replacement. Toronto Hydro notes that the 2025-2029 relay investments proposed in the Monitoring and Control segment do not overlap with planned switchgear and breaker replacements.

[1] Please refer to Exhibit 2B, Section E6.6.4.3 Table 50 at page 68

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-235

Reference: Exhibit 2B, Section E6.6.3.3, Page 30

QUESTION:

a) Is the use of "(Without Investment)" in the header cells in Tables 14 and 15 a typo?
   i. If no, how is the number of obsolete/past useful life assets being reduced in all instances by 2029 without investment?

RESPONSE:

No. Tables 14 and 15 demonstrate the deterioration of the assets over the 2025-2029 period should Toronto Hydro not intervene. These assets are targeted through switchgear renewal investments and MS Conversions as proposed in Exhibit 2B, Section E6.6.3.3, Page 33, Line 8.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 2B-STAFF-236

References: **Exhibit 2B, Section E6.7, page. 13**

Exhibit 2B, Section E5.4, pages. 16-17

Preamble:

Toronto Hydro states that the Reactive Meter Replacement costs for 2025-2029 were "derived based on a four-year weighted average of historical costs. The average percentage of meters failing remains the same but the population is increasing yearly".

QUESTION:

Please explain why Toronto Hydro used historic performance of aged meters and did not consider the impact of replacing meters in the AMI 2.0 program when projecting meter failures in the 2024-2029 period.

RESPONSE:

Toronto Hydro used the historical failure rate of meters to forecast reactive meter replacement volumes and costs for the 2025-2029 rate period since the failure rates of newer meter models and communication infrastructure that the utility will install as part of the AMI 2.0 initiative are currently unknown.