TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1:

Reference(s): Exhibit KT1.1: VECC Letter Filed April 2, 2024

VECC’s written Technical Conference questions for Panels 1, 2, 3, and 4.

RESPONSE:

Please see attached responses labeled Schedules JT1.1.1 to JT1.1.22.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.1:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
3-DRC 14 b), c) & d)
Exhibit 2B, Section E7.4, page 17

<u>Preamble:</u>

DRC 14 b) states: *"Toronto Hydro is unable to disaggregate EV charging infrastructure-specific costs from other cost drivers in these capital and operation demand-related programs."*

DRC 14 c) states: *"In the 2020-2024 rate period, Toronto Hydro received a Natural Resources Canada ("NRCAN") contribution of $255,000 related to the installation of EV charging infrastructure for Fleet and employee vehicles."*

DRC 14 d) states: *"Toronto Hydro continues to be of the opinion that these forecasts are reasonable, given future uncertainties in load materializing. Toronto Hydro has proposed a Revenue cap and Demand-Related DVA to address this concern".*

QUESTION (A) AND (B):

a) Exhibit 2B, Section E7.4 (page 17) indicates that THES' planned capital spending for 2025-2029 includes spending related to the installation of EV charging infrastructure? Has THES included any capital contributions from NRCAN associated with this spending?

b) Is any of the 2020-2024 or 2025-2029 spending on EV charging infrastructure associated with the installation of public EV charging stations that will be owned by THES?

   i. If yes, please outline THES's plans with respect to public EV charging stations (e.g., number of stations planned to be in-service each year and the kW rating for such stations).

   ii. If yes, where are the kWh/kVA associated with these stations included in THES's load forecast, what is the forecasted associated kWh/kVA usage for each year and what is the distribution revenues associated with these stations?

RESPONSE (A) AND (B):

Toronto Hydro notes that the January 29, 2024, evidence update removed the referenced Stations Expansion evidence because it related to City development plans triggering the need for an expansion at Scarborough TS which is no longer part of Toronto Hydro's application. For further clarification, the "plan" for EV charging mentioned in the original submission relates to the City of Toronto's Golden Mile Secondary Plan and not Toronto Hydro's Distribution System Plan.

Toronto Hydro's 2020-2024 and 2025-2029 investments have not included and do not include plans to install nor own public EV charging infrastructure as part of rate base. The utility has also not included capital contributions from NRCAN associated with such spending.

QUESTION (C):

c) With respect to DRC 14 d), is the a "Revenue cap and Demand-Related DVA" referenced here the same as the "Demand-Related Variance Account (DRVA)" referenced in Exhibit 9, Tab 1, Schedule 1, page 40?

RESPONSE (C):

The Revenue Cap and Demand-Related VA are separate, however the Demand-Related VA referenced in 1B-DRC-14 part (d) is the same as the Demand-Related Variance Account referenced in Exhibit 9, Tab 1, Schedule 1, page 40.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.2:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
3-VECC-45 (a)

<u>Preamble:</u>

3-VECC-45 a) states: *"The EV battery will be further depleted, assuming the same driving distances, during cold weather versus mild or hot weather. This will require more kWhs at charging. The average kWs in each hour will, therefore, increase by a corresponding amount to deliver the energy to the EV battery."*

QUESTION:

a) Please explain why the average kW would increase when the kW used in a charging session will be determined by the lesser of: i) the EV charging station kW rating and ii) the charging speed capability of the EV's battery? Won't the requirement for more kWh increase the charging time required as opposed to the average kW used?

RESPONSE (PREPARED BY CLEARSPRING):

The difference is that the load profile for the EV battery is for the average customer. So as the time expands for each individual customer that will tend to increase the kW used for the average EV load profile.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.3:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
3-VECC-48 (f)
Exhibit 3, Tab 1, Schedule 1, Page 24

<u>Preamble:</u>

3-VECC-48 f) asked for the 2022 energy delivered to THESL by rate class under the net metering program and what this represented as a portion of the total renewable energy produced in 2022 (per Table 27) for each customer class. The response referred to 3-VECC-45 c) which in turn referenced Clearspring working papers filed on a confidential basis.

Exhibit 3 states: *"The Renewable capacity forecasted for Toronto Hydro is allocated to the different rate classes. The Integration Model uses the 2022 participation percentages in Toronto Hydro's net metering program by rate class to estimate the rate class allocations."*

QUESTION (A):

a) Please provide a publicly accessible response to the specific questions posed in 3-VECC-48 f). If considered confidential, please explain why.

RESPONSE FROM CLEARSPRING (A):

The data used by Clearspring in our model is accessible via the working papers provided and discussed in our response to 3-VECC-45.

QUESTION (B):

b) With respect to the reference from Exhibit 3, what was the basis for the "participation percentages" used (e.g., were they based on number of customers, total energy produced, net energy delivered to THES, or some other metric).

RESPONSE FROM CLEARSPRING (B):

The allocation is based on the installed capacity for each rate class.

QUESTION (C):

c) Please clarify whether the forecasted Renewable (and the forecasted Non-Renewable capacity) includes or excludes generation capacity directly connected to (and selling to) the THES system (e.g., microFIT facilities).

RESPONSE FROM TORONTO HYDRO (C):

Toronto Hydro considers the DER capacity connected to its system to build its DER forecast, without distinguishing whether or not that generation capacity is selling to Toronto Hydro's system.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JTC1.1.4:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
3-VECC-50 (a) and (b)
Exhibit 3, Tab 1, Schedule 1, Appendix J, Pages 28-29

<u>Preamble:</u>

Appendix J states: *"Toronto Hydro provided the behind-the-meter Non-Renewable nameplate capacity forecast and historical data to Clearspring. It is Clearspring's understanding that these Non-Renewable DERs will be actively dispatched by the IESO."*

And

"Toronto Hydro provided the capacity factors by hour for the existing Non-Renewable generation on its system that are dispatched by the IESO."

And

3-VECC-50 a) states: *"Toronto Hydro does not collect detailed information about the number of DERs that are currently Market Participants (i.e., dispatched by the IESO)."*

QUESTION (A):

a) Please reconcile the response to 3-VECC-50 a) with the statement in Appendix J that "Toronto Hydro provided the capacity factors by hour for the existing Non-Renewable generation on its system that are dispatched by the IESO", as the statement suggests that THES does know which non-renewable DERs are dispatched by the IESO.

RESPONSE FROM CLEARSPRING (A):

Upon further review, Clearspring clarifies that our understanding on this point was mistaken, in terms of the load profiles being a sample and dispatched by the IESO. In fact, the report should now state that Toronto Hydro provided a load profile comprised of a sample of non-renewable DERs which were connected to the Toronto Hydro system in 2022 irrespective of IESO dispatching. This clarification does not affect the results of the model since both the 2022 sample load profile used in the model and the forecasted non-renewable DERs are consistent in their definition of being connected to the Toronto Hydro system irrespective of IESO dispatching.

RESPONSE FROM TORONTO HYDRO (A):

Toronto Hydro confirms its response to the interrogatory 3-VECC-50 (a). Toronto Hydro does not collect detailed information about the number of DER's that are currently Market Participants (i.e. dispatched by IESO).

QUESTION (B):

b) If not provided by Toronto Hydro (as suggested by VECC 50 a)), what is the basis for Clearspring's understanding that Non-Renewable DERs will be actively dispatched by the IESO?

RESPONSE FROM CLEARSPRING (B):

Please see the response to part (a).

QUESTION (C):

c) The Non-Renewable Production profile provided in Appendix J (page 29) indicates that production is virtually constant across all hours of the day suggesting that: i) customer owned Non-Renewable capacity is not used dispatched by the IESO to manage system peaks and ii) customer owned Non-Renewable capacity is not used by customers to manage their own billing demands either overall or in terms of their coincidence with system peaks. Please confirm that this matches THES' understanding of how customer-owned Non-Renewable generation capacity is operated.

RESPONSE FROM CLEARSPRING (C):

Clearspring can confirm that in our model the Non-Renewable Production profile is close to constant across all hours of the day.

RESPONSE FROM TORONTO HYDRO (C):

Toronto Hydro does not collect detailed information about the production profiles of the DER's in its service territory that are Market Participants. In Toronto Hydro's experience, customers can and do manage their own billing demands with owned Non-Renewable DER.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.5:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
4-STAFF 295 e) & f)

QUESTION (A):

a) Does the response to STAFF 295 e) represent the allocation of 2025 Key Accounts costs to customer classes per the cost allocation model? If not, what to the results represent?

RESPONSE (A):

Yes, the table provided in response to 4-Staff-295(e) represents the allocation of the 2025 Key Accounts segment costs to customer classes, as per the cost allocation model.

QUESTION (B):

b) Please explain why, in 4-Staff 295 e), the Key Accounts costs allocated to the GS 50-999, GS 1,000-4,999, Large Use, Street Light and USL classes are all negative.

RESPONSE (B):

The allocated costs related to the Key Accounts segment for 2025 presented in 4-Staff-295(e) were derived by comparing the output of the cost allocation model with and without the Key Accounts segment costs. The negative impacts of the GS 50-999, GS 1,000-4,999, Large Use, Street Lighting and USL classes can be primarily attributed to O&M costs and the change in percentage allocation used to allocate Key Accounts-related costs within the model. Table 1 below demonstrates that as the O&M amount is increasing, the allocation percentages are decreasing within the GS 50-999, GS 1,000-4,999, Large Use, Street Lighting and USL rate classes.

1 **Table 1: O&M Costs and Allocation Percentages by Rate Class, Including and Excluding Key Accounts Segment Costs**

O&M	Total	Residential	GS <50	GS 50-999 kW	GS 1,000-4,999 kW	Large Use >5MW	Street Light	USL	CSMUR
O&M Including Key Accounts Costs	**193,349,380**	80,359,397	31,853,228	45,466,739	14,161,894	6,026,509	4,748,432	643,527	10,089,652
O&M Excluding Key Accounts Costs	**191,883,922**	79,430,344	31,566,145	45,398,162	14,160,132	6,026,298	4,748,422	642,454	9,911,966
Variance	**1,465,458**	929,053	287,083	68,577	1,762	212	11	1,074	177,687
O&M Including Key Accounts Costs	**100.00%**	41.56%	16.47%	23.52%	7.32%	3.12%	2.46%	0.33%	5.22%
O&M Excluding Key Accounts Costs	**100.00%**	41.39%	16.45%	23.66%	7.38%	3.14%	2.47%	0.33%	5.17%
Variance	**0.00%**	0.17%	0.02%	-0.14%	-0.06%	-0.02%	-0.02%	0.00%	0.05%

QUESTION (C):

c) Does THES believe it would be appropriate to directly assign Key Account costs to customer classes?

RESPONSE (C):

The current methodology allocates the costs of the Key Accounts segment under the Customer Operations program[1] to a number of customer classes. The Key Accounts segment provides customer support primarily to Toronto Hydro's largest customers. As the team has evolved to meet customer needs, Toronto Hydro's strategic relationships with essential public service providers and developers have expanded, with support provided by this segment extending across all customer classes. In addition, the Key Accounts segment supports customers with multiple individual sites across rate classes that collectively exceed the 1,000 kW threshold, such as Real Estate Income Trusts ("REITs"). However, Toronto Hydro is open to revising the allocation of these costs to better reflect cost causality.

[1] Exhibit 4, Tab 2, Schedule 8.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.6:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
7-STAFF-325

The question asked for the derivation of the Billing and Collections weighting factors. Please provide a schedule (Excel Worksheet) that sets out the actual derivation by setting out the various metrics (i.e., cost categories) used, the total costs associated with each, the allocation factor used for each, the resulting allocation of each metric's costs to customer classes and the determination the resulting weighting factors.

RESPONSE:

Please refer to the appendix to this undertaking response.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.7:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
7-STAFF-326 a), b) & c)

QUESTION (A):

a) How was the sample size for each of the Residential, CSMUR and GS<50 customer classes determined? In particular, were they chosen so as to provide a certain level of confidence as to the accuracy of the results?

RESPONSE (A):

Toronto Hydro selected a sample size for these rate classes based on a sample size calculation with a confidence level of 95% and a 2% margin of error. For these rate classes, the percentages shown in IRR 7-STAFF-326 a) compared to the total large population selected on a random basis and statistically representative of the total.

QUESTION (B):

b) For the GS 50-999, GS 1,000-4,999 and Large Use classes, please confirm that the percentages reported represent the percentage of customers for whom there were "full data sets" and what is meant by a customer having a "full data set". If not confirmed, what do the percentages represent?

RESPONSE (B):

Toronto Hydro selected the full data sets of active customers in the year 2019. Some data sets were excluded from the population due to factors such as move-in/move-out, reclassification and missing data reads. “Full data sets” refer to the remaining customers after the exclusions.

The percentages are representative of customers with full data sets. For the GS 50-999, GS 1,000-4,999 and Large Use rate classes, Toronto Hydro selected totals from the full population that represents a 70% average of the population.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.8:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
7-VECC-79 e)
7-VECC 90 a), Appendix A, Tab I6.2

The response to 7-VECC-79 e) indicates the number of buildings in the CSMUR class is 472. However, the cost allocation model provided in response to VECC 90 a) indicates that the number of CSMUR buildings is 383. Please reconcile and update the calculation of the CSMUR Services weighting factor as required.

RESPONSE:

Toronto Hydro confirms that 383, the number used in the cost allocation model, is the correct number of buildings in the CSMUR rate class. The reference to 472 buildings in CSMUR rate class in response to 7-VECC-79(e) was an oversight and will be corrected in the updated version of cost allocation model.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.9:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
7-VECC-82
Exhibit 7, Tab 1, Schedule 3, Cost Allocation Model, Tabs I7.1 & I7.2

In THES' Cost Allocation Model, for the GS<50, GS 50-999, GS 1,000-4,999 and Large Use classes, the number of meters used for purposes of allocating meter capital costs (Tab I7.1) and meter reading costs (Tab I7.2) is set equal to the number of customers. However, VECC 82 indicates that for these classes the number of meters owned and read by THES exceeds the number of customers in each class. Please confirm that the number of meters and meter reads used for these classes in Tabs I7.1 and I7.2 should be increased accordingly. If not, why not.

RESPONSE:

Toronto Hydro confirms that the number of meters and meter reads used for these classes in Tabs I7.1 and I7.2 continue to be appropriate. The additional meters noted in 7-VECC-82 are paid for by customers and reflected in the capital contribution. The cost to read these additional meters is immaterial in the calculations, given the highly automated nature of this specific meter reading process.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.10:

Reference(s): **VECC'S Technical Conference Questions (PDF)**
7-VECC 86 c) – j)
Exhibit 7, Tab 1, Schedule 2

QUESTION (A):

With respect to Schedule 2, please confirm that columns (a) and (b) represent the best information THES has as to the customer class' relative use of electricity in each hour (i.e., its load profile)?

RESPONSE (A):

Schedule 2 shows an illustrative example of our methodology. Columns (a) and (b) represent the reasonable information available for Toronto Hydro's sampling methodology. This approach is consistent with Toronto Hydro's previous methodology approved by the OEB.

QUESTION (B):

Is it fair to say that the purpose of the calculations performed in Schedule 2, columns (c) through (g) is to, using these results, determine the load profile for the class' actual 2019 load which is then weather normalized in column (h)?

RESPONSE (B):

Toronto Hydro confirms the above statement.

QUESTION (C):

Is it fair to say that if one were to calculate the total of the values in column (c) for each rate class as a percentage of actual kWh use by each rate class the percentage would likely vary by rate class?

i. If not, why not?

ii. If yes, doesn't this impact the results in column (g) – i.e., for those classes were column c) represents a higher percentage of the class' actual load column (g) will overstate that class' percentage of total system load?

RESPONSE (C):

Yes, there is a small degree of variability as the methodology relies on the percentages.

QUESTION (D):

With respect to VECC 86 (i), in principle, if the sample provides the best estimate as to the relative hourly loads for the customer class then shouldn't the hour identified using the sample as having the highest load be the same as the hour where the highest load occurs for the estimated actual hourly load profile?

iii. If not, why not?

RESPONSE (D):

Toronto Hydro is aligned with the above statement. The methodology results in the highest load from the sample and the estimated actual load occurring in the same hour. Upon additional review, Toronto Hydro identified a minor oversight in its illustrative example submitted as part of Schedule 2 under Exhibit 7, Tab 1. Please refer to Appendix

A and Table 1 below for the updated version with revisions made to hour 17 and 19 in the sample data.

Table 1: Revised Demand Data Sample Methodology

Reference	Date	Hour	Cust 1	Cust 2	Cust 3	Cust 4	Cust 5	Cust 6	Cust 7	Cust 8	Cust 9	Cust 10	Total
Exhibit 7 Schedule 2	01-Jan-19	~~17~~ 19	0.46	1.03	1.01	0.79	1.18	0.51	0.37	0.19	0.35	1.63	**7.52**
Exhibit 7 Schedule 2	01-Jan-19	~~19~~ 17	2.29	2.4	0.88	0.89	0.78	1.13	1.33	0.52	0.96	1.51	**12.69**

QUESTION (E):

VECC 86 (e) asked "why wouldn't it be more appropriate to determine the hourly profile for the class by multiplying the hourly profile for the sample by the ratio of class's total energy to the energy use accounted for by the sample". The response outlines the approach THES used but does respond to the question posed. If the sample provides the best estimate of the customer class' relative hourly loads, please explain why the simpler approach proposed in VECC 86 (e) would not be appropriate.

RESPONSE (E):

There might be certain variations as to how the load profiles for the class are derived. Toronto Hydro believes that its methodology reasonably calculates the load profiles by rate class, for both non-coincident peak and coincident peak demand, because it relies on reliable sample data set, rate class information, and wholesale data, it estimates the rate class allocation by the hour. Toronto Hydro's methodology is also consistent with the last rate application approved by the Board.

ALL DATA are for ILLUSTRATIVE USE ONLY

	HouR	Cust 1	Cust 2	Cust 3	Cust 4	Cust 5	Cust 6	Cust 7	Cust 8	Cust 9	Cust 10	Total	Avg
													Sample size = 10
									21.056				(b) = (a) / 10
												(a)	(b)
01-Jan-19	1	0.37	1.01	0.85	0.67	0.52	1.5	0.34	0.19	0.38	1.4	7.23	0.723
01-Jan-19	2	0.25	0.92	0.58	0.62	0.51	0.99	0.56	0.19	0.54	1.45	6.61	0.661
01-Jan-19	3	0.32	0.86	0.51	0.62	0.59	0.72	0.44	0.2	0.55	1.22	6.03	0.603
01-Jan-19	4	0.29	0.67	0.59	0.63	0.53	0.68	0.37	0.17	0.46	1.42	5.81	0.581
01-Jan-19	5	0.26	0.81	0.6	0.65	0.5	0.7	0.34	0.2	0.27	1.28	5.61	0.561
01-Jan-19	6	0.33	0.87	0.61	0.72	0.6	0.8	0.6	0.22	0.39	1.44	6.58	0.658
01-Jan-19	7	0.24	0.65	0.6	0.71	0.52	0.99	0.47	0.17	0.3	1.3	5.95	0.595
01-Jan-19	8	0.18	0.65	0.83	0.66	0.44	0.98	0.44	0.21	0.32	1.37	6.08	0.608
01-Jan-19	9	2.16	0.81	1.03	0.61	0.54	0.85	0.37	0.21	0.35	1.41	8.34	0.834
01-Jan-19	10	0.63	0.59	0.79	0.63	0.54	0.67	0.47	0.36	0.32	1.44	6.44	0.644
01-Jan-19	11	1.45	1.12	0.82	0.95	0.61	0.88	1.21	0.19	0.27	1.44	8.94	0.894
01-Jan-19	12	0.66	1.02	0.82	0.88	0.58	0.8	0.58	0.28	0.32	1.33	7.27	0.727
01-Jan-19	13	2.71	0.91	0.93	1.18	0.72	0.79	0.71	0.23	0.75	1.42	10.35	1.035
01-Jan-19	14	0.83	0.95	0.8	0.96	0.62	0.87	0.59	0.19	0.58	1.67	8.06	0.806
01-Jan-19	15	0.64	0.98	0.67	1.14	0.57	0.53	0.5	0.2	0.58	1.45	7.26	0.726
01-Jan-19	16	0.57	0.78	0.75	0.77	1.43	0.51	0.25	0.14	0.5	1.6	7.3	0.73
01-Jan-19	17	2.29	2.4	0.88	0.89	0.78	1.13	1.33	0.52	0.96	1.51	12.69	1.269
01-Jan-19	18	1.14	2.79	1.01	0.84	0.7	1.03	0.33	0.26	0.44	1.49	10.03	1.003
01-Jan-19	19	0.46	1.03	1.01	0.79	1.18	0.51	0.37	0.19	0.35	1.63	7.52	0.752
01-Jan-19	20	0.8	2.54	0.88	0.94	0.88	0.96	1.85	0.58	0.57	1.38	11.38	1.138
01-Jan-19	21	1.16	2.1	1.19	1.2	0.75	1.26	0.91	0.66	0.7	1.77	11.7	1.17
01-Jan-19	22	0.8	1.15	1.12	1.04	0.62	1.15	0.79	0.53	0.73	1.88	9.81	0.981
01-Jan-19	23	0.6	0.98	1.02	0.79	0.63	1.12	0.51	0.81	0.7	1.93	9.09	0.909
01-Jan-19	24	0.52	1.02	0.64	0.78	0.64	1.01	0.34	0.34	0.71	1.86	7.86	0.786

	HouR	Sample Rate Class Hourly Profile for Jan	Total of All rate Classes (Includes Sample Rate Class)	Sample Rate Class % of Sum of all Rate Classes	IESO Purchased and Whoesale Market Participants Metered Load	Sample Rate Class portion of the Total System Load.	Weather Correction Factor for Sample Rate Class is 0.964395		Demand scaled to the 2025 load forecast based on the ratio of 2025 sample rate class kWh to sample rate Class Test year kWh.	EV and DER Consumption Combined	Net Load with EV and DER Consumption
		Total Number of Customers in Sample Rate Class in test year = 20									
		(c) = (b) * 20		(e) = (c) / (d)		(g) = (e) * (f)	(h) = (g) * 0.964395		(i) = (h) * 1.003497		(k) = (i) + (j)
		(c)	(d)	(e)	(f)	(g)	(h)		(i)	(j)	(k)
01-Jan-19	1	14.46	318.12	5%	349.93	15.91	15.34		15.39	2.16	17.56
01-Jan-19	2	13.22	290.84	5%	349.01	15.86	15.30		15.35	1.68	17.03
01-Jan-19	3	12.06	265.32	5%	318.38	14.47	13.96		14.01	1.28	15.29
01-Jan-19	4	11.62	174.30	7%	209.16	13.94	13.45		13.49	0.96	14.46
01-Jan-19	5	11.22	145.86	8%	175.03	13.46	12.98		13.03	0.64	13.67
01-Jan-19	6	13.16	128.97	10%	154.76	15.79	15.23		15.28	0.41	15.69
01-Jan-19	7	11.90	110.67	11%	132.80	14.28	13.77		13.82	0.23	14.05
01-Jan-19	8	12.16	109.44	11%	131.33	14.59	14.07		14.12	0.14	14.26
01-Jan-19	9	16.68	141.78	12%	226.85	26.69	25.74		25.83	0.09	25.92
01-Jan-19	10	12.88	103.04	13%	123.65	15.46	14.91		14.96	0.06	15.02
01-Jan-19	11	17.88	107.28	17%	128.74	21.46	20.69		20.76	0.06	20.82
01-Jan-19	12	14.54	116.32	13%	209.38	26.17	25.24		25.33	0.07	25.40
01-Jan-19	13	20.70	175.95	12%	193.55	22.77	21.96		22.04	0.08	22.11
01-Jan-19	14	16.12	145.08	11%	**365.04**	40.56	**39.12**	**Sample Rate Class Jan CP**	**39.25**	0.09	**39.34**
01-Jan-19	15	14.52	145.20	10%	188.76	18.88	18.20		18.27	0.13	18.40
01-Jan-19	16	14.60	160.60	9%	192.72	17.52	16.90		16.96	0.19	17.15
01-Jan-19	17	25.38	152.28	17%	261.97	43.66	**42.11**	**Sample Rate Class Jan NCP**	**42.25**	0.27	**42.53**
01-Jan-19	18	20.06	220.66	9%	264.79	24.07	23.21		23.30	0.35	23.64
01-Jan-19	19	15.04	165.44	9%	335.02	30.46	29.37		29.47	0.40	29.87
01-Jan-19	20	22.76	273.12	8%	327.74	27.31	26.34		26.43	0.44	26.87
01-Jan-19	21	23.40	304.20	8%	334.62	28.08	27.08		27.17	0.48	27.66
01-Jan-19	22	19.62	274.68	7%	329.62	23.54	22.71		22.79	0.50	23.29
01-Jan-19	23	18.18	272.70	7%	327.24	21.82	21.04		21.11	0.50	21.61
01-Jan-19	24	15.72	251.52	6%	301.82	18.86	18.19		18.26	2.55	20.81

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.11:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
7-VECC-79 e)
7-VECC-90, Appendices A & C, Tabs I5.2 & I6.2
Exhibit 7, Tab 1, Schedule 3, Cost Allocation Model, Tabs I5.2 & I6.2

The Application's Cost Allocation model uses number of units as the basis for the customer count for the CSMUR class and a Services weighting factor of 0.0047956353439605. In VECC 90, Appendices A & C the number of buildings is used as the basis for the customer count for the CSMUR class. However, a weighting factor of 0.0047956353439605 is still used for the allocation of Services costs to CSMUR. Shouldn't the Services weighting factor in Appendices A & C be revised (and set equal to 1.0)?

RESPONSE:

Toronto Hydro agrees that Services weighting factor Appendices A & C should be revised to "1" for CSMUR.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.12:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
8-CCMBC-21
OEB March 28, 2024 Letter re: Consultation on Policy for Standby Rates
Exhibit 8, pdf page 8

<u>Preamble:</u>

Exhibit 8 (pdf page 8) states:

> "*Toronto Hydro is not proposing final standby rates in this application*."

The OEB's March 28th Letter states:

> "*Electricity distributors with interim standby rates should inform their standby customers of the intention to apply to make the existing interim standby rates final, and then apply for this at the time of the next rate application. Distributors may choose to seek finalization of interim stand by rates in either rebasing or incentive rate-setting mechanism (IRM) applications as long as there is evidence of notice provided to customers for which any standby rate applies*."

The response to 8-CCMBC-21 describes the application of the Standby Power Service Classification's variable Distribution Volumetric Rate as follows:

> "*The Distribution Volumetric Rate normally applies to the amount of backup distribution capacity a customer contracts for and the variable rate (per kVA) is the same as is applicable to the customer's demand under the standard*

distribution rates. However, to the extent that the backup capacity is actually drawn upon by the customer, as reflected in the customer's peak metered demand for the billing period, the Distribution Volumetric Rate is correspondingly reduced."

QUESTIONS (A) AND (B):

a) Given the OEB's Letter of March 28th, is it still THES' proposal not to seek finalization of its Standby rate as part of this Application?
b) If not seeking finalization as part of this Application, when would THES anticipate doing so?

RESPONSE (A) AND (B):

In accordance with direction provided by the OEB in its letter dated March 28, 2024, regarding the Consultation on Policy for Standby Rates (EB-2023-0278), Toronto Hydro is amending its position regarding relief sought for standby rates in this application. Toronto Hydro seeks finalization of its interim standby rates on or before December 31, 2024, and the discontinuation of the standby rate effective January 1, 2025.

Toronto Hydro's standby rate is currently applied to six customers. In 2023, these charges resulted in revenue of $20,000, as indicated in interrogatory response 8-CCMBC-21(e).

Toronto Hydro's methodology and harmonization of standby rates was approved on an interim basis in the 2006 rate application (EB-2005-0421) post-amalgamation of its five former standby rates.[1] The purpose of the standby rates was to recover the cost of providing reserve capacity to customers with a load displacement nameplate generation

[1] Ontario Energy Board (EB-2005-0421) Decision with Reasons, April 12, 2006, section 6.2.1, page 40.

capacity equal to or greater than 500 kVA as well as a requirement for backup distribution capacity if the load displacement (parallel) generation is not operating.[2]

The purpose of standby rates was to recover cost of capital, operations and maintenance, taxes and administration to provide capacity that was not recovered by standard rates, as the standard rates were driven on the historical assumption of continuous use[3]. The standby rates original intent was to ensure the expected uptake in the standby rate customers class avoided burdening all other ratepayers.

In the OEB's letter dated March 28, 2024, the OEB recognized that distributors are best positioned to know their system and cost causation and are encouraged to understand their customers' needs concluding that, in some cases "circumstances may not warrant the need for a standby rate."[4] In alignment with the OEB's letter, and the feedback provided by stakeholders are part of (EB-2023-0278). Toronto Hydro proposes to discontinue the standby rate effective January 1, 2025 because it is no longer aligned with the policy objectives of encouraging the adoption of Distributed Energy Resources (DER) and advancing the integration of non-wires solutions into distribution system planning. In the future, as DER proliferation and non-wires capabilities advance and mature, it may be worthwhile to revisit the merits of standby rate proposal, based on more advanced data analytics and operational experience managing the integration of these technologies onto the local grid. However, at this early stage of the energy transition, Toronto Hydro believes that the objectives of enabling and integrating DERs safely, reliably and efficiently would not be well served by a standby rate.

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[2] Ontario Energy Board (EB-2005-0421) Tab 10, Appendix 10-D, page 1 to 9
[3] Ontario Energy Board (EB-2005-0421) Tab 10, Appendix 10-D, page 1 of 9
[4] Ontario Energy Board, (EB-2023-0278) Consultation on Policy for Standby Rates, March 28, 2024, p. 4

Toronto Hydro's maintains regular communication with Key Account customers, including current standby rate customers, and is committed to collaborative efforts and understanding future rate design needs that best fit future circumstances. Written notice with a period of 30 days to invite comment on this revised proposal to finalize and terminate the standby rate is being provided to the six standby rate customers with follow-up communication efforts by the Key Accounts team.

The standby rate and the bill impacts of discontinuing it are negligible for the affected customers, all of which are in the General Service 1-5MW or Large Use rate classes. Given the modest revenues of $20,000, terminating the standby rate will not have a material impact to the 2025 revenue requirement.

QUESTIONS (C) AND (D):

c) With respect to the response to CCMBC 21, please explain how THES determines that backup capacity has actually been drawn upon by the customer.

d) In such events is it the Distribution Volumetric Rate that is reduced or is it the billing demand (i.e., kVA) to which the standard distribution rates are applied that is reduced. Please also explain how the amount of the reduction is determined.

RESPONSE (C) AND (D):

As question (c) suggests, there are technical challenges to identifying electricity not drawn. Accordingly, Toronto Hydro has only applied a fixed standby rate. For example, in the current rate period, Toronto Hydro charges $283.28 per 30 days.

QUESTION (E):

e) Are customers with their own generation required to contract for Standby Power Service?

i. If not, would a customer with its own generation that contracts for Standby Power have a higher or lower bill than one who does not (all other things being equal) when: i) the backup capacity provided by the LDC (i.e., Standby Power) is not used in a given month and ii) backup capacity provided by the LDC (i.e., Standby Power) is used in a given month?

RESPONSE (E):

Eligible customers with their own generation are given the choice to contract standby backup power service. The customer is charged $283.28 per 30 days in scenario i) and ii).

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.13:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
7-VECC-78 a) & b)
8-STAFF-334
8-ED-45 d)
Exhibit 6, Tab 1, Schedule 2 (2025 RRWF), Tab 11 (Cost Allocation)

<u>Preamble:</u>

STAFF 334 sets out the forecast fixed and variable distribution revenue by customer class for 2025-2029.

ED 45 d) states:

> "Toronto Hydro proposes in Exhibit 1B, Tab 1, Schedule 3, section 7 that for the years 2026 to 2029, the final <u>approved base revenue requirements be allocated to each rate class based on the same allocations to rate classes established in this proceeding for 2025.</u> …..Toronto Hydro will hold constant the fixed/variable revenue split for each rate class determined in 2025 for the purpose of designing rates from 2026 to 2029."
>
> *(emphasis added)*

VECC 78 a) states:

> "The revenue requirement for 2025 will be escalated using the Custom Revenue Cap Index (CRCI) to come up with revenue requirement for 2026. Subsequently, the base revenue requirement for 2026 will be distributed across various rate classes and divided into fixed and variable split, both based on the 2025 data. In

the final stage of rate design, the fixed and variable revenue for each rate class will be divided by the forecasted 2026 billing determinants to determine the distribution rates."

VECC 78 b) states:

"Yes, the distribution rates increase will vary across the classes, depending on the annual projected growth in billing determinant for each rate class."

QUESTION (A):

a) With respect to ED 45 d), does THES propose to use the percentage allocations to rate classes as shown in the 2025 RRWF, Tab 11 (Cost Allocation), Table A to establish the service revenue requirement by rate class for 2026 to 2029?
   i. If yes, how does THES propose to allocate the forecast Miscellaneous Revenues to rate classes for each of the years 2026-2029 in order to determine the base revenue requirement by rate class for each of these years?
   ii. If not, how does THES propose to determine the base revenue requirement by customer class for each of the years 2026-2029?

RESPONSE (A):

No, Toronto Hydro uses the final base revenue requirement for 2025 from Tab 11 (Cost Allocation Model), Table B, Column 7D to allocate the base revenue requirement for 2026-2029.

QUESTION (B):

b) It is noted that THES has not applied its Cost Allocation Model to the forecast revenue requirements for 2026-2029. However, if cost allocations were undertaken for these years please confirm that for the results to produce overall percentage allocations to customer classes similar to those in 2025, the proportion of costs allocated to the various USOAs and the allocation factors (%) for each customer class would have to be similar to those for 2025.

RESPONSE (B):

Toronto Hydro cannot speculate on the approach presented above to confirm if it would be similar to those in 2025. Toronto Hydro kept a mechanistic approach for 2026-2029 to develop the rates in alignment with the Renewed Regulatory Framework for Electricity Distributors.

QUESTION (C):

c) With respect to VECC 78 b) please confirm that it will be those customer classes whose billing determinants are growing at a slower rate than average that will experience the higher distribution rate increases.

RESPONSE (C):

Toronto Hydro confirms that customer classes whose billing determinants are growing at a slower rate than average will experience higher distribution rate increases.

QUESTION (D):

d) Would it be reasonable to assume that for those customer classes where the billing determinants for 2026-2029 are growing at a slower rate, their allocation factors (as used in the cost allocation model) would also be growing at a slower rate?

RESPONSE (D):

Yes, it is reasonable to assume that for those customer classes where the billing determinants for 2026-2029 are growing at a slower rate, their allocation factors (as used in the cost allocation model) would also be growing at a slower rate.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.14:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
8-STAFF-335
8-SEC-123 b)

<u>Preamble:</u>

The response to STAFF 335 describes THES' rate smoothing proposal as follows:

> "Toronto Hydro's proposal for rate smoothing does not defer cost recovery; it carefully times the disposition of DVA balances in order to smooth the overall change in the distribution portion of the customer bill. In accordance with OEB rules for DVAs, the balances of those accounts accumulate interest – a credit or debit as applicable – so long as they carry a balance."

SEC 123 b) shows the annual customer bill impacts before the rate smoothing proposal.

a) What were the assumed recovery periods for the various DVA balances for purposes of SEC 123 b)?

RESPONSE:

Toronto Hydro assumes a recovery period of five years for all the DVA's balances.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.15:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
3-VECC-22 d)
3-VECC-23 d)
3-VECC 23 e), Appendix A

<u>Preamble:</u>

VECC 22 d) states:

> "Toronto Hydro sources its population data from the Conference Board of Canada, and extends the forecast using simple linear trend when the forecast does not cover the full rate application period."

VECC 23 d) states:

> "Toronto Hydro sources its employment data from the Conference Board of Canada, and extends the forecast using simple linear trend when the forecast does not cover the full rate application period."

QUESTION (A):

a) With respect to the 2022-2029 population data provided in VECC 23 e), Appendix A (Variables Tab, Column L) please indicate which values are based on:i) actual population, ii) the CBOC forecast values and iii) a simple linear trend.

   i. For those population values based on a simple linear trend, what was the basis for the trend (e.g. what years' values were used to establish the trend)?

RESPONSE (A):

The customer forecast submitted on April 2, 2024 relies on CBOC values for the 2022-2028 population data, while 2029 is based on a simple linear trend. The simple linear trend for the 2029 forecast relies on the 2024-2028 CBOC forecasted values.

QUESTION (B):

b) With respect to the 2022-2029 employment data provided in VECC 23 e), Appendix A (Variables Tab, Column M) please indicate which values are based on: i) actual employment, ii) the CBOC forecast values and iii) a simple linear trend.
    i. i. For those employment values based on a simple linear trend, what was the basis for the trend (e.g. what years' values were used to establish the trend)?

RESPONSE (B):

The customer forecast submitted on April 2, 2024 relies on CBOC values for the 2022-2028 employment data, while 2029 is based on a simple linear trend. The simple linear trend relies on 2024-2028 CBOC forecasted values.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.16:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
3-STAFF-278 b)
Exhibit 3, Tab 1, Schedule 1, Appendix H

QUESTION (A):

a) With respect to Staff 278 b), for each of the years 2020 to 2022 the reduction in the GS 50-999 customer count due to reclassification exceeds the increase in the GS<50 customer count due to reclassification. For each of these years what accounts for the difference?

RESPONSE (A):

The reclassification captured in these two classes is the product of the model output and not the manual adjustments. Even with the high-degree of predictive accuracy and adjusted R of 98-99%, there is a small degree of the variability of reclassification count between the two classes.

QUESTION (B):

b) In Appendix H, for the forecast years 2023-2029 why was the RECLASS3 dummy variable assigned a value of 1.0?

RESPONSE (B):

The dummy variable was assigned a value of 1.0 because the customer trends suggest that the customer numbers would not immediately revert back to pre-reclassification levels; assigning it any value other than 1.0 may suggest that.

QUESTION (C):

c) For the forecast years 2023-2029 were any specific adjustments made to the forecast customer counts for the other customer classes (i.e., other the GS<50 and GS 50-999) to account for the fact that the RECLASS3 dummy variable decreases the monthly customer count for the GS 50-999 class by 373.04 but only increases the GS<50 monthly customer count by 122.44 (per Exhibit 3, Tab 1, Schedule 1)? It not, why not?

RESPONSE (C):

No manual adjustments were made to the forecast customer counts in these classes. Toronto Hydro's proposed methodology accounts for reclassification through the statistical model. Please see response a) above.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.17:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
3-STAFF-276 b)
3-SEC-79 b)
3-VECC-25 b)

<u>Preamble:</u>

STAFF 276 b) states:

"Customer reclassification contributes to the decreasing trends in the GS 1,000-4,999 kW and Large Use rate classes."

SEC 79 b) states:

> "The GS 1000-4999 kW and Large Use class customer count forecasts were developed with a combination of 1) customer counts from new connections during this period, and 2) forecasted changes in customer counts due to reclassification."

VECC 25 b) states:

> "The GS 1,000-4,999 customer count forecast declines between 2023 and 2025 due to forecasted impacts from reclassification. The forecasted reclassification was based on a 10-year average reclass (prior to the COVID-19 pandemic)."

QUESTION (A):

a) With respect to Staff 276 b) and SEC 79 b), for each of the GS 1,000-4,999 and Large Use classes, please provide a schedule that breaks down the annual increase in customer count forecast for each of the years after 2022 up to 2029 as between: 1) customer counts from new connections during this period, and 2) forecasted changes in customer counts due to reclassification.

RESPONSE (A):

Please refer to the table below for the analysis of the annual changes in customer count forecast for years 2024-2029 for the GS 1,000-4,999 and Large Use classes.

Please note that the information is based on the rate application update, submitted to the OEB on April 2, 2024.

	GS 1,000-4,999 kW	
Year	**Customer counts from new connections during this period**	**Forecasted changes in customer counts due to reclassification**
2024	6	-2
2025	4	-2
2026	12	-2
2027	0	-2
2028	5	-2
2029	0	-2
	Large User	
Year	**Customer counts from new connections during this period**	**Forecasted changes in customer counts due to reclassification**
2024	0	-1
2025	0	-1
2026	5	-1
2027	0	-1
2028	0	-1
2029	0	-1

QUESTION (B):

b) Between the results of the regression equations used for the GS<50 and GS 50-999 classes customers counts and the assumptions underlying the forecast customer counts for GS 1,000-4,999 and Large Use, do the impacts of customer reclassification across all classes net out to zero for each of the years 2023-2029?

   i. If yes, please provide a schedule setting out impact of customer reclassification for each of these customer classes demonstrating that the net impact is zero.

   ii. If not, do any adjustments need to be made to the forecast customer counts?

RESPONSE (B):

No, Toronto Hydro believes the proposed reclassification reasonably captures reclassification impacts. For GS 1,000-4,999 and Large Use rate classes, Toronto Hydro's methodology accounts for reclassification based on a 10-year average reclass (prior to COVID-19 pandemic). Please refer to JT1.1.16 parts a) and c) for Toronto Hydro's reclassification methodology for GS<50 kW and GS 50-999 kW rate classes.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.18:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
3-Staff-277 (b)
3-Staff-284 (a)

<u>Preamble:</u>

STAFF-277 b) states:

> "*The City of Toronto is the sole customer in the Street Lighting rate class for both historic and forecast years. Toronto Hydro does not own street lighting on Ministry of Transportation expressways (e.g. Hwy 401*)."

STAFF 284 a) states:

> "*Since the completion of the transactions in EB-20090180/1/2/3, Toronto Hydro has owned certain street lighting assets in the city of Toronto that were deemed by the OEB to serve a distribution purpose and Toronto Hydro Energy has owned other street lighting and expressway lighting assets that were deemed not to serve a distribution purpose.*"

QUESTION (A):

a) Please clarify whether it is the City of Toronto, Toronto Hydro Energy or some other party that owns street lighting on expressways and pays for the electricity distribution service provided by THES.

RESPONSE (A):

Toronto Hydro Energy Services Inc. ("THESI"), which is a non-rate regulated affiliate of the LDC, owns the street lighting assets on the Don Valley Parkway ("DVP"), William R. Allen Road and Gardiner expressways. The Province of Ontario owns the street lighting assets on the provincial highways (i.e. 401, 427). The utility usage for the DVP, William R. Allen Road and Gardiner expressways street lighting is paid for by the City of Toronto. The provincially-owned assets are metered and billed and included in the appropriate commercial rate class.

QUESTION (B):

b) If not the City of Toronto then why is the City of Toronto the sole street lighting customer and what customer class is street lighting on expressways considered to be in?

RESPONSE (B):

THESI-owned expressway streetlighting is billed as part of the streetlight rate class.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.19:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
3-VECC 41 (a)
3-VECC 42 (a) and (b)

<u>Preamble:</u>

VECC 41 a) states: *"Toronto Hydro utilized data from the Ontario Ministry of Transportation to obtain the number of LDEVs in Toronto for 2018 to 2021. Toronto's share of Ontario's new vehicles is assumed to be constant over time at 12.7%. The forecast of new vehicle registration and total vehicles registered each year was built up to achieve 20% of the total LDV fleet in 2030, a target provided by City of Toronto's Electric Vehicles Strategy."*

VECC 42 b) states: *"The resulting MD and HD vehicles in Toronto were used, in conjunction with the EV adoption rates described in 3-VECC42, a) to develop the MDEV and HDEV vehicle forecasts. Please to refer to Appendix A for supporting calculations."*

QUESTION (A):

a) Does the City of Toronto have any specific policies or programs designed to achieve its 20% EVLD target by 2030?

RESPONSE (A):

Yes, the City of Toronto has specific policies and programs designed to achieve its goals for its 2030 targets. Further details on the City of Electric Vehicle Strategy and the most recent information can be found on the City's website at the following links:

- City of Toronto, Electric Vehicle Strategy: https://www.toronto.ca/wp-content/uploads/2020/02/8c46-City-of-Toronto-Electric-Vehicle-Strategy.pdf
- City of Toronto, Electric Vehicles: https://www.toronto.ca/services-payments/water-environment/environmentally-friendly-city-initiatives/reports-plans-policies-research/electric-vehicles/

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.20:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
3-VECC 31 (c) & (d)
Exhibit 3, Tab 1, Schedule 1, Appendix C

<u>Preamble:</u>

VECC 31 c) states:

"Toronto Hydro used a 5-year average monthly distribution of consumption to account for the fact that in the first year the CDM savings realized will be less than the annualized value. Please refer to Exhibit 3, Tab 1, Schedule 1, Appendix C for the full calculations."

QUESTION (A):

a) A review of Appendix C indicates that application of the monthly distribution percentages results in the full annualized savings being allocated to all months even in the first year the CDM savings are realized. Does THES agree?
   i. If not, please indicate precisely where and how Appendix C accounts for the fact that the first year CDM savings will be less than the annualized value.
   ii. If yes, please revise the values (both historic and forecast) for the CDM variables used to reflect this fact, re-estimate the regression models and provide a revised forecast by customer class for 2023-2029, as originally requested in VECC 31 d).

RESPONSE (A):

Yes, Toronto Hydro used a 5-year average monthly distribution of consumption to account for the fact that the annual CDM savings need to be distributed throughout the year and has not made any adjustments to account for the fact that in the first year the CDM savings realized will be less than the annualized value. However, the utility no longer has the level of project installation and savings details to calculate realization rates since its calculations for the 2015 CIR application, and can not determine how the CDM savings may actually be realized.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.21:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
3-VECC-35 (a)-(c)

Preamble:

The responses indicate that THES has not undertaken nor is it planning on undertaking any Local (CDM) Initiatives in the 2022-2024 period.

The response to VECC 35 a) states:

> *"However, the IESO's local initiatives program was developed to deliver CDM savings in targeted areas of the province. Part of Toronto was identified as one of the first four targeted areas*."

QUESTION:

a) The IESO web-site indicates that the Toronto-area local initiative is being delivered in collaboration with Toronto Hydro (https://saveonenergy.ca/For-Business-and-Industry/Programs-and-incentives/Local-Initiatives/BizEnergySaver). Please provide any information that THES has regarding the current status of the Toronto-area local initiative including the period the program will be in effect, the savings to date, and the planned overall annualized savings.

RESPONSE:

Toronto Hydro does not have the information requested as the program is administered and maintained by the IESO. The IESO have not yet released any CDM results from the program as it began in 2023. Toronto Hydro's non-regulated business supports the IESO administered program through marketing and outreach to eligible customers.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.1.22:

Reference(s): **Exhibit KT1.1: VECC Letter Filed April 2, 2024**
3-VECC-54
8-VECC-94 (a)

<u>Preamble:</u>

VECC 94 a) states:

"Toronto Hydro proposes to update Other Revenue on an annual basis using the CRCI formula."

With respect to microFIT revenues, VECC 54 states: "Toronto Hydro has forecasted 2025 revenues using trending from 2021-2023 and escalated it by inflation for the 2026-2029 period."

QUESTION:

a) With respect to VECC 54, when the response states that for 2026-2029 the microFIT revenues will be escalated by inflation does THES mean the CRCI formula? If not, please reconcile this response with the response to VECC 94 a).

RESPONSE:

Toronto Hydro has escalated Other Revenues in OEB Appendix 2-H for 2026-2029 by inflation. Whereas, the funding for Other Revenues in the base revenue requirement calculation is proposed to be updated on an annual basis using the CRCI formula.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT1.2:

Reference(s): 2B-SEC-31

To reproduce the table in 2B-SEC-31 for the 2018 to 2023 period.

RESPONSE:

Please see Table 1 below for the Assets at End of Useful Life by the years 2018 to 2023 using the breakdown from interrogatory response 2B-SEC-31.

Table 1: Assets at End of Useful Life from 2018 to 2023

	2018	2019	2020	2021	2022	2023
OH Conductor	0.41%	0.43%	0.35%	0.33%	0.60%	0.57%
OH Switches	0.02%	0.02%	0.05%	0.07%	0.07%	0.10%
OH Transformers	0.86%	0.81%	0.80%	0.29%	0.32%	0.85%
Poles	2.75%	2.77%	2.44%	2.35%	2.33%	2.59%
UG Cables	9.12%	8.54%	7.60%	9.36%	9.32%	7.38%
UG Switches	0.06%	0.06%	0.04%	0.07%	0.07%	0.06%
UG Transformers	1.03%	0.89%	0.86%	0.40%	0.41%	2.70%
Network Assets	0.44%	0.62%	0.63%	0.60%	0.60%	0.42%
Switchgear	3.31%	3.30%	3.62%	3.54%	3.77%	3.65%
DC Systems	0.03%	0.03%	0.04%	0.05%	0.07%	0.06%
Power TX	1.05%	1.08%	1.09%	1.07%	1.08%	1.02%
Circuit Breakers	0.59%	0.60%	0.64%	0.63%	0.62%	0.59%
Civil Assets	4.65%	3.80%	4.04%	3.95%	4.10%	4.24%
Meters	0.00%	0.00%	0.02%	0.55%	1.00%	0.95%
TOTAL	**24%**	**23%**	**22%**	**23%**	**24%**	**25%**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT1.3:

Reference(s): 2B-SEC-43, Appendix A

To provide further risk management information about Appendix A of 2B-SEC-43.

RESPONSE:

Toronto Hydro's Enterprise Risk Management ("ERM") framework employs a consistent and disciplined methodology which incorporates judgment of subject matter experts within Toronto Hydro, informed by qualitative and quantitative risk indicators, risk trends and risk interdependencies. The quantification of the status of the enterprise risk areas is periodically translated to a heat map which is directed by the relative impacts and likelihoods of enterprise risk-level events and plausible scenarios.

The risk criteria used to assess each enterprise risk relate to: reputational, financial, stakeholder management, distribution system, information system, compliance, occupational health and safety, and public safety impact factors. The assessment of risk likelihood reflects the occurrence of similar events at Toronto Hydro and electricity industry levels. Toronto Hydro has assigned designated responsible persons for each enterprise risk to ensure that such risks are being monitored and that short interval controls and medium to long-term mitigation plans, including both individual action plans and programmatic mitigations, are in place. Action plans and programmatic mitigations are identified by these responsible persons where emerging risks or plausible risk scenarios are expected to have risk impacts which are beyond Toronto Hydro's risk tolerance.

The utility conducts a business plan risk review in accordance with the business planning process. This includes assessing the rationale for investment requests against most current statuses or ratings for enterprise risks. The review identifies areas where potential additional risk exposure could exist and provides recommendations to ensure risk-adjusted decisions are made in alignment with Toronto Hydro's strategic priorities.

Toronto Hydro does not have a single document that details the extensive analysis and information collected through the ERM process described above, as this analysis and information is embedded in different organizational systems and processes and is managed in a programmatic fashion through in-depth and iterative discussions with numerous subject matter experts across the organization. It is not possible to meaningfully extract, summarize and produce a summary of this information within the timelines for responding to undertakings. Nor is this information likely to provide any incremental probative value, since the 2025-2029 Investment Plan (detailed in the pre-filed evidence at Exhibits 2B and 4 and supporting interrogatories, technical conference testimony and undertakings), already reflects in a programmatic manner the outputs of the ERM framework.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT1.4:

Reference(s): 2B-SEC-34, Appendix A, Clause 9.2

To file the audit document referred to at Clause 9.2 and the document it references.

RESPONSE:

The external audit referenced in the 2023 AM Gap Assessment (2B-SEC-34, Appendix A) refers to the external audit conducted in 2022 for the maintenance of ISO 14001 and ISO 45001 certification of the Environment Health & Safety ("EHS") Management System. AMCL considered this audit in assessing Toronto Hydro's internal audit processes as it demonstrated that the utility follows the Deming Cycle of PDCA (Plan-Do-Check-Act), which is a systematic continuous improvement process common to other ISO frameworks including ISO 55001. The 2022 EHS audit report is attached as Appendix A to this response.

Total Quality. Assured.

Toronto Hydro-Electric System Limited
EB-2023-0195
Technical Conference
Schedule JT1.4
Appendix A
FILED: April 22, 2024
(18 Pages)

Toronto Hydro Electric System Limited

AUDIT REPORT

Surveillance 1- Remote + On-site

Report issued at 19:18 GMT on 23-Nov-2022

Toronto Hydro Electric System Limited **AUDIT REPORT**

Client ID#:	CMPY-044021
Client/Address:	Toronto Hydro Electric System Limited 14 Carlton St., Toronto, Ontario, M 5B 1K5, Canada Other 500 Commissioners St., Toronto, Ontario, M4M 1B4, Canada Other 71 Rexdale Blvd, Etobicoke, Ontario, M9W, Canada Other 715 Milner Ave, Scarborough, Ontario, M1B 6B6 , Canada
Audit Criteria:	ISO 14001:2015, ISO 45001:2018
Audit Activity:	Surveillance 1- Remote + On-site
Date(s) of Audit:	Toronto, Canada: 19-Sep-2022 to 22-Sep-2022
Auditor(s) (level):	Baljinder Singh (Lead Auditor, Toronto, Canada) Nitin Shahani (Auditor, Toronto, Canada) Payman Saffari (Auditor, Toronto, Canada)
Scope of Audit and Scope of Certification:	***Site: Toronto Hydro Electric System Limited, Toronto, Ontario, Canada*** **ISO 14001:2015:** Overall scope/Main and additional sites scope: The provision of all activities and operations associated with the distribution of electricity throughout the City of Toronto. **Exclusions from scope:** No Exclusions. **ISO 45001:2018:** Overall scope/Main and additional sites scope: The provision of all activities and operations associated with the distribution of electricity throughout the City of Toronto.

OVERALL RESULT:

Action Required

The management system was found to be effectively implemented although minor nonconformities were cited.

EXECUTIVE SUMMARY

The current ISO 14001:2015 and ISO 45001: 2018 Surveillance audit was conducted at Toronto Hydro at its head office, Work centre locations and Field operations. Due to COVID 19 pandemic situation, the current audit was conducted partially remote (3.0 MDs) through use of ICT: WebEx meetings for interviews with Management and admin. processes, and In-person (3.5 MDs) visit to audit the Work centre operations and field activities. The audit was conducted by interviewing the various levels of management team, office employees and field crew members. The management team and employees demonstrated good commitment levels through the audit process as evidenced during the audit. Prior assessment identified 02 minor nonconformities and the corrective actions verified in this audit for effective closure. The current audit also identified, 01 minor nonconformity and 05 opportunities for improvement as reported in this audit report. Based on the audit evidences verified and interviews conducted, it can be concluded that the overall EHS management system requirements are effectively implemented pending corrective action plan acceptance for the minor finding identified in this audit.

SWOT ANALYSIS

Strengths	• Robust, well-managed EHSMS, proving to be very effective in helping THESL to fulfil its EHS commitments (outlined in the organization's EHS Policy). • Strong framework to support EHS monitoring and measurement: Corporate scorecards cascaded to divisional and department level scorecards. • Integration of EHS requirements into Supplier selection and procurement management processes. • Detailed Incident investigation and corrective action process; Periodical analysis for continual improvement. • Good knowledge and awareness were demonstrated by the Managers, crew lead and crew members during audit of field operations, regarding EHSMS requirements. • Continual improvement focus: ○ EHS objectives/ Stringent targets; ○ Improved waste diversion rates year over year; ○ Electronic tailboards; ○ Ergonomic bins for used battery storage; ○ More stable and duration Galvanized metal secondary containment for used transformer storage.
Weaknesses	• Operational controls for identified OH&S hazards/ risks found not effective always.
Opportunities	• While the scope of EHSMS documented in the EHSMS manual was developed considering the context of the organization, an opportunity for improvement exists to provide more clarity for the permanent locations/WorkCentre in the defined scope. (Repeat from previous year audit) • While the OH&S risk assessments are reviewed at annual frequency, it may be beneficial to formalize the process of periodical review of task specific Job safety risk assessments (JSA) maintained by the fleet maintenance. • Although the EHS management system are properly implemented in Stations, more attention to shared areas/activities with "TTC" and "Hydro one" may have value added. • While the competence of Toronto Hydro employees are properly covered by LMS, more attention to monitoring the competence of contracted employees/work force via ISN/…..would be beneficial. • While the internal audit processes found effectively implemented, it may be added value to include expand the Audit evaluation checklist for post audit evaluation questions.
Threats	• None that the management team is no aware off (e.g. COVID 19 pandemic).

INTERTEK MATURITY MODEL

The score descriptions are generic to all management systems and cannot be customized by the auditor, thus allowing for the consistency of interpretation and standardization of audit results worldwide. The scores provided to your organisation are for benchmarking purposes only and are based on the audit team's evaluation.

Management

Mature

Consistent evidence of management commitment, customer and/or interested party satisfaction, knowledge/awareness of policy and objectives being demonstrated by the majority of staff. Responsibility and authority is evident and supported via data, trends and related KPI's. Management reviews are complete and demonstrate support by the majority of personnel. Records are complete and demonstrate positive trends in improvement and lessons learned.

Auditor Comments:

The processes including policy deployment and integrated system management review were reviewed. The records of the management review held on August 25, 2022, were reviewed. All the inputs and outputs of the review were found to be addressed well and in accordance with the standards. The Integrated Master Plan and the Projects including the Box construction, Arc Flash, Electronic Tailboards, PCB Asset Replacement were reviewed. Also, the plan is to incorporate sustainability criteria in ISN.

Internal Audits

Mature

Internal audits are being performed at planned intervals and are based on status and importance of the Management System. Data is being collected analyzed and reviewed by senior management on a regular basis. There exists a link between the internal audit results and the overall health of the Management System. Audit teams are trained, impartial and objective in their approach. Audit reports are clear, concise and supported with applicable correction actions. Management is involved in the corrective action process ensuring timely implementation and overall effectiveness of resolution.

Auditor Comments:

THESL is performing the EMS and OH&S Management system internal audits at annual frequency and compliance to EMS and OH&S in alternative years. Last audit cycle was conducted on June 13-17, 2022 by external provider: Integrated Management Solutions (IMS) – by Tony Tarsitano and Jessica Staples-Campetelli.
The EHSMS and Environmental Compliance audit report of July 15, 2022 including, 5 minor nonconformities related EHSMS and 08 OFIs. All the nonconformities are posted on Intelex software i.e. NC # 194 to 197, # 200 and # 204 for further root cause analysis and corrective action implementation and follow up per due date(s). While the internal audit processes found effectively implemented, an OFI identified in this area and reported in this audit report.

Corrective Action

Mature

The corrective action process has demonstrated to be effective in practice. Data from sources such as customer and/or interested party complaints, internal audits, warranty analysis, defects, internal metrics and supplier performance show stability over time as the system matures. The process includes a thorough review of the effectiveness of the actions taken. There is evidence of problem solving tools being used to support the process.

Auditor Comments:
THESL is using Intelex (e-tool) for addressing the nonconformities through corrective actions process and maintaining the documented info. The nonconformities identified through audits (internal/ external), inspections and incident/ accidents are posted on Intelex for follow up actions per assigned responsibilities and authorities. The process was sampled for internal audit and compliance audit findings e.g. Nonconformance # 194, # 197, # 200, # 204 and found effectively implemented.
Incident investigation, corrective and preventive actions: Incidents are reported, and corrective actions plans are followed up and recorded through Intelex. PRC-1810-06 (rev10) / Incident documentation procedure and Incident # 1225 (Sept 13, 2022), # 1183 (July 13, 2022), 1124 (In progress) and # 1213 (Aug 22, 2022) have been reviewed. The process is effective.

Continuous Improvement

Mature

Data streams are being used as sources to drive continual improvement over time. These may include management system policy, objectives, and audit results, analysis of data, CAPA and management reviews. There is some evidence of advanced techniques being used during the improvement cycle. Economic benefits have been realized.

Auditor Comments:
The EHS scorecard 2022 maintained including various performance indicators to monitor the performance of EMS and OHSMS programmes. Some of the examples of EHS objectives/ targets and performances reviewed as below;

- Total Recordable Injury Frequency, target: ≤ 1.15 (previously: <1.30) / Year 2019: 0.82/ Year 2020: 0.58/ Year 2021: 0.56
- Lost Time Injury Frequency and Severity rates, target: 0.10 and 2.0 respectively / actual Year 2019: 0.21; 6.72/ Year 2020: 0.22, 8.25 / Year 2021: 1.91, 0.24.
- Restricted work severity rate, target: 27 (35 previously) / actual Year 2019: 10.5 / Year 2020: 21.12 / Year 2021: 21.89.
- Total Near Miss incidents, target: 27/ actual Year 2021: 41 (New objective).
- Attendance (Absence rates), target: 2.10/ actual Year 2020: 1.29/ Year 2021: 0.83.
- IMP (Integrated Master Plan) tasks, target: 90% / actual Year 2019: 2 / Year 2020: N/A / Year 2021: 99%. (Changes to monitoring method).
- Safety leadership – EHS, target: 110%/ actual Year 2020: 131%/ Year 2021: 145%.
- Contractor safety rating, target: 85% / actual Year 2019: 89% / Year 2020: 88%/ Year 2021: 90%.
- Non-hazardous waste to landfill, target: 400 tonnes/ actual Year 2020: 316.32/ Year 2021: 203. (tracked on Sustainability card).
- P1 Spill investigation completion time, target: 12 days/ actual Year 2021: 4.35 days (New objective)
- Incident investigation closure time, target: 85% (previously 2.0 days) / actual Year 2019: 1.56 / Year 2020: NA / Year 2021: 91% (Changes to monitoring method) – tracked as part of Investigation quality score.
- Tailboard quality audit score, target: 80%/ actual Year 2020: 87.5%/ Year 2021: 86%.

- Inspection Quality score, target: 72% (previously 70%) / actual Year 2019: 84%/ Year 2020: 73%/ Year 2021: 81%.
- Serious incident action closure on-time, target: 90%/ Year 2021: 100%.
- Reduction of PCB spills to waterways, target: NA (Previously, Zero)/ actual Year 2019: 1 / Year 2020: 1/ Year 2021: 0
- Corporate recycling rate, target: 70% / actual Year 2019: 87% / Year 2020: 90%/ Year 2021: 91%.

An EHS annual plan 2022 including Environmental and OH&S objectives, targets and programs maintained. Objectives and targets are monitored on monthly basis and supported with actions for under-performing targets. Analysis of the score (separate tab) maintained for the follow up actions for under-performing areas.
Monthly review during the OSR meeting (Operational status review meeting) with involvement of EHS dept. These meetings are filtered to divisional levels.

Operational Control

Meets Intent

Operational Controls are planned and developed. Planning is consistent with many of the other Management processes. Objectives, process requirements, needs for appropriate additional documents and resources, verification and monitoring activities and records requirements have been determined, as appropriate. Processes and activities run consistently. Some data is collected to verify the adequacy of operational controls with evidence of some improvement trends.

Auditor Comments:
EHS Operational Controls:
The field, station and facility visits were conducted and the field, station and facility activities of the Toronto Hydro's crews and employees were audited at those locations incl. 14 Carlton, 71 Rexdale, 715 Milner, and 500 Commissioners. Employees at these facilities and crew members at the stations, field crews from the stations, metering, above ground, DCW - overhead and DCC - underground, were involved in the audits. Some of the significant hazards included those arising from traffic, use of vehicles and working with electrical energy and controls included procedures, permits, risk assessments and tailboards, traffic management plan, use of PPEs (harness, gloves, hard hat, safety boots, high visibility clothing), equipment and tools (emergency equipment such as fire extinguisher, eye wash, first-aid kit and spill kits). Some of the significant environmental aspects reviewed included air emissions from fleet vehicles and waste generation from field activities and the respective controls include anti-idling (use of Grip system), use of hybrid and electrical vehicles and waste segregation, collection, labeling and disposal.
EHS monitoring and measurement for the field activities included EHS operational control audits, monthly safety meetings, multiple site safety inspections in a month by the supervisors (at least 20 per month) and regular inspections of the fleet vehicles, PPEs and field equipment/tools used by the field crew.
Based on the evidence gathered during the interviews of crew members, crew leaders, Managers, and review of controls, while the controls found to be effectively implemented, a minor nonconformity related OH&S operational controls identified and reported in this audit report.

Communication, consultation & participation (incl. Worker's representation, JHSC member interview):
Interviews were conducted with JHSC member and Co-chair for worker's representation. There are monthly meetings with participation from management team and JHSC members for reviewing the issues escalated by the crew

members, open items from monthly JHSC inspections and other OH&S developments. The output from the management review is tracked for follow up actions. The open items from JHSC inspections are also tracked for closure. Based on the interviews and documentation review, the Communication, consultation & participation processes found to be effective.

Waste Management:
Solid waste management procedure ref: PRM-1810-019 outlines the requirements for managing the different waste streams and disposal methods. The waste management processes were sampled for segregation and identification of different waste stream at different WorkCentres, stations and during field visits. Last annual waste audit was conducted in Oct 2021 by GFL including observations for mixed recycle waste and organic waste into Garbage bin with recommendations for improvement. A waste reduction work plan established and implemented to ensure continual improvement. The hazardous waste is disposed through manifestation process and sampled for waste manifest # 10027404, # MX551020 and MX446238-2. The waste management processes found effectively implemented.

EHS Performance monitoring and measurement:
A framework of performance management established including, Corporate: Scorecard, Strategic projects; Divisional: Scorecard; Div. projects; Department: Scorecard & other initiatives and Individual: Objectives, Core job, Competencies. EHS 2022 Scorecard was sampled for Threshold, Targets and actual performances. The management team is conducting monthly operations status review (OSR) meetings at executive, division and department levels including reviewing the performances against scorecards. A KPI profiler is maintained including the planning actions to ensure tracking and achieving the set targets. The EHS performance monitoring and tracking processes found effectively implemented.

External Communications and Complaints, Concerns of interested parties:
EHS related external communication, concerns and complaints received through social media or municipal offices, are handled by the Media and public relation dept. and Office of the President. All the reported issues and complaints are tracked for follow up actions. There were total 28 EHS issues reported during last period and addressed through necessary follow up actions. Based on the interviews conducted and documentation reviewed, the external communication and complaint handling processes found effectively implemented.

Consultation & participation of workers:
PRC 1810-013 Communication, Participation and consultation, Rev V6, Aug 2022 outlines the process requirements. There are various methods used by the organization for ensuring consultation and participation of workers related to EHSMS requirements and processes such as, review of EHS risk assessments, daily tailboards, safety meetings, identify and trailing new tools/ equipment, Incident investigation processes etc.

Procurement:
Procurement policy, V7.02020-05-26 is followed by the organization's procurement/supply chain department. EHS requirements are ingrained into the procurement process. Suppliers are selected, monitored and evaluated based on the organization's quality, EHS and cost requirements. Sustainability questionnaire is built into the Request for proposal packages for suppliers. EHS requirements are scaled up or down based on the nature of work with safety requirements

taking priority in construction projects. The performance of the suppliers is monitored and evaluated. If performance of a supplier/ service provider is not meeting the criteria, then an notification letter is issued to vendor for performance requirements to improve the performance. Bi-annual meetings are held with suppliers. NCRs are raised in case of any deficiencies with regards to the performance criteria set in the contract with the supplier/service provide. Based on the review of request for proposals, submission evaluation, sustainability questionnaire, performance summary and other procurement documents, the process was found to be effectively implemented.

Emergency Preparedness and Response:
Emergency situations (including Fire, Severe weather and…) and relevant responses are addressed in PRG 1810-029. Fire drills are conducted annually. Grid emergency management system (GEM) covers the emergency situations during operation. Relevant trainings are also addressed and covered by GEM. Samples of emergency situations/incidents have been reviewed. The process is effective.

Management of change process:
MOC process for some samples (equipment/facility/….) have been reviewed. Evaluation process and link to risk assessment are properly documented and followed up. Records of FRM-1810-021 (Rev 07) and FRM-1810-168 (Rev 01) have been sampled and reviewed. The process is effective.

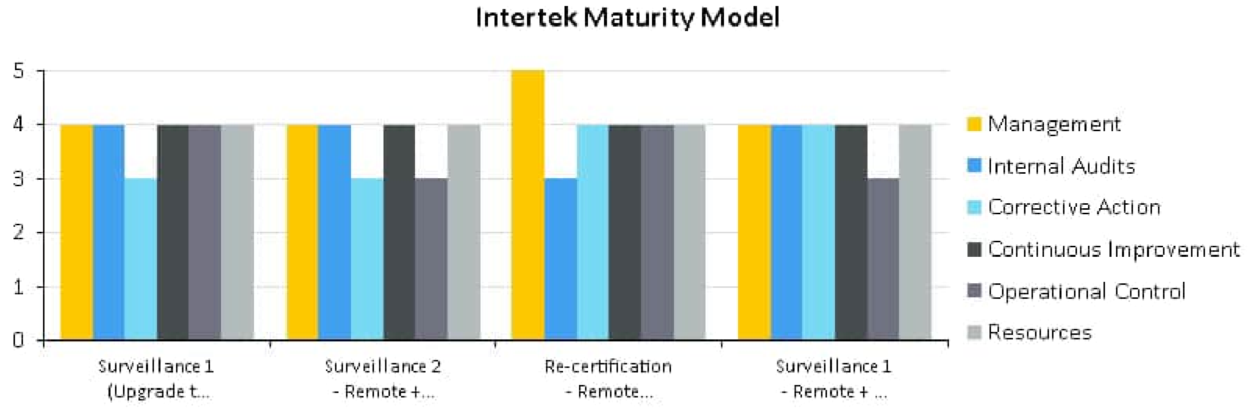
Resources

Mature

Resources required for the effective maintenance and improvement of the management system have been defined and deployed. Improvements have been noted in areas such as customer and/or interested party satisfaction, continual improvement, process variation. Levels of competency have been defined and documented within the existing management system.

Auditor Comments:
The management team has ensured adequate resources to fulfill EHSMS requirements. The employees interviewed were found experienced and knowledgeable.
Competence, Training and Awareness: Training process for new employee/employee are managed via Learning Management System. Target is 85% in compliance. Learning profile of some employees have been reviewed. Learning administration/learning management processes for employee and students are effective. However, an OFI identified in this area and reported in this audit report.

Toronto Hydro Electric System Limited AUDIT REPORT



Rating: 5=Benchmark | 4=Mature | 3=Meets Intent | 2=Beginning | 1=Not Evident

FINDING SUMMARY

	Minor	Major
Issued during current activity	1	0
Closed from previous activities	2	0

Opportunities for improvement have been identified

Yes

STATUS OF PREVIOUS AUDIT FINDINGS

Follow-up on findings issued at previous audit:

Non conformities raised at the last audit have been closed. No further actions required.

Report on closure of previous findings

Prior assessment identified 2 minor nonconformities and the corrective action effectiveness verified in this audit as below;

Finding 1052889 - 1:

· An internal NC # 160 initiated on Oct 15, 2021 incl. corrective actions: 3 action items, closed as of Nov 30, 2021.

· An audit checklist to support the evaluation of internal EHSMS audit is implemented for effectiveness review post completion of internal audit by external provider i.e. Internal audit evaluation dt. June 07, 2022, Intelex audit # 120.

Finding 1052889 – 2:

· An internal NC# 161 dt. Oct 15, 2021 to ensure EHS communication to external visitors/ contractors incl. corrective actions: 8 action items, status: closed as of Aug 30, 2022. (Management approval for delayed action items evident through email).

· Visitor orientation packages were sent to audit team in advance to audit week for each WorkCentre location.

· Visitor sign in/ sign out logs were sampled during WorkCentre audit and found maintained effectively.

· An electronic system for visitor sign in implemented for generating visitor pass at each WorkCentre.

Based on the documentation reviewed and processes sampled, both the above findings stand closed now.

Findings from the previous activity that could not be closed

No

FINDING DETAIL

Finding #:	Audit Criteria:	Corrective Action Plan Due Date:	Corrective Action Implementation Date:
Finding 1224926 - 1	ISO 45001:2018	23-Oct-2022	22-Nov-2022
Issued by:	**Classification:**	**Document Ref#:**	**Action Required:**
Baljinder Singh	Minor	MSE-1810-005	Submit corrective action plan

Finding:
The operational controls for identified OH&S hazards and risks found not effective always.

Requirement:
Others: 8.1
8.1.1 General
The organization shall plan, implement, control and maintain the processes needed to meet requirements of the OH&S management system, and to implement the actions determined in Clause 6, by:
a) establishing criteria for the processes;
b) implementing control of the processes in accordance with the criteria.

Objective Evidence:
The following discrepancies were observed related to OH&S Operational controls;
500 Commissioners:

- Building C – lower parking area found having SF6 cylinders tied up with rope, and not properly secured.
- Vehicle parked at Loading dock ramp (downward slope) found not having chalks applied to prevent rollover.

71 Rexdale Blvd:

- Outdoor Generator area: No safety signage provided such as, Flammable, No Smoking…for diesel storage tank.

EVIDENCE SUMMARY

The state of the management system is summarized below:

Process for Monitoring and Maintaining Compliance with Legal and Other Requirements

The organization has a robust process in place to maintain knowledge of its compliance status. A registry of Environmental, health & safety requirements MSC-1810-003 is maintained and updated on a quarterly basis. The registry was last updated by an external company (Integrated Management Solutions Limited/IMS) in year 2022.
Changes to the legal and other requirements are evaluated for applicability to THESL's operations and captured as part of the operational status review (OSR) meetings. The changes are also discussed in the management reviews.
THESL is performing the EMS and OH&S Management system internal audits at annual frequency and compliance to EMS and OH&S in alternative years. Last audit cycle was conducted on June 13-17, 2022 by external provider: Integrated Management Solutions (IMS) – by Tony Tarsitano and Jessica Staples-Campetelli.
The EHSMS and Environmental Compliance audit report of July 15, 2022 including, 1 minor noncompliance related to Environment and couple of OFIs. All the nonconformities are posted on Intelex software i.e. NC # 194 to 197, # 200 and # 204 for further root cause analysis and corrective action implementation and follow up per due date(s). The status of corrective actions was reviewed.
Permits and registrations including Equivalency Certificate (Permit of Equivalent Level of Safety), HWIN registration and Environmental Compliance Approval are in place for WorkCentres. Manifests, NPRI, ESDM and other monitoring requirements were reviewed and found in order.
Based on the records reviewed and interview held, no adverse trend in the results of compliance evaluations over the last three years was noted. THESL's process of monitoring and maintaining compliance with EHS legal and other requirements is mature and effective.

Assessment of Implementation related to Significant Environmental Aspects

THESL has identified the aspects applicable to its activities; these are tracked in the Environmental Aspects Database using the criteria based on Likelihood X (Severity/Benefit+ Scale+ Duration+ Legal Requirements+ Concerns of Interested Parties). Aspects scoring 300 and higher are considered significant.
Annual Environmental Risk assessment workshop identified the SEAs as below;
The negative SEAs e.g. Air emission – Combustion by-products, Release of SF6 gas; Potential for spill or leak of PCB oil; Operation of air conditioners, refrigerators and chillers: Reduction in air quality; Increase in ozone depleting substances/ GHG.
The positive SEAs e.g. Recycling of non-hazardous materials (Scrap, Aluminium, Wood etc.) and hazardous materials (Fluorescent tubes, street lights, batteries etc.); Generation of electricity with solar panels: Improved air quality - reduction of GHG; Electrification of the fleet: reduction in Air emission.
The SEAs register includes the identified potential risks and opportunities based on the environmental aspects/ impacts. The risks and opportunities are tracked through IMPs and 2022 EHS annual plan.

EMS Operational Controls:
Field Visit: (DCC - Underground)

1 underground switching visit (Hold off: 72356 with truck # 803) was conducted in Toronto. The field activities of the Toronto Hydro's crew were audited at that location: 98 Vanderhoof Avenue. Employees at 500 Commissioner and crew members at the municipal transformer station, field crews, which included both underground and above ground operations, were involved in the audit. Some of the significant environmental aspects reviewed included air emissions from fleet vehicles and waste generation from field activities and the respective controls include anti-idling (use of Grip system), use of hybrid and electrical vehicles and waste segregation, collection, labeling and disposal.

Field Visits: (DCW - Overhead)
One DCW Overhead field visit was conducted at Project: Thornecrest phase 10 at Princess Margret, and the field, station and facility activities of the Toronto Hydro's crews and employees were audited at those locations. Employees at 71 Rexdale Blve and field crews, which included both underground and above ground operations, were involved in the audits. Some of the significant environmental aspects reviewed included air emissions from fleet vehicles and waste generation from field activities and the respective controls include anti-idling (use of Grip system), use of hybrid and electrical vehicles and waste segregation, collection, labeling and disposal.

Field Visits: (Metering)
One meter exchange field visits at 59 Lakeside avenue (Fleet vehicle # 0647V) was conducted, and the field activities of the Toronto Hydro's crews were audited at that location. Employees at 715 Milner Ave and field crews were involved in the audits. Some of the significant environmental aspects reviewed included air emissions from fleet vehicles and waste generation from field activities and the respective controls include anti-idling (use of Grip system), use of hybrid and electrical vehicles and waste segregation, collection, labeling and disposal.

Field Visits: (Stations)
Carlaw station has been audited. Orientation, maintenance, inspection, waste management and….. processes including NOP (notice of project) process have been reviewed with the team. Risk assessment is addressed the relevant risks properly and updated per project. Emergency response including fire alarm, communication with responders have been reviewed. Maintenance/inspection/recording/labeling for some of lifting equipment and Battery Test have been checked in this station. Housekeeping and using of PPE are properly followed up by the team.

Based on the evidence gathered during the interviews of crew members, crew leaders' supervisors and review of controls including use of tailboard, training records, vehicle anti-idling, inspections, employee awareness, waste management and handling, the controls were found to be effectively implemented and maintained for the significant environmental aspects.

Assessment of Implementation related to Hazards and Risks

THESL has identified the OHS Hazards & Risk applicable to its activities and assessed them using the criteria based on Risk = Severity (1-10) x Frequency of exposure - FE (1-10) x Duration of exposure – DE (1-10). Hazard control registry ref: MSE-1810-005 maintained.
Operational controls are considered based on the hierarchy while evaluating the risk. The risks are considered as High (700 to 1000), Medium (300 to 699), Low (60 to 299) and Negligible (1 to 59).

The hazards and risks are separated by work group or sub-groups e.g. Overhead, Underground, Facilities, Office staff, IT etc.
The identified high/ medium levels hazards/ risks include e.g. General workplace activities involving designated substances (Customer location only) (Friable/ Non-Friable); Contact with hot objects including slag (during hot work operations); Crushed and struck (while working near mobile work equipment); Exposure to primary electric voltage >750 (while working on energized power system equipment); Equipment at same level tipping or falling onto workers; Working alone: Lack of detection/ response (emergencies); Exposure to pandemic infections/ diseases; and Working outdoor – winter – Exposure to cold stress (excluding water), Caught b/w or compressed by equipment or material while loading or unloading on trailers or trucks., and Harassment or violence due to interacting with the public (incl. Customers).

OH&S Operational Controls:

Field Visits: (DCC - Underground)
1 underground switching visit (Hold off: 72356 with truck # 803) was conducted in Toronto. The field activities of the Toronto Hydro's crew were audited at that location: 98 Vanderhoof Avenue. Employees at 500 Commissioner and crew members at the municipal transformer station, field crews, which included both underground and above ground operations, were involved in the audits. Some of the significant hazards included those arising from traffic, use of vehicles, Slip/ trip & fall and working with electrical energy and controls included safety procedures, risk assessments and tailboards, traffic management plan, use of PPEs (harness, gloves, hard hat, safety boots, high visibility clothing), equipment and tools (emergency equipment such as fire extinguisher, eye wash, first-aid kit and spill kits).

Field Visits: (DCW - Overhead)
One DCW Overhead field visit was conducted at Project: Thornecrest phase 10 at Princess Margret, and the field, station and facility activities of the Toronto Hydro's crews and employees were audited at those locations. Employees at 71 Rexdale Blve and field crews, which included both underground and above ground operations, were involved in the audits. Some of the significant hazards included those arising from Working at height, traffic, use of vehicles and working with electrical energy and controls included procedures (Bucket rescue and evacuation), risk assessments and tailboards, traffic management plan, use of PPEs (harness, gloves, hard hat, safety boots, high visibility clothing), equipment and tools (emergency equipment such as fire extinguisher, eye wash, first-aid kit and spill kits).

Field Visits: (Metering)
One meter exchange field visits at 59 Lakeside avenue (Fleet vehicle # 0647V) was conducted, and the field activities of the Toronto Hydro's crews were audited at that location. Employees at 715 Milner Ave and field crews were involved in the audits. Some of the significant hazards included those arising from traffic, use of vehicles and working with electrical energy and controls included procedures, risk assessments and tailboards, traffic management plan, use of PPEs (harness, gloves, hard hat, safety boots, high visibility clothing), equipment and tools (volt meter, emergency equipment such as fire extinguisher, first-aid kit and spill kits).

Field Visits: (Stations)

Carlaw station has been audited. Orientation, maintenance, inspection, waste management and….. processes including NOP (notice of project) process have been reviewed with the team. Risk assessment is addressed the relevant risks properly and updated per project. Emergency response including fire alarm, communication with responders have been reviewed. Maintenance/inspection/recording/labeling for some of lifting equipment and Battery Test have been checked in this station. Housekeeping and using of PPE are properly followed up by the team.

Based on the evidence gathered during the interviews of crew members, crew leaders and review of controls including use of tailboard, training records, vehicle anti-idling, inspections, employee awareness, waste management and handling, the controls were found to be effectively implemented.

Identified opportunities for improvement

- While the scope of EHSMS documented in the EHSMS manual was developed considering the context of the organization, an opportunity for improvement exists to provide more clarity for the permanent locations/WorkCentre in the defined scope. (Repeat from previous year audit)
- While the OH&S risk assessments are reviewed at annual frequency, it may be beneficial to formalize the process of periodical review of task specific Job safety risk assessments (JSA) maintained by the fleet maintenance.
- Although the EHS management system are properly implemented in Stations, more attention to shared areas/activities with “TTC” and “Hydro one” may have value added.
- While the competence of Toronto Hydro employees are properly covered by LMS, more attention to monitoring the competence of contracted employees/work force via ISN/…..would be beneficial.
- While the internal audit processes found effectively implemented, it may be added value to include expand the Audit evaluation checklist for post audit evaluation questions.

Conclusions regarding risk assessment/risk treatment processes

THESL identify the risks and opportunities related to its EHSMS by taking into consideration the context issues, environmental aspects, OH&S hazards and compliance obligations. Based on the documentation review and interviews with management, the key risks include, COVID-19 and Vehicle and work equipment, Air and noise emissions, water and waste management were reviewed. The management team is monitoring and reviewing the risks and opportunities and mitigation actions through monthly operations and yearly management review meetings. The process for addressing the risks and opportunities found effective.

Conclusions regarding context of the organization

THESL has determined the organizational context issues and requirements. An Annual EHS plan 2022 has been established including the Context issues. The interested parties, and their needs and expectations are gathered through feedback on submitted reports, Surveys, regulatory applications, social media monitoring and direct line to the Office of President. The process for determining interested parties and compliance obligations is outlined in the MSC-1810-003. Interested parties include; Shareholders, Government agencies, NGO, Media, Customers, Suppliers, Contractors, Employees (including the Union) etc. The environmental context issues and interested party requirements are reviewed during the management review meetings for any changes or new requirements to be addressed. Based on the documentation review and interviews with management, the determination of organizational context found effective.

Impact of Significant Changes (If Any)

iEnable database can be updated for the current EC: 1316 (previously: 1432)

Additional information/unresolved issues

Performance monitoring and measurement (Employee Health monitoring including interview of employees' health representative including nurse, doctor or other professional) :
Health monitoring process has been reviewed. Shelley Quinlin (Nurse) has been interviewed and also invited to attend on closing meeting. Sample of health monitoring (biological monitoring) of relevant team/project has been reviewed. The process will be followed by an internal audit/Inspection.

Communication/Changes during the visit (if applicable)

N/A

References to appendices:

Interview record; Audit plan (as executed)

Have all shifts been audited:

Yes

The audit has been performed according to audit plan meeting audit objectives, scopes and duration (on-site and off-site) as given within the audit plan

Confirmed.

Extent of use and effectiveness of Information and Communications Technology (ICT).

ICT was used for 37% of this audit.

ICT used was effective in achieving the audit objectives.

LEAD AUDITOR RECOMMENDATION

Lead Auditor's Recommendation for ISO 45001:2018

The nonconformity(ies) identified do not jeopardize the certification of the management system. Continued certification is therefore recommended pending acceptance of the corrective action plans(s) for identified nonconformity(ies).

Lead Auditor's Recommendation for ISO 14001:2015

The management system is in conformity with the audit criteria and can be considered effective in assuring that objectives will be met. Continued certification is therefore recommended.

OTHER OR ADDITIONAL LEAD AUDITOR RECOMMENDATION

N/A

CLIENT ACKNOWLEDGEMENT

Client Representative Name and Mailing Address:	Pat Allen 14 Carlton St., Toronto, Ontario, M 5B 1K5, Canada
Acknowledged By:	Phil Genoway - Director, Environment, Health & Safety

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT1.5:

Reference(s): 2B-SEC-42

To provide assistive or explanatory material for the Alteryx Model.

RESPONSE:

At this time, Toronto Hydro does not have a manual or guide regarding the Alteryx Model beyond the workflow provided as an appendix to Toronto Hydro's detailed explanation of the Reliability Projection Methodology ("RPM") in its response to interrogatory 2B-SEC-42, part (a). As such, in the response below, Toronto Hydro is providing additional details regarding the RPM process, specifically the defective equipment reliability projection modelling used for major asset classes.

<u>Preamble on Defective Equipment Reliability Modelling</u>

Each major asset class is calibrated with asset class-specific parameters and inputs to project the likely impact of asset replacements and additions through time. For each major asset class, SAIFI and SAIDI is calculated based on the forecasted number of interruptions, multiplied by the average SAIFI and SAIDI contribution per interruption, respectively, based on a five-year historical average. For assets with limited historical data and/or those deemed to pose a low risk to system-wide reliability metrics (i.e., Network, Secondary Distribution, etc.), a five-year historical average was used.

The methodology models defective equipment outages by projecting failures and outage impacts at an asset class level based on:

1. asset demographics data and associated failure projections;
2. historical reliability performance; and
3. planned program investments.

Procedure Used for Defective Equipment Projections

Figure 1 below outlines the procedure for projecting SAIFI/SAIDI contributions rooted in system outages caused by major asset classes, as implemented in the Alteryx models.

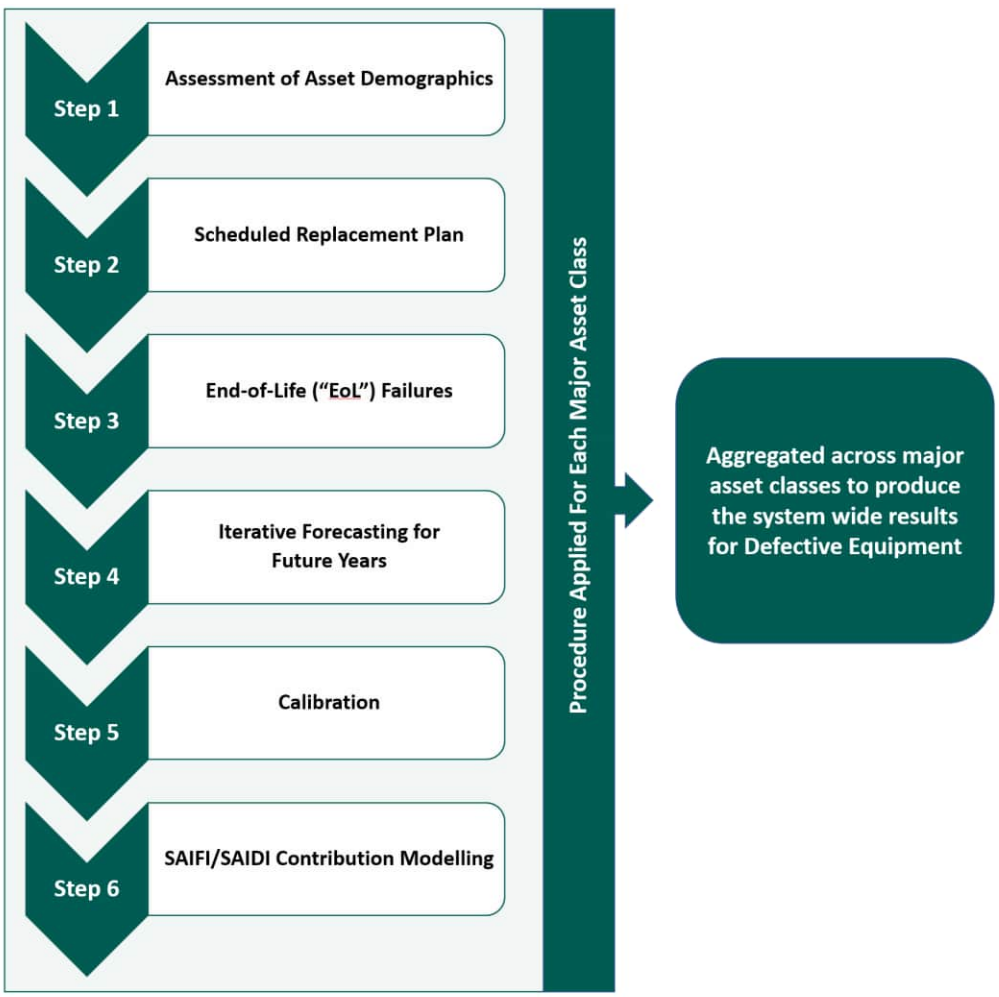


Figure 1: Process for developing SAIFI & SAIDI projections for Defective Equipment Forecasting

The steps outlined in Figure 1 above are explained in further detail below.

1. **Assessment of asset age demographics:** The modelling approach begins with an assessment of current asset class demographics and the effects of turnover and new additions. This approach accounts for the aging of assets through time, which are gradually replaced through planned and reactive replacement volumes. In addition, it accounts for new assets that are installed each year. The following inputs were considered:
    a. 2022 year-end asset age demographics from Toronto Hydro's information systems.
    b. New asset additions based on historical trends, i.e., average rate of historical growth for each asset class.

2. **Scheduled replacement plan:** Planned replacement volumes are then considered.
    a. Planned asset replacement volumes for relevant programs as set out in the 2025-2029 Rate Application are applied in order to estimate the impact of investments on failure risk for the 2023-2029 period. Alternative scenarios are run by increasing or decreasing volumes of replacement in specific asset classes.

3. **End-of-Life ("EoL") failures:** the corresponding failure curve is applied to the asset population to project the expected end-of-life ("EoL") failures for a specific asset class. The resulting failures are inclusive of all failure modes.

4. **Iterative forecasting for future years**: The asset population is aged from one year to the next, resulting in a shift in the population demographic. The

population is adjusted for EoL failures from the previous year, which are reset in age. Furthermore, additions and replacements are made to the adjusted asset population. EoL failures for the year are then calculated using the adjusted asset population.

5. **Calibration:** The model is then calibrated to ensure failure projections are reflective of only those failures which result in outages by right-sizing it to the 3-year historical average number of outages for each asset class.

6. **SAIFI/SAIDI contribution modelling:** the historical 5-year average SAIFI and SAIDI contribution per interruption, from Toronto Hydro's Interruption Tracking system, is then applied to the projected number of system outage failures to calculate the SAIFI and SAIDI projection for the respective asset class.

The asset class level information obtained from the procedure is then aggregated across asset classes to produce the system wide results.

The outputs of the Defective Equipment reliability forecasts (Alteryx model) are then combined with projections for other cause codes and the estimated benefits of grid modernization investments to arrive at the final system wide forecast.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT1.6:

Reference(s): **2B-SEC-66 part (c)**

To clarify the response to 2B-SEC-66c.

RESPONSE:

The correction Toronto Hydro made in 2B-SEC-66 part (c) was intended to address the fact that the units of measure used for the two periods in the original Table 8 (2020-2024 vs. 2025-2029) were different. Specifically, conductor length ("km") was used for the 2020-2024 units (actuals and bridge), while circuit length ("cct-km") was used for the 2025-2029 forecast. Both units are valid measures for underground cable. In 2B-SEC-66, part (c), Toronto Hydro elected to convert the units for the 2020-2024 period to cct-kms to create consistency with the presentation used for the 2025-2029 plan.

Toronto Hydro has reviewed the evidence in EB-2018-0165 and notes that the units in the 2020-2024 Distribution System Plan (Exhibit 2B, Section E6.2, Table 11 at page 28) were presented as conductor length. To avoid further confusion, Toronto Hydro offers the following tables, which present the planned and actual (or bridge year) cable volumes for 2020-2024, as well as the planned 2025-2029 cable volumes, in both conductor length and circuit length.

Table 1: 2020-2024 Forecast and Actual/Bridge Cable Volumes

		2020	2021	2022	2023	2024	Total
EB-2023-0195, Exhibit 2B, Section E6.2, Table 8 at Page 30, Total Cable (2020-2023 Actuals and 2024 Bridge)	*conductor -km*	114	83	128	83	55	**463**
EB-2023-0195, Exhibit 2B, Section E6.2, Table 8 at Page 30, Total Cable (2020-2023 Actuals and 2024 Bridge)	*circuit length-km*	45	33	51	33	22	**184**
EB-2018-0165, Exhibit 2B, Section E6.2, Table 11 at Page 28, Cable (2020-2024 Forecast)	*conductor -km*	103	96	96	98	98	**491**
EB-2018-0165, Exhibit 2B, Section E6.2, Table 11 at Page 28, Cable (2020-2024 Forecast)	*circuit length-km*	41	38	38	39	39	**196**

Table 2: 2025-2029 Planned Cable Volumes

		2025	2026	2027	2028	2029	Total
EB-2023-0195, Exhibit 2B, Section E6.2, Table 8 at Page 30, Total Cable (2025-2029 Forecast)	*conductor -km*	75	181	211	198	188	**854**
EB-2023-0195, Exhibit 2B, Section E6.2, Table 8 at Page 30, Total Cable (2025-2029 Forecast)	*circuit length-km*	30	72	84	79	75	**340**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT1.7:

Reference(s): 2B-AMPCO-33

To provide more detail on the Distribution Assets Failure Curve Study.

RESPONSE:

Please see Appendix A to this response for the "Distribution Asset Failure Curves" report produced by HATCH. Note that some parts of this document have been redacted for confidentiality purposes.

Toronto Hydro-Electric
System Limited
EB-2023-0195
JT1.7
Appendix A
FILED: April 22, 2024
ORIGINAL
(17 pages)

Distribution Asset Failure Curves

Toronto Hydro

Hatch Project H368064

Notice to the Reader

This report was prepared by Hatch Ltd. ("Hatch"), for the sole and exclusive benefit of Toronto Hydro-Electric System Limited ("Toronto Hydro", "Toronto Hydro", or "Client") for the purpose of this Asset Failure Curve Analytics Project (the "Project"), and may not be provided to, relied upon, or used by any third party.

Any use of this report by the Client is subject to the terms and conditions of the Master Agreement for the Purchase of Services between Hatch and the Client dated January 1, 2021, including the limitation on liability set out therein.

This report is meant to be read as a whole, and sections should not be read or relied upon out of context. The report includes information provided by Client and by certain other parties on behalf of Client. Unless specifically stated otherwise, Hatch has not verified the accuracy or completeness of such information and disclaims any responsibility or liability in connection with such information.

This Report contains the expression of the professional opinion of Hatch, based upon information available at the time of preparation. The quality of the information, conclusions, and estimates contained herein is consistent with the intended level of accuracy as set out in this report, as well as the circumstances and constraints under which this report was prepared. Therefore, while the work, results, estimates and projections herein may be considered to be generally indicative of the nature and quality of the Project, they are not definitive. No representations or predictions are intended as to the results of future work, nor can there be any promises that the estimates and projections in this report will be sustained in the future.

Table of Contents

Overview

Toronto Hydro-Electric System Limited ("THESL") is looking to advance in-house asset failure curves analytics to improve the value-based asset management processes. The overall objective of the project was to advance the existing failure curves form industry consensus-based to data-driven evidence based.

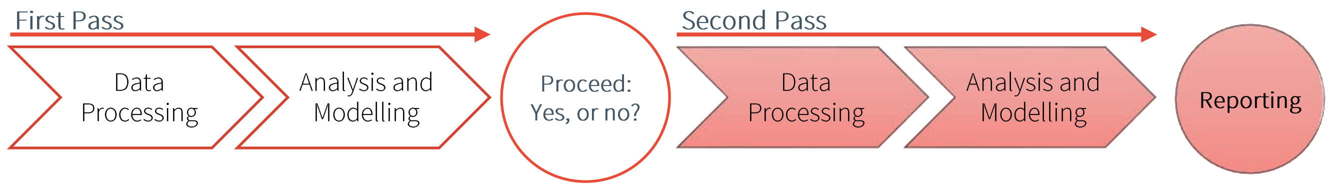
Through this project, Hatch has developed data-driven failure curves leveraging THESL's own failure records. The client-provided datasets were cleaned, validated, and engineering judgement was applied to data anomality.

The following analysis were performed for twelve (12) asset classes:

- ✓ Transformers: Vault transformer, Pad-mounted transformer, Submersible transformer, and Overhead transformer.
- ✓ Poles: Wood poles and Concrete poles.
- ✓ Switches: Pad-mounted SF6-insulated switches, Pad-mounted Air-insulated switches, Submersible SF6-insulated switches, Submersible Air-insulated switcher, Overhead load break switches, and Overhead Scadamate switches.

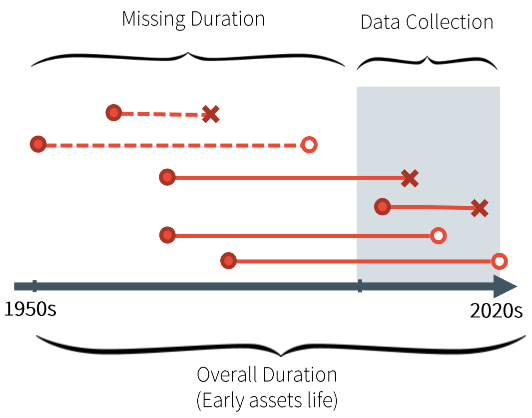
The failure curve project was started by reviewing the THESL existing methodologies and complementing them to further incorporate the accuracy and utility of the available data.

The project team had devised a streamlined process of data cleaning and modeling in two stages. The first pass is to determine the overall characteristics of the asset and analyze the data with respect to the asset's inherent behavior. Within the second pass, the project team would engage with asset data in higher resolution to combine all data sources, consider all data scenarios, use all methodologies, and arrive at the most accurate results.



Methodologies

Data Driven Reliability Engineering Methodology



Hatch's experience in asset management, risk-based capital and maintenance planning, and reliability engineering, provides valuable insights into the strengths and weaknesses of various mathematical methods for addressing asset management challenges in various industry sectors.

The transmission and distribution (T&D) domain, due to various complexities and nature of its historical operations is particularly prone to various data challenges (e.g., lack or incompleteness of data). This problem presents itself in several ways, including poor data quality due to past system migrations and consolidations, or simply because of insufficient data collection efforts. This can overlook past failures or other relevant information (e.g., assets not included in the data set from the start). To address these challenges, Hatch has applied advanced reliability engineering methods, incorporating artificial intelligence (AI) and machine learning, probabilistic data imputation techniques, as well as various simulation methods to fill these gaps.

The methodologies used in this report include scientific reliability engineering techniques suitable for analyzing data that is right-censored or left-truncated. In cases where assets have been replaced due to technological advancements or as part of policy-driven age replacements, [redacted] while assessing their reliability. Furthermore, [redacted] were employed to enhance the utility of the available data where its availability was limited. Crucially, to account for potential data biases and the impact of replacing older asset classes, various data scenarios were defined and analyzed. This approach helps in understanding the implications of significant asset replacement programs in the past or major vintage asset changes.

It is important to note that any probabilistic analysis relying heavily on data, such as this one, comes with limitations and that the results should be interpreted considering data quality and availability challenges.

Modelling Methodology/ Data Scenario

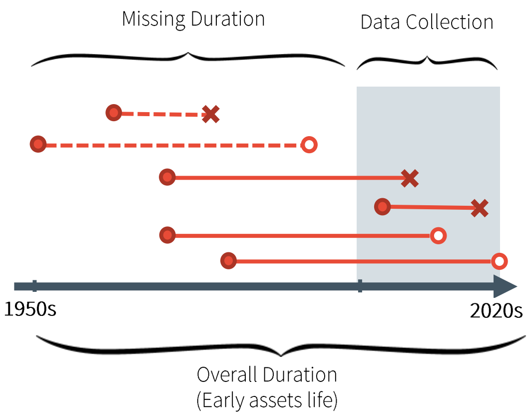
Hatch's combined expertise in risk analytics and asset management has fostered innovative approaches to better deal with uncertainties raised due to data challenges and to accurately model and estimate failure characteristics.

Multiple reliability analysis methodologies are used to capture the behavior of the data, as well as to understand and validate the extent of uncertainty.

- ✓ M0: [redacted]
- ✓ M1: [redacted]
- ✓ M2: [redacted]
- ✓ M3: [redacted]
- ✓ M4: [redacted]
- ✓ M5: [redacted]

Multiple data scenarios were developed to understand the effect of right and left trimming on the data (i.e., infant mortality and burn out periods). This was particularly useful in distinguishing against various vintages within assets vintage, manufacturer and technologies.

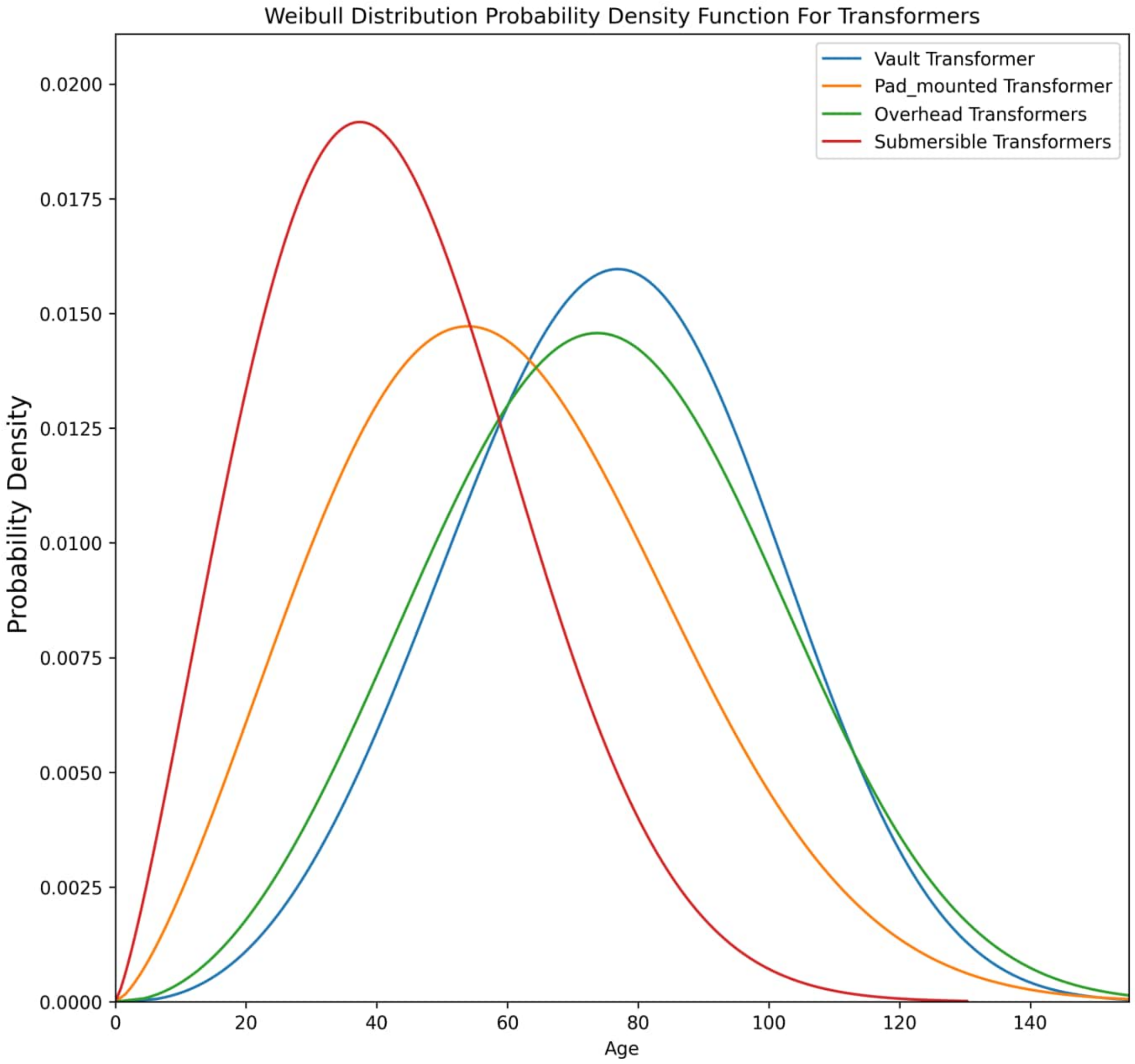
- ✓ S0: [redacted]
- ✓ S1: [redacted]
- ✓ S2: [redacted]
- ✓ S3: [redacted]

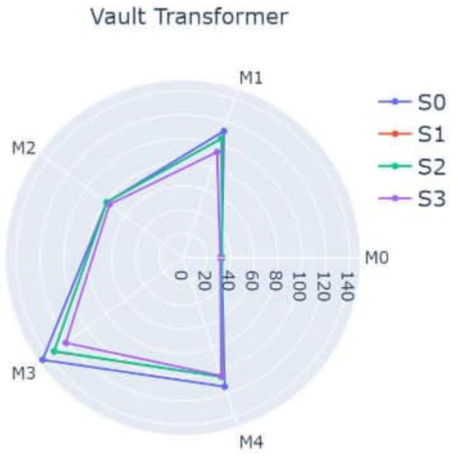


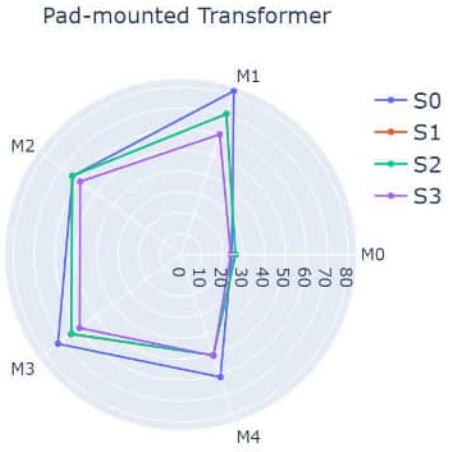
Results Presentation

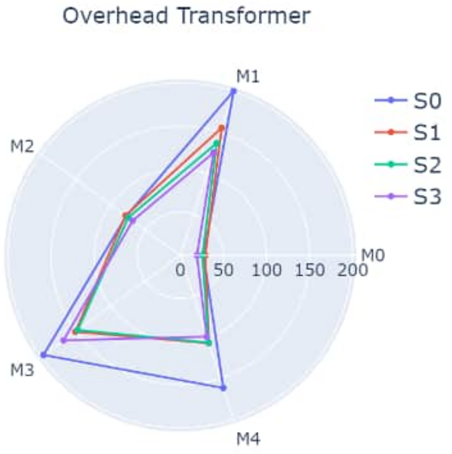
Assets Results Summary (Transformers)

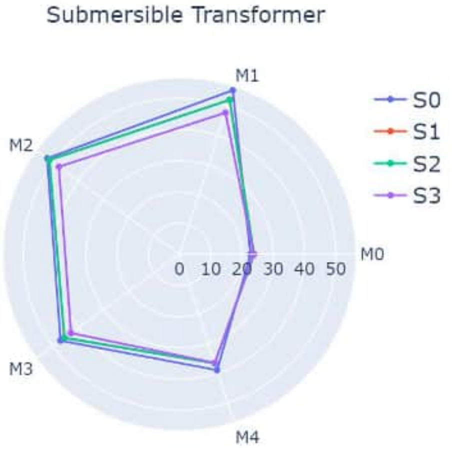
Asset	Contribution	Data Scenario	Method	Shape	Scale
Vault Transformer	5.02%	Installation Year >= 1970 & Age >=4	(M0) [redacted]	3.09	35.1
			(M1) [redacted]	2.79	104.61
			(M2) [redacted]	3.51	84.61
Pad-mounted Transformer	9.57%	Installation Year >= 1970 & Age >=4	(M0) [redacted]	2.45	26.99
			(M1) [redacted]	2.74	67.86
			(M3) [redacted]	2.43	67.09
Overhead Transformer	4.81%	Installation Year >= 1960 & Age >=3	(M0) [redacted]	2.01	29.02
			(M1) [redacted]	1.90	154.09
			(M2) [redacted]	3.12	83.47
Submersible Transformer	12.14%	Installation Year >= 1965 & Age >=3	(M0) [redacted]	2.53	26.87
			(M1) [redacted]	2.51	53.77
			(M3) [redacted]	2.25	48.58


Weibull Distribution Probability Density Function For Transformers
Vault Transformer
Pad_mounted Transformer
Overhead Transformers
Submersible Transformers
Probability Density
Age
0.0000
0.0025
0.0050
0.0075
0.0100
0.0125
0.0150
0.0175
0.0200
0
20
40
60
80
100
120
140


Vault Transformer
M0
M1
M2
M3
M4
S0
S1
S2
S3
0
20
40
60
80
100
120
140


Pad-mounted Transformer
M0
M1
M2
M3
M4
S0
S1
S2
S3
0
10
20
30
40
50
60
70
80

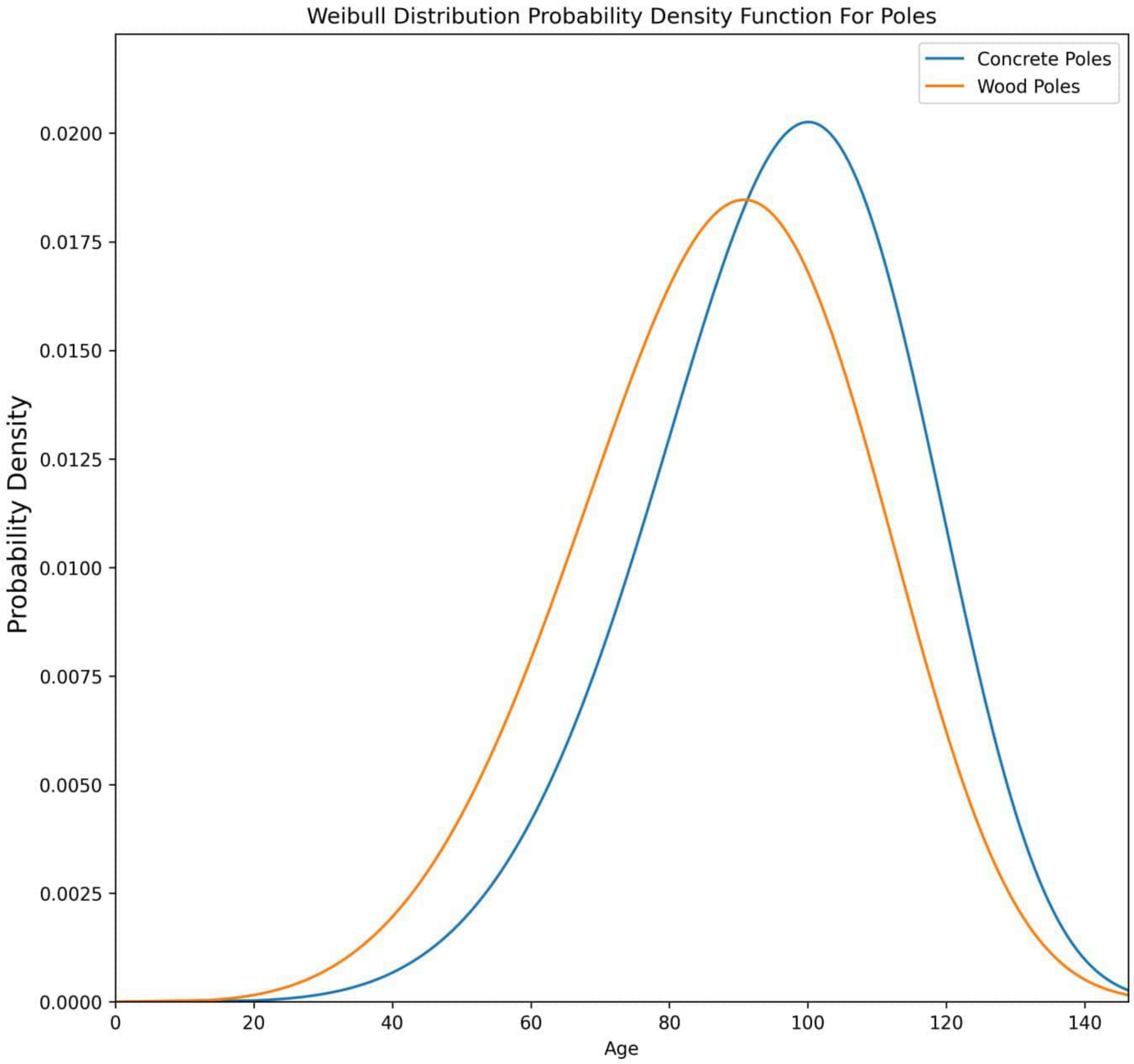

Overhead Transformer
M0
M1
M2
M3
M4
S0
S1
S2
S3
0
50
100
150
200

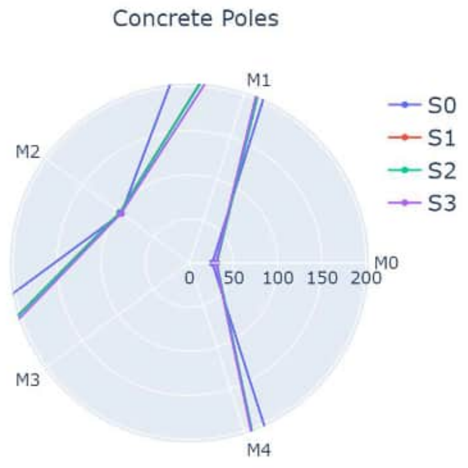

Submersible Transformer
M0
M1
M2
M3
M4
S0
S1
S2
S3
0
10
20
30
40
50

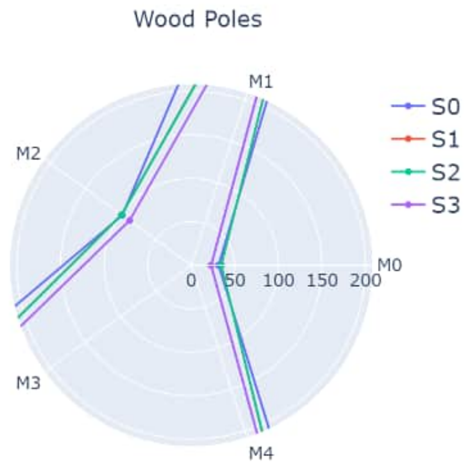
Assets Results Summary (Poles)

CONFIDENTIAL

Asset	Contribution	Data Scenario	Method	Shape	Scale
Concrete Poles	0.67%	Installation Year >= 1960 & Failed Assets Age >=4	(M0) [redacted]	2.25	33.79
			(M1) [redacted]	2.14	418.87
			(M2) [redacted]	5.61	103.62
Wood Poles	0.62%	Installation Year >= 1970 & Failed Assets Age >=3	(M0) [redacted]	2.01	25.68
			(M1) [redacted]	1.82	486.32
			(M2) [redacted]	4.68	95.56


Weibull Distribution Probability Density Function For Poles
Concrete Poles
Wood Poles
Probability Density
0.0200
0.0175
0.0150
0.0125
0.0100
0.0075
0.0050
0.0025
0.0000
0
20
40
60
80
100
120
140
Age


Concrete Poles
M0
M1
M2
M3
M4
0
50
100
150
200
S0
S1
S2
S3

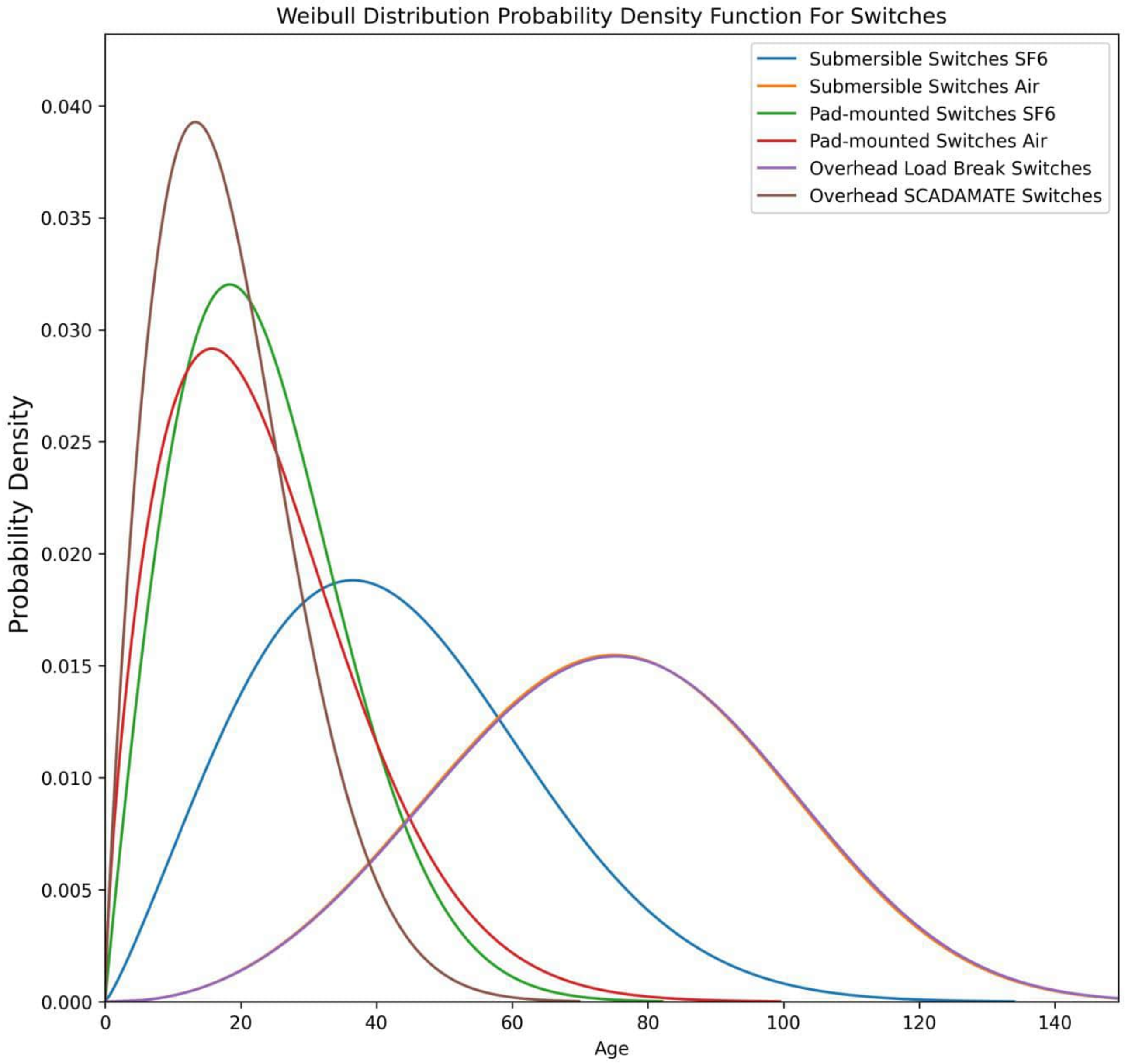

Wood Poles
M0
M1
M2
M3
M4
0
50
100
150
200
S0
S1
S2
S3

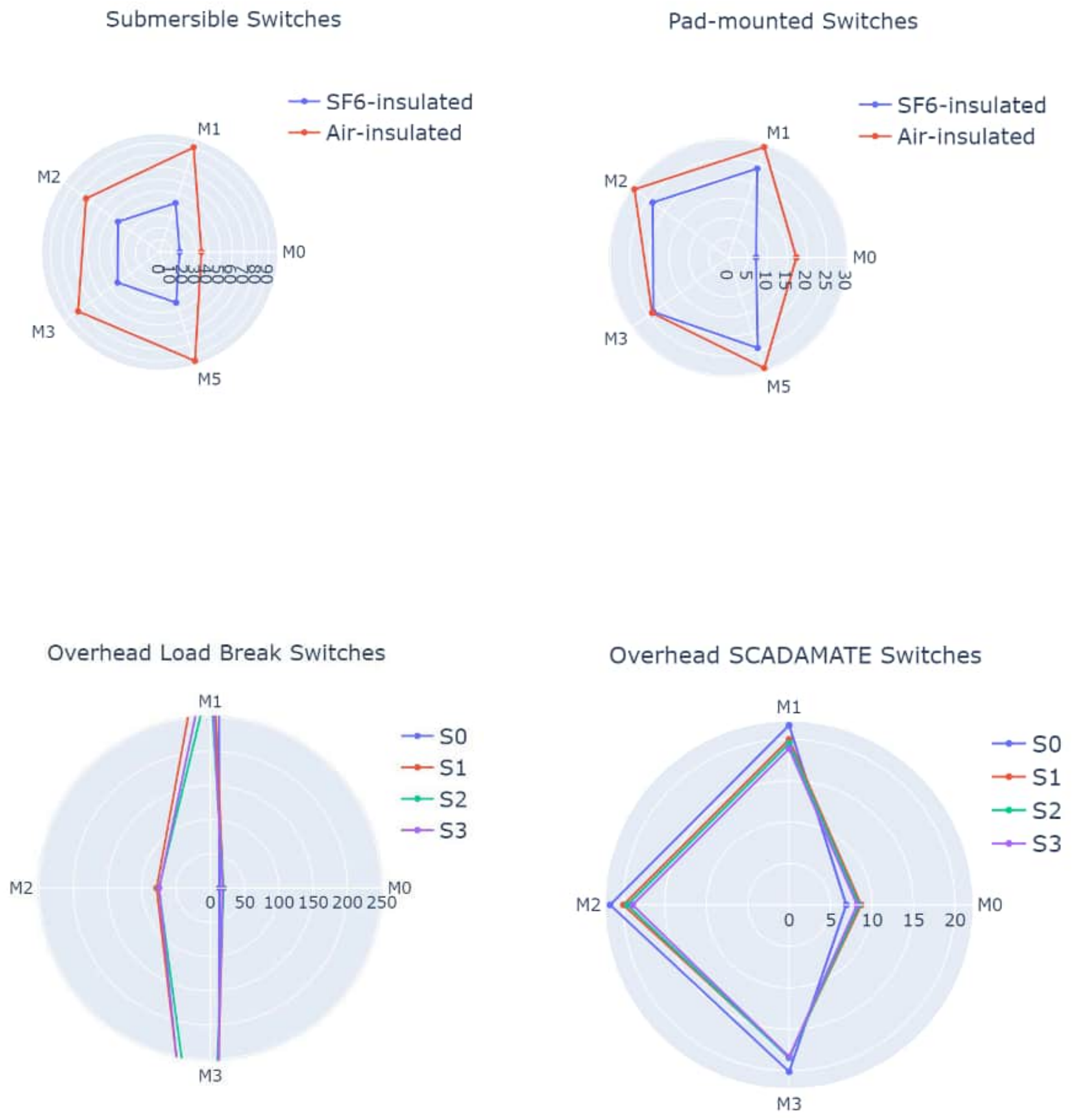
Assets Results Summary (Switches part 1)

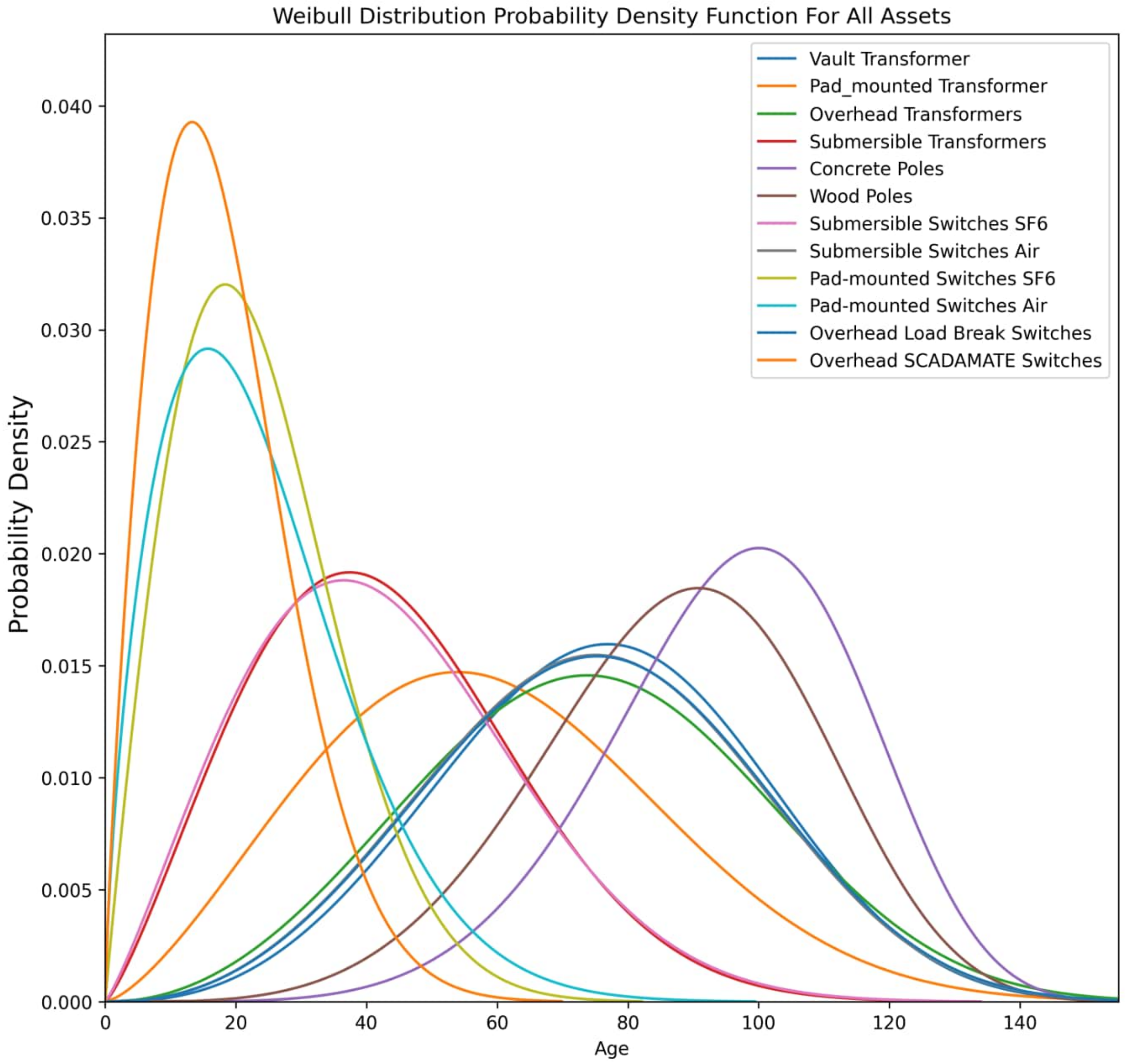
Asset	Contribution	Data Scenario	Method	Shape	Scale
Submersible Switches (SF6-insulated)	8.43%	Failed Assets Age >=3	(M0) [redacted]	2.32	18.66
			(M1) [redacted]	2.39	47.83
			(M3) [redacted]	2.18	48.37
Submersible Switches (Air-insulated)	4.09%	Failed Assets Age >=3	(M0) [redacted]	2.37	38.82
			(M1) [redacted]	2.67	101.83
			(M2) [redacted]	3.34	83.44
Pad-mounted Switches (SF6-insulated)	13.19%	Failed Assets Age >=3	(M0) [redacted]	1.98	7.94
			(M1) [redacted]	1.96	26.72
			(M3) [redacted]	1.96	26.44
Pad-mounted Switches (Air-insulated)	34.52%	Failed Assets Age >=3	(M0) [redacted]	1.54	19.15
			(M1) [redacted]	1.72	32.98
			(M3) [redacted]	1.69	26.73

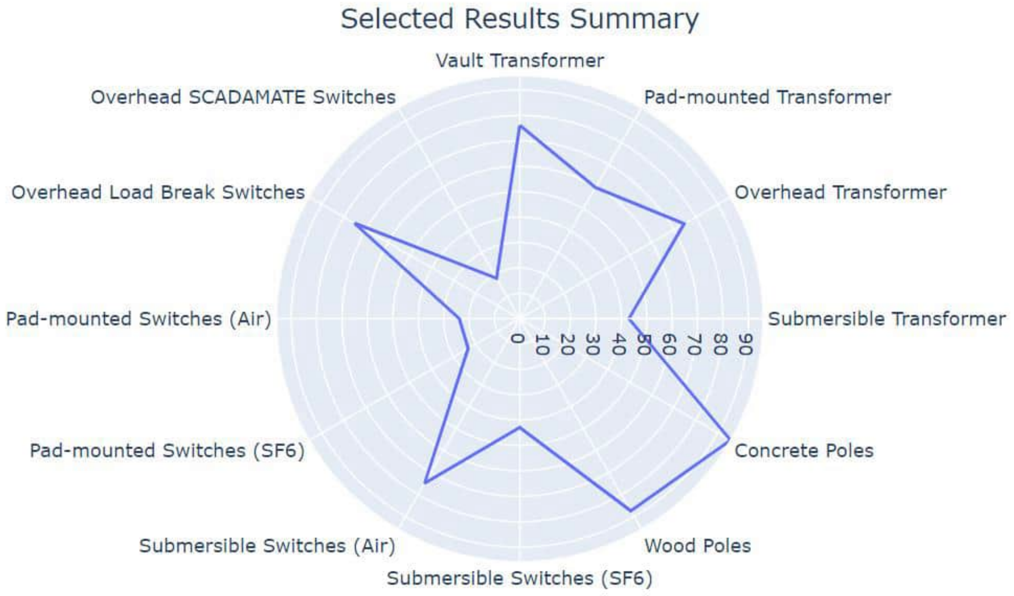
Assets Results Summary (Switches Part 2)

Asset	Contribution	Method	Data Scenario	Shape	Scale
Overhead Load Break Switches	2.66%	(M0) [redacted]	Installation Year >= 1970 & Age >=3	1.68	21.30
		(M1) [redacted]		1.49	343.78
		(M2) [redacted]		3.34	83.75
Overhead SCADAMATE Switches	28.10%	(M0) [redacted]	Installation Year >= 1960 & Age >=3	1.63	9.16
		(M1) [redacted]		1.79	21.22
		(M3) [redacted]		1.82	20.62


Weibull Distribution Probability Density Function For Switches
Submersible Switches SF6
Submersible Switches Air
Pad-mounted Switches SF6
Pad-mounted Switches Air
Overhead Load Break Switches
Overhead SCADAMATE Switches
Probability Density
0.000
0.005
0.010
0.015
0.020
0.025
0.030
0.035
0.040
Age
0
20
40
60
80
100
120
140


Submersible Switches
SF6-insulated
Air-insulated
M0
M1
M2
M3
M5
Pad-mounted Switches
SF6-insulated
Air-insulated
M0
M1
M2
M3
M5
0 5 10 15 20 25 30
Overhead Load Break Switches
S0
S1
S2
S3
M0
M1
M2
M3
0 50 100 150 200 250
Overhead SCADAMATE Switches
S0
S1
S2
S3
M0
M1
M2
M3
0 5 10 15 20


Weibull Distribution Probability Density Function For All Assets
Vault Transformer
Pad_mounted Transformer
Overhead Transformers
Submersible Transformers
Concrete Poles
Wood Poles
Submersible Switches SF6
Submersible Switches Air
Pad-mounted Switches SF6
Pad-mounted Switches Air
Overhead Load Break Switches
Overhead SCADAMATE Switches
Probability Density
0.000
0.005
0.010
0.015
0.020
0.025
0.030
0.035
0.040
Age
0
20
40
60
80
100
120
140


Selected Results Summary
Vault Transformer
Pad-mounted Transformer
Overhead Transformer
Submersible Transformer
Concrete Poles
Wood Poles
Submersible Switches (SF6)
Submersible Switches (Air)
Pad-mounted Switches (SF6)
Pad-mounted Switches (Air)
Overhead Load Break Switches
Overhead SCADAMATE Switches
0
10
20
30
40
50
60
70
80
90

Thank you

For more information,
please visit www.hatch.com

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT1.8:

Reference(s): Exhibit 2B, Section D2, Page 14

To provide the data at page 14, section D2 of the distribution system code in tabular format; to clarify time lag between time of order and time of installation.

RESPONSE:

Please see Tables 1 and 2 below for the moving average unit costs for each major asset class, covering the years 2019 to 2023 underpinning Figure 11 at Page 14 of Exhibit 2B, Section D2.

The moving average price is an inventory costing method wherein the average price of a stock code is calculated after every goods' movement. It is not the same as the current purchase price of the goods, however, it does represent the value of the goods in the system at a particular point in time.

The moving average price for all Top Usage Cable stock codes shown in Table 1 increased from 2019 to 2023.

Table 1: Moving Average Price for Top Usage Cable SKUs ($/m)

	2019	2020	2021	2022	2023	Avg. Increase per Year
9662955 CABLE TRIPLEX 2 #2 AL AL XLPEI 1- #4	$2.44	$2.30	$2.81	$3.29	$3.89	**15%**

	2019	2020	2021	2022	2023	Avg. Increase per Year
7180052 CABLE 1/0 AL 28KV TRXLPE ECNPEJ	$9.19	$9.18	$11.59	$11.73	$11.79	**7%**
7150228 CABLE 300 KCMIL CU 600V TW75 WHITE AS	$14.42	$14.70	$20.43	$16.92	$19.20	**8%**

The moving average price for all Top Usage Transformer stock codes shown in Table 2 increased from 2019 to 2023.

Table 2: Moving Average Price for Top Usage Transformer SKUs ($/ea)

	2019	2020	2021	2022	2023	Avg. Increase per Year
9665518 TRANSFORMER POLEMOUNT 1PH 100KVA	$3,989.25	$3,753.13	$4,270.17	$5,132.18	$7,525.06	**22%**
9665522 TRANSFORMER POLEMOUNTED 1PH 167KVA	$5,658.58	$5,272.01	$5,881.80	$7,239.86	$8,561.53	**13%**
9665517 TRANSFORMER POLEMOUNTED 1PH 50KVA	$2,362.12	$2,347.07	$2,524.69	$3,410.32	$4,869.39	**27%**
6661303 TRANSFORMER PADMOUNTED 1PH 100KVA	$4,403.94	$4,403.14	$6,772.54	$11,806.14	$9,029.01	**26%**
6661304 TRANSFORMER PADMOUNTED 1PH 167KVA	$6,484.96	$6,219.10	$7,298.47	$13,425.27	$14,070.69	**29%**

The time lag between when equipment is purchased and when it is in service in the field includes the (i) purchase order lead time, (ii) the lead time between material arrival and issuance at the warehouse, and (iii) time for delivery and installation.

The purchase order lead time is the time between placing a purchase order with the supplier and the time the material is delivered and received into the warehouse. Purchase order lead time varies widely across stock codes. Currently, the average purchase order lead time for Toronto Hydro's top usage cables is approximately 195 days, and the average purchase order lead time for the top usage transformers is approximately 231 days.

On a best-efforts basis, Toronto Hydro analyzed a representative sample of projects and found that the average time lag between material arrival and issuance from warehouse for distribution transformers is 16 business days. However, due to the complexity associated with tracking and the dynamic nature of projects and associated turnover of equipment, Toronto Hydro is unable to provide the overall time lag between purchase and installation for cables within the timelines for responding to undertakings.

Toronto Hydro follows a made-to-stock inventory strategy. Typically, material is ordered for inventory stock based on forecasted project demand. Toronto Hydro will hold a calculated amount of stock in inventory to support reactive and emergency work, planned capital project demand and to protect against variations in lead time and demand. When inventory drops below the set reorder point, new materials are procured to replenish stock. Materials used to replenish critical spares are marked as a critical spare and will remain in the warehouse until there is a failure in the field. The remaining stock will stay in the warehouse until the requested issuance date of demand. In response to periods with excess demand and low inventory stock, the time between material arrival and issuance from the warehouse may be as brief as a week, as material is turned over quickly in response to higher demand.

When material is issued out to crews for a reactive project, the material is typically in the field the same day, or next day in order to support restoration efforts. For planned capital projects, the size of the project, complexity of coordination efforts with third parties, and complexity of outage planning with customers are all factors that will influence the time it takes for installation of the equipment. On a best-efforts basis, Toronto Hydro analyzed a representative sample of projects and found that after the material is shipped and delivered from the warehouse, the materials would be in service 50-80 business days on average.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO

UNDERTAKING NO. JT1.9:

Reference(s): **1B-AMPCO-15**

To clarify amounts for the category, difference in time not spent working on a project.

RESPONSE:

The increase in time not spent working on a specific operating or capital project is due to a refinement in the estimation of these hours being reflected in 2024-2025 resulting in the inclusion of components that were previously not accounted for in the calculation of down-time such as lunch hour, safety meetings, or training.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO

UNDERTAKING NO. JT1.10:

Reference(s): 2B-SEC-31

For the assets described in 2B-SEC-31, to show the representative unit cost for each asset, to show the derivation of the 2.7 billion figure.

RESPONSE:

Please see the requested data corresponding to the interrogatory response 2B-SEC-31 in Table 1 below. The unit costs below are representative averages as some asset classes utilize more granular average unit costs to produce the total cost in this calculation. Note that these unit costs should not be compared to the more up-to-date and tailored unit costs used to estimate program costs in the 2025-2029 Distribution System Plan. Toronto Hydro has maintained the same unit costs used to develop the Assets Past Useful Life percentage since the inception of the metric. These unit costs are held constant in order to have better comparability of the asset demographics year-over-year. By controlling the unit costs for this model, Toronto Hydro is able to monitor the overall rate of aging of its asset population with less obscurity.

Table 1: Detailed Breakdown of Units and Associated Costs Contributing to Assets at End of Useful Life by 2023

Asset Class	Unit	Unit Counts	Average Unit Cost	Cost ($ Millions)
OH Conductor	*km*	1,301	$45,946	$60
OH Switches	*per unit*	2,493	$4,073	$10
OH Transformers	*per unit*	7,646	$11,761	$90

Asset Class	Unit	Unit Counts	Average Unit Cost	Cost ($ Millions)
Poles	*per unit*	36,789	$7,434	$273
UG Cables	*km*	3,062	$254,675	$780
UG Switches	*per unit*	700	$8,917	$6
UG Transformers	*per unit*	19,754	$14,464	$286
Network Assets	*per unit*	512	$87,590	$45
Switchgear	*per unit*	135	$2,860,791	$386
DC Systems	*per unit*	142	$47,073	$7
Power TX	*per unit*	137	$788,358	$108
Circuit Breakers	*per unit*	860	$72,156	$62
Civil Assets	*per unit*	11,124	$40,245	$448
Meters	*per unit*	393,024	$256	$101
Total				**$2,661**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO

UNDERTAKING NO. JT1.11:

Reference(s): 2B-AMPCO-18

Referring to 2B-AMPCO-18, to provide a start date for the probability of failure initiative.

RESPONSE:

The Probability of Failure analysis started in May 2021.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO

UNDERTAKING NO. JT1.12:

Reference(s): 2B-AMPCO-20

Referring to 2B-AMPCO-20, to confirm a start date for the Engineering Asset Investment Planning initiative.

RESPONSE:

The start date of the Engineering Asset Investment Planning ("EAIP") initiative was Q1 2021 which began with the RFP process. The implementation of the system with the selected vendor began July 2021.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO

UNDERTAKING NO. JT1.13:
Reference(s): 2B-AMPCO-42

Referring to 2B-AMPCO-42 Appendix A, Forecast Units Installed, to provide data for 2025-2029 for all programs in the DSP.

RESPONSE:
Please see Appendix A for the forecast units to be installed over the 2025-2029 period for each segment in the Distribution System Plan.

In developing this response, Toronto Hydro identified some missing and incorrect information in Appendix A to its response to interrogatory 2B-AMPCO-42 regarding 2020-2024 forecast and actual/bridge units. Toronto Hydro has revised data, provided additional clarification, or added new rows for the following programs in an updated version of that appendix, provided as Appendix B to this response (identified by "/C"):

- Generation Protection, Monitoring and Control;
- Customer Connections;
- Underground System Renewal – Horseshoe;
- Network Condition Monitoring and Control;
- System Enhancements;
- IT-OT Systems; and
- Facilities.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO

UNDERTAKING NO. JT1.14:

Reference(s): 4-AMPCO-75

To explain the difference for 2022 year-end figures for priority deficiencies.

RESPONSE:

The P1/P2/P3 deficiencies in 2022 from Table 1 in 4-AMPCO-75, which total to 11,707, only include deficiencies to be addressed by operating and maintenance expenses (i.e. O&M) in the Corrective Maintenance program (Exhibit 4, Tab 2, Schedule 4) whereas the 12,000+ reported in Table 1 in Exhibit 2B, Section D2, Page 17 includes both capital and O&M related-deficiencies addressed through the Reactive and Corrective Capital (Exhibit 2B, Section E6.7) and the Corrective Maintenance (Exhibit 4, Tab 2, Schedule 4) programs.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO DISTRIBUTED RESOURCE COALITION

UNDERTAKING NO. JT1.15:

Reference(s): **2B-DRC-07(i)**

To confirm which of the 14 barriers THESL agrees with.

RESPONSE:

The Pollution Probe report referenced in Toronto Hydro's response to interrogatory 2B_DRC-7 part (i), identified the following 14 barriers to EV charging installations in multi-unit residential buildings (Table 1 on page 12 of the report).

Type	Barriers
Grid Preparedness & Charging Infrastructure Barriers	• Electrical Capacity • Metering
Building Design & Physical Infrastructure Barriers	• Parking Supply • Design • Connectivity
Education & Awareness Barriers	• Condo Board or Strata Council Decision-Making and Building Owner Awareness
Regulatory & Policy Barriers	• Physical Barriers • Condo and Strata Legislation • Electricity-related Legislative & Regulatory • Measurement Rules
Financial Barriers	• Installation Costs • Operation & Maintenance Costs • Cost Sharing
Other Barriers	• Rental Specific Barriers

While Toronto Hydro has not adopted this report nor conducted its own research into this area, Toronto Hydro's understanding is that the barriers provided in Table 1 of the referenced report, present challenges to customers in MURB's as well as those with garage arrangements to install electric vehicle charging within their properties/buildings. From a grid perspective, as a licenced distributor of electricity within the City of Toronto, Toronto Hydro is obligated to connect customers (new and upgrades) to its grid and works closely with all customers to understand their requirements and provide a safe and reliable grid connection to meet the needs of their property/buildings.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO CONSUMERS COUNCIL OF CANADA

UNDERTAKING NO. JT1.16:

Reference(s): Exhibit 2B, Section E5.1, Page 20

To provide the calculations behind the increase in the basic connection fee to $3,059, shown at Exhibit 2B, Section E5.1, Page 20.

RESPONSE:

The basic connection allowance is based upon a typical overhead service connection of a residential customer as defined in the Distribution System Code, Section 3.1.4. This includes the cost of the transformer, labour, materials, distribution bus wire, and service wires required to service the connected customers.

The basic connection allowance is further derived by calculating the total cost of servicing twenty customers per transformer, using 30 metres of overhead service wire per customer.

Table 1: Calculation of the Proposed Basic Connection Allowance

Item	Cost	Service Portion = Cost divided by 20 customers
Electrical (Transformer)	$11,557.18	$577.86
Electrical (Wires)	$48,242.90	$2,412.15
Design	$1,377.04	$68.85
	Total	**$3,058.86**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO CONSUMERS COUNCIL OF CANADA

UNDERTAKING NO. JT1.17:

Reference(s): 2A-CCC-52

In 2A-CCC-52, in the category of Contributions and Grants, to provide actual forecast versus actuals for 2020 to 2024.

RESPONSE:

Please see the table below which provides the 2020-2023 Actuals and 2024 Bridge Contributions and Grants and the 2020-2024 Approved Forecast.

Table 1: 2020-2024 Capital Contribution and Grants ($ Millions)

	2020	2021	2022	2023	2024
2020-2023 Actuals and 2024 Bridge Capital Contributions & Grants[1]	(335.1)	(459.9)	(586.3)	(679.7)	(883.2)
2020-2024 Forecast Capital Contributions & Grants[2]	(378.0)	(448.4)	(504.6)	(556.8)	(789.8)
Variance	**42.9**	**(11.5)**	**(81.7)**	**(122.8)**	**(93.4)**

[1] 1B-SEC-01, Appendix B

[2] EB-2018-0165, Draft Rate Order Update (February 12, 2020), Schedule 2 - OEB Appendix 2-BA

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO POWER WORKERS' UNION

UNDERTAKING NO. JT1.18(2):

Reference(s): 2B-PWU-3

To advise of the dollar figure that corresponds to the 24 percent reference at line 6 of 2B-PWU-3.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that in the exchange between CCC and Toronto Hydro at Page 142, Lines 1-22 of the Technical Conference Day 1 Transcript (April 8, 2024) no undertaking was provided by Toronto Hydro for JT1.18.

The 24 percent represents $141.9 million, which is the difference between the sum of 2020-2022 Actuals and 2023-2024 Bridge versus the 2020-2024 Planned in its last rebasing application. The updated comparison, referencing 2020-2023 Actuals and updated 2024 Bridge[1] compared to 2020-2024 Planned in the last rebasing application, is a $139.0 million variance, which continues to round to 24 percent.

[1] 2A-Staff-104, Appendix A

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO POWER WORKERS' UNION

UNDERTAKING NO. JT1.19:

Reference(s): 2B-PWU-3

To respond again to 2B-PWU-32.

RESPONSE:

Reviewing the transcript, Toronto Hydro notes this undertaking is intended to refer to 2B-PWU-3 and does not accurately reflect the request made by PWU. The scope of the undertaking is to provide the costs associated with planned work deferred in Tables 1 and 2 of 2B-PWU-3 using the unit costs underpinning the 2025-2029 forecast.[1] Please see Tables 1 and 2 below. Note that these costs do not include inflation and other allocations, nor is any civil work associated with replacing electrical assets accounted for in the estimates. For details on program unit costs, please see Toronto Hydro's response to undertaking JT3.4.

Table 1: 2020-2024 Underground Asset Replacement Deferral Volumes and Associated Cost

Asset Class	Planned Work Deferred	% of Planned Work Deferred	Estimated Cost ($ Millions)
Total Cable (in circuit km)	12	6%	$2.5
Transformers	0	0%	$0
Switches	87	38%	$11.6

[1] EB-2023-0195, Technical Conference Vol. 1 (April 9, 2024) at page 149, lines 7-20

In preparing its response to this undertaking, Toronto Hydro identified an error in the number of URD submersible switches deferred and has corrected it in Table 2 below.

Table 2: 2020-2024 Underground Renewal Downtown Asset Replacement Deferral Volumes and Associated Cost

Asset Class	Planned Work Deferred	% of Planned Work Deferred	Estimated Cost ($ Millions)
PILC (in circuit km)	0	0%	0
AILC (in circuit km)	47	89%	23.5
Cable chamber rebuilds	50	67%	22.5
Cable chamber roof rebuild	87	73%	7.0
URD submersible switches	9	52	1.8
URD transformers	0	0%	0
URD vault roof	9	50%	1.8

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO POWER WORKERS' UNION

UNDERTAKING NO. JT1.20:

Reference(s): 2B-PWU-4

Re Table 1 in 2B-PWU-3, to reformulate with the unit cost as described previously, multiplied by the volumes in the table.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking is intended to refer to 2B-PWU-4.[1]

Please see Table 1 below for an updated version of Table 1 in Toronto Hydro's response to interrogatory 2B-PWU-4 with the estimated costs associated with the deferred volumes of work using the unit costs underpinning the 2025-2029 forecast in the Distribution System Plan. Note that these costs do not include inflation and other allocations, nor is any civil work or secondary assets associated with replacing primary electrical assets accounted for in the estimates. For details on program unit costs, please see Toronto Hydro's response to undertaking JT3.4.

Table 1: 2020-2024 Overhead Asset Replacement Deferral Volumes and Associated Cost

Asset Class	Planned Work Deferred	% of Planned Work Deferred	*Estimated Cost ($ Millions)
Poles	3,727	32%	$30.2
Pole Top Transformers	3,201	48%	$58.8

[1] EB-2023-0195, Technical Conference Vol. 1 (April 9, 2024) at page 152, lines 18-19.

Asset Class	Planned Work Deferred	% of Planned Work Deferred	*Estimated Cost ($ Millions)
Overhead Switches	0	0%	$0
Primary Conductor (km)	27	8%	$0.9

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO POWER WORKERS' UNION

UNDERTAKING NO. JT1.21:

Reference(s): **2B-PWU-14; 2B-PWU-15; 2B-PWU-16; 2B-PWU-17**

To provide the data in the table at Figure 9 of 2B-PWU-14.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that the undertaking also includes 2B-PWU-15, 2B-PWU-16 and 2B-PWU-17. Tables 1-4 provides the tabular data underpinning the charts included in the referenced interrogatories.

Table 1: 2B-PWU-14 – Tabular data corresponding to Age Demographics of Direct-Buried Cable XLPE in Underground Horseshoe as of 2022 and by 2029 (without investment)

Age Range	Circuit Length (km)	
	2022	2029 (without investment)
0-9	3.0	0.2
10-19	11.6	6.8
20-29	83.4	14.0
30-39	70.4	100.9
40-49	72.7	73.2
50-59	39.1	49.3
60-69	5.6	35.8
70-79	0.6	5.6
80+	0	0.6

Table 2: 2B-PWU-15 – Tabular data corresponding to Age Demographics of Direct-Buried Cable in-Duct in Underground Horseshoe as of 2022 and by 2029 (without investment)

Age Range	Circuit Length (km)	
	2022	**2029 (without investment)**
0-9	4.7	0.2
10-19	47.9	14.8
20-29	209.5	65.2
30-39	63.6	231.8
40-49	13.3	15.9
50-59	30.7	14.1
60-69	8.3	27.7
70-79	1.2	8.3
80+	0	1.2

Table 3: 2B-PWU-16 – Tabular data corresponding to Age Demographics of Cable in Concrete-Encased Ducts as of 2022 and by 2029 (without investment)

Age Range	Circuit Length (km)	
	2022	**2029 (without investment)**
0-9	1169.8	285.3
10-19	577.1	1196.4
20-29	579.2	319.6
30-39	247.1	613.7
40-49	104.8	174.0
50-59	210.5	95.4
60-69	45.3	205.0
70-79	13.1	44.2
80+	0	13.1

Table 4: 2B-PWU-17 – Tabular data corresponding to Age Distribution of All Transformers in Underground Horseshoe System as of 2022 and by 2029 (without investment)

Age Range	Number of Transformers	
	2022	2029 (without investment)
0-9	8466	1563
10-19	6730	9340
20-29	3830	4849
30-39	3310	4632
40-49	1927	2566
50-59	895	1734
60-69	106	524
70-79	12	63
80+	477	482

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO POWER WORKERS' UNION

UNDERTAKING NO. JT1.22:

Reference(s): 1B-PP-07

To advise the number of customers that would fall within the area of the 30-MW project, and the proportion that number of customers would represent of all customers in the THESL system.

RESPONSE:

143,260 customers are served by the six stations targeted for Local Demand Response over the 2025-2029 period. This represents approximately 18% of Toronto Hydro's total customer base. Please see the table below for the breakdown by station. Toronto Hydro notes that the data represents a snapshot in time (as of April 2024) and does not indicate future growth that may be triggering the need for relief in these areas in the future.

Station	Customer Count as of April 2024	Percentage of Customers
Cecil TS	12,437	1.6%
Copeland TS	3,174	0.4%
Finch TS	36,794	4.7%
Leslie TS	33,547	4.3%
Manby TS	26,842	3.4%
Strachan TS	30,466	3.9%
Total of 6 Station Areas	143,260	18.1%
Total Number of Customers	**789,793**	**100.0%**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO POLLUTION PROBE

UNDERTAKING NO. JT2.1:

Reference(s): 1B-PP-11

To provide the outputs of the model on a gross and a net basis.

RESPONSE:

For a graph of gross peak, please refer to Exhibit 2B, Section D4, Appendix A, page 11. For a graph of net peak, please see Figure 1 below. Summer and winter gross and net peaks are broken down by driver in Tables 1-12. Please note that all peaks are coincident.

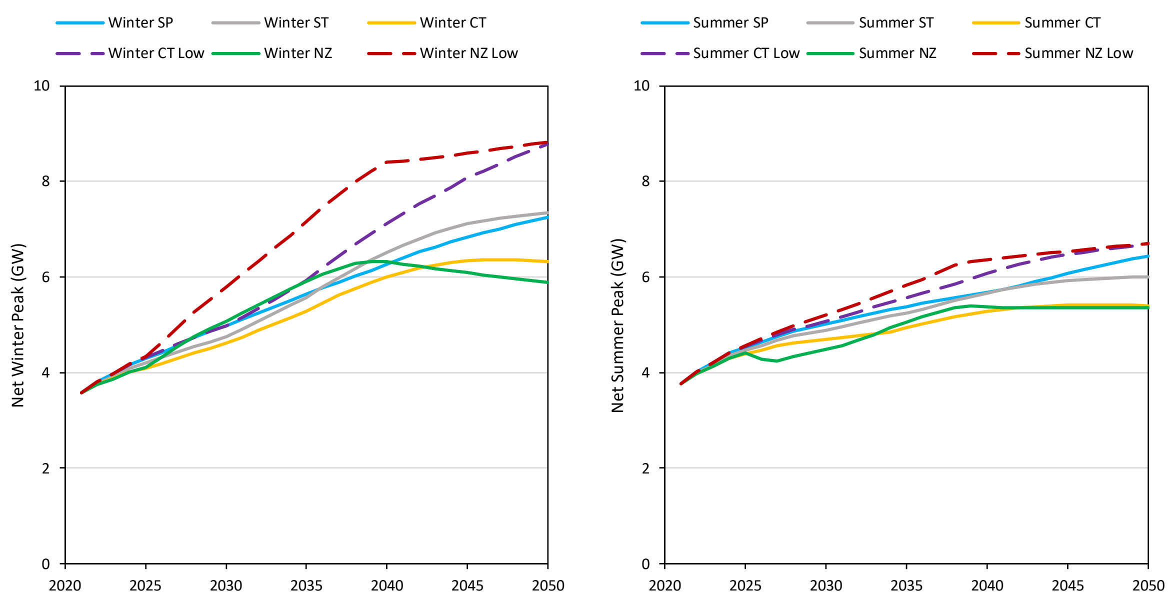


Figure 1. Net Winter (left) and Summer (right) Peak (GW)

Table 1: Steady Progression Summer Net Peak (left) and Gross Peak (right)

	Baseload (A) (MW)	De-carbonised Heating (B) (MW)	Electric Vehicles (C) (MW)	Gross Demand (at time of Net Peak) (D)=(A+B+C) (MW)	Storage (E) (MW)	Generation (F) (MW)	Net Peak (G)=(D-E-F) (MW)
2021	3,883	23	6	3,912	-	148	3,764
2022	4,139	25	7	4,170	-	159	4,010
2023	4,330	26	10	4,366	-	171	4,196
2024	4,533	27	14	4,574	(0)	172	4,402
2025	4,657	28	20	4,706	(0)	173	4,533
2026	4,755	30	32	4,817	(0)	175	4,642
2027	4,849	31	55	4,936	(0)	177	4,758
2028	4,923	35	84	5,042	(0)	180	4,862
2029	4,970	38	115	5,123	(0)	185	4,939
2030	5,014	41	146	5,201	(0)	189	5,012
2031	5,054	44	183	5,281	(0)	195	5,087
2032	5,094	47	219	5,361	(0)	200	5,161
2033	5,131	49	264	5,445	(0)	210	5,235
2034	5,172	52	301	5,526	(1)	217	5,310
2035	5,211	55	338	5,604	(1)	224	5,380
2036	5,240	60	375	5,674	(1)	232	5,443
2037	5,266	63	410	5,740	(1)	241	5,500
2038	5,293	66	449	5,809	(1)	251	5,559
2039	5,320	70	487	5,877	(1)	261	5,618
2040	5,347	74	527	5,948	(1)	272	5,678
2041	5,373	78	569	6,021	(2)	284	5,739
2042	4,871	81	980	5,933	2	121	5,810
2043	4,896	83	1,046	6,024	2	124	5,897
2044	4,859	80	1,153	6,091	2	101	5,988
2045	4,883	81	1,215	6,179	3	103	6,074
2046	4,908	82	1,275	6,264	3	105	6,157
2047	4,933	83	1,325	6,341	3	107	6,231
2048	4,960	84	1,377	6,421	3	110	6,307
2049	4,985	85	1,419	6,488	4	113	6,372
2050	5,010	86	1,454	6,550	4	116	6,430

	Baseload (A) (MW)	De-carbonised Heating (B) (MW)	Electric Vehicles (C) (MW)	Gross Peak (D)=(A+B+C) (MW)
2021	3,883	23	6	3,912
2022	4,139	25	7	4,170
2023	4,330	26	10	4,366
2024	4,533	27	14	4,574
2025	4,657	28	20	4,706
2026	4,755	30	32	4,817
2027	4,849	31	55	4,936
2028	4,923	35	84	5,042
2029	4,970	38	115	5,123
2030	5,014	41	146	5,201
2031	5,050	43	189	5,282
2032	5,090	46	227	5,363
2033	5,131	49	264	5,445
2034	5,172	52	301	5,526
2035	5,211	55	338	5,604
2036	5,240	60	375	5,674
2037	5,266	63	410	5,740
2038	5,293	66	449	5,809
2039	5,320	70	487	5,877
2040	5,347	74	527	5,948
2041	5,373	78	569	6,021
2042	5,400	82	612	6,094
2043	5,427	84	655	6,166
2044	5,455	86	696	6,237
2045	5,482	88	734	6,305
2046	5,510	91	771	6,371
2047	5,538	93	802	6,433
2048	5,567	95	835	6,497
2049	5,596	97	861	6,553
2050	5,624	99	882	6,606

1 ## Table 2: Steady Progression Winter Net Peak (left) and Gross Peak (right)

	Baseload (A) (MW)	De-carbonised Heating (B) (MW)	Electric Vehicles (C) (MW)	Gross Demand (at time of Net Peak) (D)=(A+B+C) (MW)	Storage (E) (MW)	Generation (F) (MW)	Net Peak (G)=(D-E-F) (MW)
2021	3,367	291	8	3,666	36	55	3,575
2022	3,589	313	9	3,911	50	64	3,797
2023	3,754	336	14	4,104	63	73	3,967
2024	3,928	359	19	4,306	71	73	4,161
2025	4,034	378	30	4,442	76	74	4,292
2026	4,121	402	47	4,570	82	74	4,414
2027	4,213	433	81	4,726	87	74	4,565
2028	4,282	488	121	4,890	93	74	4,723
2029	4,323	542	164	5,028	99	74	4,855
2030	4,360	592	210	5,163	106	74	4,983
2031	4,395	645	263	5,303	112	75	5,116
2032	4,430	696	315	5,441	119	75	5,247
2033	4,465	747	366	5,578	126	75	5,378
2034	4,500	798	415	5,713	132	76	5,505
2035	4,380	767	553	5,700	0	69	5,630
2036	4,404	824	611	5,839	1	69	5,770
2037	4,426	864	667	5,957	1	69	5,887
2038	4,448	903	727	6,078	1	69	6,008
2039	4,470	943	787	6,200	1	69	6,130
2040	4,492	990	850	6,332	1	69	6,262
2041	4,514	1,036	915	6,465	1	69	6,395
2042	4,537	1,075	980	6,592	1	69	6,522
2043	4,559	1,093	1,046	6,698	1	69	6,627
2044	4,582	1,111	1,108	6,800	1	69	6,730
2045	4,604	1,128	1,166	6,898	1	69	6,828
2046	4,627	1,145	1,222	6,993	2	69	6,922
2047	4,650	1,161	1,269	7,080	2	69	7,009
2048	4,674	1,176	1,316	7,167	2	69	7,096
2049	4,698	1,192	1,355	7,244	2	69	7,173
2050	4,721	1,208	1,388	7,317	2	70	7,245

	Baseload (A) (MW)	De-carbonised Heating (B) (MW)	Electric Vehicles (C) (MW)	Gross Peak (D)=(A+B+C) (MW)
2021	3,312	353	7	3,671
2022	3,536	377	7	3,920
2023	3,702	401	11	4,114
2024	3,877	426	15	4,318
2025	3,984	444	23	4,451
2026	4,071	469	37	4,577
2027	4,163	502	64	4,730
2028	4,282	488	121	4,890
2029	4,323	542	164	5,028
2030	4,360	592	210	5,163
2031	4,395	645	263	5,303
2032	4,430	696	315	5,441
2033	4,465	747	366	5,578
2034	4,500	798	415	5,713
2035	4,534	847	462	5,843
2036	4,559	912	508	5,979
2037	4,582	958	552	6,091
2038	4,605	1,004	597	6,206
2039	4,628	1,051	642	6,322
2040	4,651	1,106	688	6,446
2041	4,674	1,161	735	6,570
2042	4,698	1,208	782	6,687
2043	4,721	1,232	827	6,781
2044	4,698	1,201	974	6,874
2045	4,721	1,223	1,021	6,966
2046	4,745	1,244	1,065	7,054
2047	4,769	1,265	1,103	7,137
2048	4,794	1,284	1,140	7,218
2049	4,818	1,304	1,170	7,292
2050	4,842	1,324	1,197	7,363

1 **Table 3: System Transformation Summer Net Peak (left) and Gross Peak (right)**

	Baseload *(A)* *(MW)*	De-carbonised Heating *(B)* *(MW)*	Electric Vehicles *(C)* *(MW)*	Gross Demand (at time of Net Peak) *(D)=(A+B+C)* *(MW)*	Storage *(E)* *(MW)*	Generation *(F)* *(MW)*	Net Peak *(G)=(D-E-F)* *(MW)*
2021	3,883	23	6	3,912	-	148	3,764
2022	4,113	25	7	4,144	-	159	3,986
2023	4,286	26	11	4,323	(0)	169	4,153
2024	4,468	27	18	4,514	(0)	168	4,345
2025	4,572	28	33	4,632	(0)	168	4,465
2026	4,651	29	57	4,737	(0)	168	4,569
2027	4,725	30	86	4,842	(0)	169	4,673
2028	4,779	32	120	4,931	(0)	171	4,760
2029	4,806	33	159	4,999	(0)	175	4,824
2030	4,829	35	205	5,068	(1)	180	4,889
2031	4,848	39	260	5,147	(1)	187	4,961
2032	4,865	43	321	5,230	(1)	195	5,036
2033	4,884	47	385	5,315	(1)	204	5,112
2034	4,901	51	449	5,401	(1)	217	5,185
2035	4,913	54	519	5,486	(2)	237	5,250
2036	4,918	66	582	5,565	(2)	257	5,310
2037	4,375	67	1,028	5,470	2	59	5,408
2038	4,376	74	1,115	5,565	3	61	5,501
2039	4,375	81	1,198	5,655	3	64	5,588
2040	4,375	88	1,272	5,735	3	66	5,666
2041	4,375	94	1,343	5,812	4	69	5,740
2042	4,375	100	1,400	5,874	4	71	5,799
2043	4,375	105	1,446	5,925	5	75	5,846
2044	4,375	110	1,485	5,970	5	78	5,886
2045	4,378	114	1,516	6,008	6	82	5,920
2046	4,380	116	1,540	6,036	6	87	5,943
2047	4,383	118	1,559	6,060	7	91	5,962
2048	4,386	119	1,575	6,081	7	96	5,978
2049	4,390	121	1,589	6,100	8	100	5,992
2050	4,394	122	1,601	6,118	8	105	6,005

	Baseload *(A)* *(MW)*	De-carbonised Heating *(B)* *(MW)*	Electric Vehicles *(C)* *(MW)*	Gross Peak *(D)=(A+B+C)* *(MW)*
2021	3,883	23	6	3,912
2022	4,113	25	7	4,144
2023	4,286	26	11	4,323
2024	4,468	27	18	4,514
2025	4,572	28	33	4,632
2026	4,651	29	57	4,737
2027	4,725	30	86	4,842
2028	4,779	32	120	4,931
2029	4,806	33	159	4,999
2030	4,825	34	210	5,069
2031	4,843	38	266	5,148
2032	4,861	42	328	5,232
2033	4,880	46	393	5,318
2034	4,897	50	458	5,405
2035	4,913	54	519	5,486
2036	4,918	66	582	5,565
2037	4,914	75	647	5,637
2038	4,914	86	704	5,704
2039	4,914	96	757	5,766
2040	4,914	105	804	5,823
2041	4,914	114	850	5,878
2042	4,913	123	887	5,922
2043	4,913	131	917	5,960
2044	4,913	139	942	5,994
2045	4,915	146	963	6,024
2046	4,917	150	978	6,045
2047	4,919	155	991	6,065
2048	4,922	159	1,002	6,082
2049	4,390	121	1,589	6,100
2050	4,394	122	1,601	6,118

1 **Table 4: System Transformation Winter Net Peak (left) and Gross Peak (right)**

	Baseload (A) (MW)	De-carbonised Heating (B) (MW)	Electric Vehicles (C) (MW)	Gross Demand (at time of Net Peak) (D)=(A+B+C) (MW)	Storage (E) (MW)	Generation (F) (MW)	Net Peak (G)=(D-E-F) (MW)
2021	3,367	291	8	3,667	36	55	3,575
2022	3,567	312	9	3,888	57	63	3,768
2023	3,715	333	15	4,062	77	71	3,914
2024	3,871	353	24	4,249	95	68	4,086
2025	3,960	368	43	4,371	105	65	4,201
2026	4,030	388	72	4,490	115	63	4,313
2027	4,105	409	109	4,622	125	60	4,438
2028	4,157	430	152	4,739	136	57	4,547
2029	4,039	390	254	4,683	0	48	4,635
2030	4,057	416	326	4,799	0	45	4,754
2031	4,073	469	413	4,954	0	43	4,911
2032	4,088	521	506	5,114	1	40	5,073
2033	4,103	572	604	5,278	1	38	5,240
2034	4,117	622	701	5,441	1	36	5,404
2035	4,130	671	794	5,595	1	34	5,560
2036	4,134	799	888	5,822	1	32	5,789
2037	4,134	907	978	6,019	1	31	5,987
2038	4,135	1,010	1,061	6,206	2	29	6,175
2039	4,134	1,109	1,139	6,382	2	28	6,352
2040	4,134	1,201	1,209	6,543	2	26	6,515
2041	4,133	1,286	1,275	6,694	2	24	6,668
2042	4,133	1,366	1,329	6,827	2	22	6,802
2043	4,132	1,441	1,372	6,945	3	21	6,922
2044	4,132	1,511	1,409	7,052	3	20	7,030
2045	4,134	1,571	1,439	7,145	3	18	7,123
2046	4,136	1,602	1,462	7,199	3	18	7,178
2047	4,138	1,630	1,481	7,248	4	17	7,228
2048	4,140	1,654	1,497	7,291	4	16	7,271
2049	4,143	1,676	1,510	7,329	4	15	7,310
2050	4,146	1,698	1,522	7,366	5	13	7,348

	Baseload (A) (MW)	De-carbonised Heating (B) (MW)	Electric Vehicles (C) (MW)	Gross Peak (D)=(A+B+C) (MW)
2021	3,312	353	7	3,672
2022	3,514	375	7	3,896
2023	3,663	397	12	4,072
2024	3,822	418	20	4,260
2025	3,911	433	34	4,378
2026	3,982	454	58	4,494
2027	4,105	409	109	4,622
2028	4,157	430	152	4,739
2029	4,180	452	202	4,834
2030	4,199	477	258	4,934
2031	4,215	535	325	5,075
2032	4,230	593	395	5,218
2033	4,246	650	468	5,364
2034	4,261	706	541	5,508
2035	4,233	726	686	5,646
2036	4,278	915	680	5,874
2037	4,279	1,046	746	6,072
2038	4,279	1,172	808	6,259
2039	4,279	1,294	864	6,436
2040	4,279	1,408	914	6,601
2041	4,278	1,515	959	6,753
2042	4,278	1,616	997	6,891
2043	4,228	2,008	790	7,027
2044	4,228	2,120	809	7,157
2045	4,230	2,222	823	7,275
2046	4,231	2,279	834	7,345
2047	4,233	2,335	843	7,411
2048	4,235	2,386	849	7,470
2049	4,237	2,432	854	7,523
2050	4,241	2,477	858	7,577

1 **Table 5: Consumer Transformation Summer Net Peak (left) and Gross Peak (right)**

	Baseload (A) (MW)	De-carbonised Heating (B) (MW)	Electric Vehicles (C) (MW)	Gross Demand (at time of Net Peak) (D)=(A+B+C) (MW)	Storage (E) (MW)	Generation (F) (MW)	Net Peak (G)=(D-E-F) (MW)
2021	3,883	23	6	3,912	-	148	3,764
2022	4,104	24	7	4,135	(0)	160	3,975
2023	4,261	25	11	4,298	(0)	172	4,126
2024	4,428	26	18	4,472	(0)	177	4,296
2025	4,515	27	32	4,575	(0)	182	4,392
2026	4,580	28	56	4,664	(0)	189	4,476
2027	4,639	29	85	4,753	(1)	197	4,557
2028	4,678	30	119	4,827	(1)	207	4,621
2029	4,689	31	157	4,878	(1)	220	4,659
2030	4,696	33	203	4,932	(1)	239	4,694
2031	4,698	36	258	4,992	(2)	262	4,732
2032	4,700	40	318	5,057	(2)	290	4,770
2033	4,701	43	381	5,125	(2)	323	4,804
2034	4,569	50	489	5,108	(3)	270	4,841
2035	4,168	44	810	5,021	3	88	4,930
2036	4,154	51	906	5,111	4	90	5,016
2037	4,137	56	998	5,190	4	94	5,092
2038	4,119	61	1,083	5,263	5	98	5,160
2039	4,100	65	1,164	5,329	6	102	5,222
2040	4,082	70	1,236	5,387	6	106	5,275
2041	4,063	73	1,306	5,442	7	110	5,325
2042	4,045	76	1,361	5,481	7	114	5,360
2043	4,026	78	1,406	5,511	8	119	5,384
2044	4,009	80	1,444	5,533	9	124	5,401
2045	3,997	82	1,475	5,553	9	129	5,415
2046	3,983	81	1,498	5,562	10	135	5,418
2047	3,970	81	1,517	5,568	11	141	5,416
2048	3,958	80	1,533	5,570	11	147	5,412
2049	3,945	79	1,546	5,570	12	153	5,406
2050	3,934	78	1,558	5,571	13	158	5,399

	Baseload (A) (MW)	De-carbonised Heating (B) (MW)	Electric Vehicles (C) (MW)	Gross Peak (D)=(A+B+C) (MW)
2021	3,883	23	6	3,912
2022	4,104	24	7	4,135
2023	4,261	25	11	4,298
2024	4,428	26	18	4,472
2025	4,515	27	32	4,575
2026	4,580	28	56	4,664
2027	4,639	29	85	4,753
2028	4,678	30	119	4,827
2029	4,689	31	157	4,878
2030	4,692	32	208	4,932
2031	4,694	36	264	4,994
2032	4,695	39	326	5,060
2033	4,696	42	390	5,128
2034	4,697	45	454	5,196
2035	4,695	48	515	5,258
2036	4,680	58	578	5,316
2037	4,661	67	637	5,365
2038	4,637	74	699	5,409
2039	4,616	81	752	5,449
2040	4,596	89	799	5,483
2041	4,575	95	844	5,515
2042	4,555	101	881	5,537
2043	4,535	107	911	5,552
2044	4,515	112	936	5,563
2045	4,501	116	957	5,573
2046	4,484	118	972	5,574
2047	4,468	120	985	5,573
2048	3,958	80	1,533	5,570
2049	3,945	79	1,546	5,570
2050	3,934	78	1,558	5,571

1 **Table 6: Consumer Transformation Winter Net Peak (left) and Gross Peak (right)**

	Baseload (A) (MW)	De-carbonised Heating (B) (MW)	Electric Vehicles (C) (MW)	Gross Demand (at time of Net Peak) (D)=(A+B+C) (MW)	Storage (E) (MW)	Generation (F) (MW)	Net Peak (G)=(D-E-F) (MW)
2021	3,367	291	8	3,667	36	55	3,575
2022	3,559	310	9	3,878	61	63	3,753
2023	3,693	329	15	4,036	86	71	3,879
2024	3,835	347	24	4,206	125	72	4,010
2025	3,910	362	41	4,313	146	71	4,096
2026	3,835	324	88	4,247	0	65	4,182
2027	3,893	343	133	4,369	0	63	4,305
2028	3,929	364	185	4,478	0	62	4,416
2029	3,939	386	244	4,568	1	60	4,508
2030	3,944	412	312	4,668	1	58	4,609
2031	3,945	457	395	4,797	1	56	4,740
2032	3,946	499	485	4,930	1	53	4,876
2033	3,946	540	579	5,065	1	50	5,014
2034	3,946	579	674	5,199	2	48	5,149
2035	3,944	615	763	5,323	2	46	5,275
2036	3,931	720	855	5,505	2	44	5,459
2037	3,915	802	941	5,658	3	43	5,613
2038	3,898	878	1,021	5,798	3	41	5,754
2039	3,880	948	1,097	5,925	3	40	5,882
2040	3,863	1,011	1,165	6,039	4	38	5,998
2041	3,846	1,063	1,229	6,139	4	36	6,099
2042	3,828	1,110	1,281	6,219	4	34	6,181
2043	3,811	1,149	1,324	6,284	5	33	6,247
2044	3,795	1,182	1,359	6,336	5	31	6,300
2045	3,783	1,207	1,388	6,378	5	30	6,342
2046	3,769	1,207	1,410	6,386	6	29	6,351
2047	3,756	1,204	1,429	6,389	6	28	6,355
2048	3,744	1,197	1,444	6,384	7	27	6,350
2049	3,731	1,185	1,457	6,374	7	26	6,341
2050	3,720	1,172	1,469	6,361	7	25	6,329

	Baseload (A) (MW)	De-carbonised Heating (B) (MW)	Electric Vehicles (C) (MW)	Gross Peak (D)=(A+B+C) (MW)
2021	3,312	353	7	3,671
2022	3,506	373	7	3,886
2023	3,642	392	12	4,046
2024	3,787	411	19	4,217
2025	3,863	425	32	4,320
2026	3,921	445	54	4,420
2027	4,028	401	102	4,531
2028	4,066	421	143	4,631
2029	4,076	443	188	4,707
2030	4,081	468	239	4,788
2031	4,082	517	301	4,901
2032	4,083	565	367	5,014
2033	4,084	610	436	5,129
2034	4,083	654	503	5,241
2035	4,042	665	646	5,353
2036	4,029	784	723	5,535
2037	4,012	880	795	5,686
2038	3,995	969	861	5,825
2039	3,977	1,052	923	5,951
2040	3,959	1,128	978	6,065
2041	3,941	1,192	1,029	6,163
2042	3,924	1,250	1,071	6,245
2043	3,906	1,301	1,105	6,312
2044	3,797	1,577	1,011	6,385
2045	3,784	1,637	1,032	6,453
2046	3,769	1,661	1,048	6,478
2047	3,754	1,684	1,061	6,499
2048	3,740	1,700	1,071	6,511
2049	3,726	1,710	1,080	6,516
2050	3,712	1,718	1,088	6,518

1 **Table 7: Consumer Transformation Low Summer Net Peak (left) and Gross Peak (right)**

	Baseload (A) (MW)	De-carbonised Heating (B) (MW)	Electric Vehicles (C) (MW)	Gross Demand (at time of Net Peak) (D)=(A+B+C) (MW)	Storage (E) (MW)	Generation (F) (MW)	Net Peak (G)=(D-E-F) (MW)
2021	3,883	23	6	3,912	-	148	3,764
2022	4,139	25	7	4,170	-	159	4,011
2023	4,330	26	11	4,368	-	171	4,197
2024	4,533	27	18	4,579	(0)	172	4,407
2025	4,657	28	33	4,718	(0)	173	4,545
2026	4,755	30	57	4,842	(0)	175	4,667
2027	4,849	31	86	4,967	(0)	177	4,789
2028	4,923	33	121	5,077	(0)	180	4,897
2029	4,970	35	160	5,166	(0)	185	4,981
2030	5,014	37	207	5,257	(0)	189	5,068
2031	5,054	42	263	5,359	(0)	195	5,164
2032	5,094	46	324	5,465	(0)	200	5,265
2033	5,135	51	388	5,575	(0)	207	5,368
2034	5,172	55	461	5,688	(1)	217	5,472
2035	5,211	60	523	5,793	(1)	224	5,570
2036	5,240	73	586	5,899	(1)	232	5,668
2037	5,266	86	646	5,998	(1)	241	5,758
2038	4,714	84	1,143	5,940	1	93	5,846
2039	4,737	92	1,227	6,057	1	94	5,962
2040	4,761	100	1,303	6,165	2	95	6,068
2041	4,786	108	1,376	6,269	2	97	6,171
2042	4,810	116	1,434	6,359	2	98	6,259
2043	4,834	123	1,481	6,438	2	100	6,337
2044	4,859	130	1,521	6,510	2	101	6,407
2045	4,883	137	1,553	6,573	3	103	6,468
2046	4,908	141	1,578	6,627	3	105	6,519
2047	4,933	146	1,598	6,676	3	107	6,566
2048	4,960	150	1,614	6,724	3	110	6,611
2049	4,985	154	1,628	6,768	4	113	6,651
2050	5,010	158	1,641	6,810	4	116	6,690

	Baseload (A) (MW)	De-carbonised Heating (B) (MW)	Electric Vehicles (C) (MW)	Gross Peak (D)=(A+B+C) (MW)
2021	3,883	23	6	3,912
2022	4,139	25	7	4,170
2023	4,330	26	11	4,368
2024	4,533	27	18	4,579
2025	4,657	28	33	4,718
2026	4,755	30	57	4,842
2027	4,849	31	86	4,967
2028	4,923	33	121	5,077
2029	4,970	35	160	5,166
2030	5,014	37	207	5,257
2031	5,050	41	269	5,360
2032	5,090	45	331	5,467
2033	5,131	50	396	5,577
2034	5,172	55	461	5,688
2035	5,211	60	523	5,793
2036	5,240	73	586	5,899
2037	5,266	86	646	5,998
2038	5,289	96	708	6,093
2039	5,316	107	761	6,185
2040	5,343	119	809	6,271
2041	5,370	130	855	6,355
2042	5,397	141	892	6,430
2043	5,424	152	922	6,498
2044	5,455	165	941	6,562
2045	5,482	176	962	6,620
2046	5,510	183	978	6,670
2047	5,538	191	991	6,719
2048	5,567	198	1,001	6,766
2049	5,596	205	1,010	6,810
2050	5,624	212	1,018	6,854

1 **Table 8: Consumer Transformation Low Winter Net Peak (left) and Gross Peak (right)**

	Baseload (A) (MW)	De-carbonised Heating (B) (MW)	Electric Vehicles (C) (MW)	Gross Demand (at time of Net Peak) (D)=(A+B+C) (MW)	Storage (E) (MW)	Generation (F) (MW)	Net Peak (G)=(D-E-F) (MW)
2021	3,367	291	8	3,667	36	55	3,575
2022	3,589	314	9	3,912	50	64	3,798
2023	3,754	337	15	4,106	63	73	3,970
2024	3,928	361	25	4,313	71	73	4,168
2025	4,034	381	44	4,459	76	74	4,309
2026	4,121	407	74	4,602	82	74	4,446
2027	4,213	435	112	4,760	87	74	4,599
2028	4,282	465	158	4,905	93	74	4,738
2029	4,323	497	210	5,030	99	74	4,856
2030	4,360	534	269	5,163	106	74	4,982
2031	4,395	602	338	5,335	112	75	5,148
2032	4,280	598	523	5,401	0	69	5,331
2033	4,314	662	623	5,599	0	69	5,529
2034	4,348	726	724	5,797	0	69	5,727
2035	4,380	789	819	5,988	0	69	5,918
2036	4,404	943	916	6,263	1	69	6,193
2037	4,426	1,074	1,008	6,508	1	69	6,438
2038	4,448	1,204	1,094	6,745	1	69	6,675
2039	4,470	1,330	1,174	6,974	1	69	6,904
2040	4,492	1,454	1,246	7,192	1	69	7,122
2041	4,514	1,573	1,314	7,402	1	69	7,332
2042	4,537	1,690	1,370	7,596	1	69	7,525
2043	4,559	1,803	1,415	7,777	1	69	7,706
2044	4,653	2,627	864	8,144	162	103	7,879
2045	4,675	2,785	882	8,342	163	105	8,074
2046	4,698	2,898	897	8,493	164	108	8,221
2047	4,722	3,012	909	8,643	166	110	8,367
2048	4,747	3,123	919	8,788	167	114	8,508
2049	4,770	3,229	927	8,927	169	117	8,641
2050	4,794	3,339	935	9,067	170	121	8,776

	Baseload (A) (MW)	De-carbonised Heating (B) (MW)	Electric Vehicles (C) (MW)	Gross Peak (D)=(A+B+C) (MW)
2021	3,312	353	7	3,671
2022	3,536	377	7	3,920
2023	3,702	402	12	4,116
2024	3,877	427	20	4,324
2025	3,984	446	35	4,465
2026	4,071	473	59	4,603
2027	4,213	435	112	4,760
2028	4,282	465	158	4,905
2029	4,323	497	210	5,030
2030	4,360	534	269	5,163
2031	4,395	602	338	5,335
2032	4,430	671	411	5,512
2033	4,465	741	488	5,694
2034	4,500	811	564	5,876
2035	4,534	882	637	6,052
2036	4,559	1,064	711	6,334
2037	4,582	1,224	781	6,587
2038	4,605	1,381	846	6,832
2039	4,628	1,535	906	7,069
2040	4,651	1,687	960	7,298
2041	4,617	2,120	784	7,521
2042	4,640	2,293	815	7,748
2043	4,663	2,463	842	7,967
2044	4,686	2,627	864	8,177
2045	4,709	2,785	882	8,375
2046	4,732	2,898	897	8,526
2047	4,755	3,012	909	8,676
2048	4,780	3,123	919	8,822
2049	4,804	3,229	927	8,960
2050	4,827	3,339	935	9,101

Table 9: Net Zero 2040 Summer Net Peak (left) and Gross Peak (right)

	Baseload *(A)* *(MW)*	De-carbonised Heating *(B)* *(MW)*	Electric Vehicles *(C)* *(MW)*	Gross Demand (at time of Net Peak) *(D)=(A+B+C)* *(MW)*	Storage *(E)* *(MW)*	Generation *(F)* *(MW)*	Net Peak *(G)=(D-E-F)* *(MW)*
2021	3,883	23	6	3,912	-	148	3,764
2022	4,104	24	7	4,135	(0)	157	3,977
2023	4,261	24	13	4,298	(0)	166	4,132
2024	4,428	24	29	4,481	(0)	175	4,306
2025	4,515	24	51	4,591	(0)	186	4,405
2026	4,542	35	82	4,659	(0)	387	4,273
2027	4,123	34	193	4,351	1	107	4,243
2028	4,155	40	270	4,465	2	128	4,335
2029	4,164	45	352	4,562	3	151	4,408
2030	4,169	50	442	4,661	4	173	4,484
2031	4,170	53	546	4,770	6	197	4,567
2032	4,170	57	671	4,898	7	221	4,670
2033	3,971	45	850	4,866	8	61	4,797
2034	3,971	47	991	5,008	10	65	4,933
2035	3,969	48	1,123	5,141	11	70	5,060
2036	3,955	51	1,242	5,249	13	74	5,162
2037	3,939	53	1,367	5,358	14	79	5,265
2038	3,922	54	1,488	5,464	16	83	5,365
2039	3,903	55	1,533	5,492	17	88	5,386
2040	3,886	56	1,543	5,485	19	92	5,374
2041	3,868	53	1,555	5,476	20	96	5,360
2042	3,850	51	1,567	5,468	22	99	5,347
2043	3,275	24	1,660	4,959	(413)	23	5,349
2044	3,260	23	1,675	4,958	(416)	24	5,350
2045	3,249	22	1,688	4,959	(419)	24	5,354
2046	3,236	21	1,701	4,959	(422)	24	5,356
2047	3,223	20	1,714	4,958	(425)	25	5,358
2048	3,211	19	1,727	4,957	(427)	25	5,360
2049	3,199	18	1,739	4,956	(430)	25	5,361
2050	3,187	18	1,751	4,956	(433)	25	5,364

	Baseload *(A)* *(MW)*	De-carbonised Heating *(B)* *(MW)*	Electric Vehicles *(C)* *(MW)*	Gross Peak *(D)=(A+B+C)* *(MW)*
2021	3,883	23	6	3,912
2022	4,104	24	7	4,135
2023	4,261	24	13	4,298
2024	4,428	24	29	4,481
2025	4,515	24	51	4,591
2026	4,580	34	81	4,695
2027	4,639	43	119	4,801
2028	4,678	51	167	4,896
2029	4,689	58	219	4,966
2030	4,696	64	276	5,036
2031	4,694	68	347	5,109
2032	4,695	72	426	5,194
2033	4,696	76	517	5,290
2034	4,697	79	604	5,380
2035	4,695	82	686	5,463
2036	4,680	85	760	5,525
2037	4,656	86	844	5,586
2038	4,637	87	924	5,648
2039	4,616	88	953	5,657
2040	4,596	89	959	5,644
2041	4,575	85	965	5,625
2042	4,555	81	972	5,608
2043	4,026	65	1,505	5,596
2044	4,009	62	1,515	5,586
2045	3,997	60	1,524	5,581
2046	3,983	58	1,532	5,573
2047	3,970	55	1,541	5,566
2048	3,958	53	1,549	5,559
2049	3,945	51	1,557	5,553
2050	3,934	48	1,564	5,547

1 **Table 10: Net Zero 2040 Winter Net Peak (left) and Gross Peak (right)**

	Baseload *(A)* *(MW)*	De-carbonised Heating *(B)* *(MW)*	Electric Vehicles *(C)* *(MW)*	Gross Demand (at time of Net Peak) *(D)=(A+B+C)* *(MW)*	Storage *(E)* *(MW)*	Generation *(F)* *(MW)*	Net Peak *(G)=(D-E-F)* *(MW)*
2021	3,367	291	8	3,667	36	55	3,575
2022	3,559	302	9	3,870	61	61	3,748
2023	3,693	314	16	4,023	86	66	3,871
2024	3,835	324	34	4,194	125	58	4,011
2025	3,910	332	60	4,302	146	51	4,105
2026	3,835	398	124	4,357	0	39	4,318
2027	3,893	500	182	4,575	1	34	4,540
2028	3,929	590	254	4,773	1	29	4,743
2029	3,939	670	332	4,940	2	25	4,913
2030	3,944	739	416	5,098	3	19	5,077
2031	3,945	800	513	5,259	3	19	5,236
2032	3,946	854	630	5,430	4	20	5,406
2033	3,946	901	763	5,610	5	20	5,585
2034	3,946	941	889	5,776	6	20	5,750
2035	3,944	980	1,008	5,932	7	20	5,905
2036	3,931	1,029	1,115	6,076	8	21	6,047
2037	3,915	1,059	1,228	6,202	9	21	6,172
2038	3,898	1,083	1,339	6,320	10	21	6,289
2039	3,880	1,100	1,380	6,360	11	22	6,328
2040	3,863	1,111	1,389	6,363	12	22	6,329
2041	3,846	1,061	1,398	6,305	12	22	6,270
2042	3,772	986	1,494	6,252	13	22	6,217
2043	3,755	946	1,505	6,206	14	23	6,170
2044	3,738	909	1,515	6,162	15	23	6,124
2045	3,727	873	1,524	6,124	15	23	6,085
2046	3,713	837	1,532	6,083	16	23	6,043
2047	3,701	802	1,541	6,043	17	24	6,002
2048	3,688	766	1,549	6,002	18	24	5,961
2049	3,676	730	1,557	5,962	18	24	5,919
2050	3,664	692	1,564	5,921	19	25	5,878

	Baseload *(A)* *(MW)*	De-carbonised Heating *(B)* *(MW)*	Electric Vehicles *(C)* *(MW)*	Gross Peak *(D)=(A+B+C)* *(MW)*
2021	3,312	353	7	3,671
2022	3,506	363	7	3,876
2023	3,642	373	13	4,029
2024	3,787	383	27	4,197
2025	3,910	332	60	4,302
2026	3,921	545	75	4,541
2027	3,984	684	110	4,778
2028	4,022	807	151	4,981
2029	4,032	915	196	5,143
2030	4,038	1,007	244	5,288
2031	4,040	1,088	296	5,424
2032	4,040	1,159	360	5,559
2033	4,084	1,054	560	5,697
2034	4,083	1,099	652	5,834
2035	4,042	1,076	846	5,963
2036	4,029	1,128	935	6,092
2037	3,973	1,091	1,143	6,208
2038	3,898	1,083	1,339	6,320
2039	3,880	1,100	1,380	6,360
2040	3,863	1,111	1,389	6,363
2041	3,846	1,061	1,398	6,305
2042	3,828	1,016	1,408	6,252
2043	3,755	946	1,505	6,206
2044	3,738	909	1,515	6,162
2045	3,727	873	1,524	6,124
2046	3,713	837	1,532	6,083
2047	3,701	802	1,541	6,043
2048	3,688	766	1,549	6,002
2049	3,676	730	1,557	5,962
2050	3,664	692	1,564	5,921

Table 11: Net Zero 2040 Low Summer Net Peak (left) and Gross Peak (right)

	Baseload (A) (MW)	De-carbonised Heating (B) (MW)	Electric Vehicles (C) (MW)	Gross Demand (at time of Net Peak) (D)=(A+B+C) (MW)	Storage (E) (MW)	Generation (F) (MW)	Net Peak (G)=(D-E-F) (MW)
2021	3,883	23	6	3,912	-	148	3,764
2022	4,139	25	7	4,170	-	159	4,011
2023	4,330	26	13	4,369	-	171	4,199
2024	4,533	27	29	4,589	(0)	172	4,418
2025	4,657	28	51	4,737	(0)	173	4,564
2026	4,755	42	82	4,879	(0)	175	4,704
2027	4,849	54	121	5,024	(0)	177	4,847
2028	4,923	67	169	5,159	(0)	180	4,979
2029	4,970	79	222	5,272	(0)	185	5,088
2030	5,014	91	281	5,385	(0)	189	5,196
2031	5,054	103	347	5,504	(0)	195	5,309
2032	5,094	114	425	5,634	(0)	200	5,434
2033	5,135	126	517	5,778	(0)	207	5,571
2034	5,176	137	603	5,916	(1)	213	5,703
2035	5,211	146	695	6,051	(1)	224	5,828
2036	4,665	116	1,247	6,029	1	91	5,937
2037	4,689	125	1,374	6,187	1	92	6,094
2038	4,714	133	1,498	6,345	1	93	6,251
2039	4,737	141	1,543	6,421	1	94	6,326
2040	4,761	149	1,553	6,463	2	95	6,367
2041	4,786	149	1,564	6,498	2	97	6,400
2042	4,810	150	1,575	6,534	2	98	6,434
2043	4,834	151	1,586	6,570	2	100	6,469
2044	4,859	152	1,596	6,607	2	101	6,503
2045	4,883	153	1,606	6,642	3	103	6,536
2046	4,908	155	1,614	6,677	3	105	6,569
2047	4,933	156	1,623	6,712	3	107	6,602
2048	4,960	158	1,631	6,749	3	110	6,636
2049	4,985	160	1,639	6,784	4	113	6,668
2050	5,010	161	1,647	6,819	4	116	6,699

	Baseload (A) (MW)	De-carbonised Heating (B) (MW)	Electric Vehicles (C) (MW)	Gross Peak (D)=(A+B+C) (MW)
2021	3,883	23	6	3,912
2022	4,139	25	7	4,170
2023	4,330	26	13	4,369
2024	4,533	27	29	4,589
2025	4,657	28	51	4,737
2026	4,755	42	82	4,879
2027	4,849	54	121	5,024
2028	4,923	67	169	5,159
2029	4,970	79	222	5,272
2030	5,014	91	281	5,385
2031	5,054	103	347	5,504
2032	5,090	112	432	5,635
2033	5,131	124	524	5,779
2034	5,172	134	612	5,919
2035	5,211	146	695	6,051
2036	5,240	159	770	6,169
2037	5,266	170	849	6,286
2038	5,289	179	936	6,405
2039	5,316	190	965	6,471
2040	5,343	201	971	6,515
2041	5,370	201	977	6,548
2042	5,397	201	984	6,582
2043	5,424	202	991	6,616
2044	5,451	203	997	6,651
2045	5,479	204	1,003	6,685
2046	5,510	208	1,001	6,719
2047	5,538	210	1,007	6,754
2048	5,567	211	1,012	6,790
2049	5,596	213	1,017	6,825
2050	5,624	214	1,022	6,859

Table 12: Net Zero 2040 Low Winter Net Peak (left) and Gross Peak (right)

	Baseload (A) (MW)	De-carbonised Heating (B) (MW)	Electric Vehicles (C) (MW)	Gross Demand (at time of Net Peak) (D)=(A+B+C) (MW)	Storage (E) (MW)	Generation (F) (MW)	Net Peak (G)=(D-E-F) (MW)
2021	3,367	291	8	3,667	36	55	3,575
2022	3,589	314	9	3,912	50	64	3,798
2023	3,754	337	17	4,108	63	73	3,971
2024	3,928	360	36	4,324	71	73	4,179
2025	4,034	381	64	4,479	76	74	4,329
2026	4,071	652	81	4,804	82	97	4,626
2027	4,163	851	119	5,134	87	98	4,949
2028	4,233	1,046	165	5,443	93	98	5,252
2029	4,273	1,236	216	5,724	99	100	5,525
2030	4,310	1,415	271	5,996	106	101	5,789
2031	4,344	1,594	328	6,266	112	103	6,051
2032	4,378	1,768	399	6,546	119	104	6,322
2033	4,413	1,941	480	6,834	126	106	6,603
2034	4,448	2,110	559	7,117	132	108	6,877
2035	4,481	2,284	636	7,401	139	110	7,152
2036	4,505	2,492	705	7,702	143	112	7,448
2037	4,527	2,673	779	7,980	146	115	7,719
2038	4,550	2,854	855	8,260	150	117	7,993
2039	4,573	3,030	880	8,482	153	120	8,209
2040	4,595	3,202	885	8,682	155	123	8,404
2041	4,617	3,202	891	8,711	157	127	8,428
2042	4,640	3,209	898	8,747	159	130	8,458
2043	4,630	3,224	904	8,758	160	101	8,497
2044	4,653	3,239	910	8,802	162	103	8,538
2045	4,675	3,263	915	8,854	163	105	8,586
2046	4,698	3,282	920	8,901	164	108	8,629
2047	4,722	3,308	925	8,955	166	110	8,679
2048	4,747	3,334	930	9,010	167	114	8,729
2049	4,770	3,358	935	9,063	169	117	8,777
2050	4,794	3,378	939	9,111	170	121	8,819

	Baseload (A) (MW)	De-carbonised Heating (B) (MW)	Electric Vehicles (C) (MW)	Gross Peak (D)=(A+B+C) (MW)
2021	3,312	353	7	3,671
2022	3,536	377	7	3,920
2023	3,702	402	14	4,117
2024	3,877	426	29	4,332
2025	3,984	446	51	4,481
2026	4,071	652	81	4,804
2027	4,163	851	119	5,134
2028	4,233	1,046	165	5,443
2029	4,273	1,236	216	5,724
2030	4,310	1,415	271	5,996
2031	4,344	1,594	328	6,266
2032	4,378	1,768	399	6,546
2033	4,413	1,941	480	6,834
2034	4,448	2,110	559	7,117
2035	4,481	2,284	636	7,401
2036	4,505	2,492	705	7,702
2037	4,527	2,673	779	7,980
2038	4,550	2,854	855	8,260
2039	4,573	3,030	880	8,482
2040	4,595	3,202	885	8,682
2041	4,617	3,202	891	8,711
2042	4,640	3,209	898	8,747
2043	4,663	3,224	904	8,790
2044	4,686	3,239	910	8,835
2045	4,709	3,263	915	8,887
2046	4,732	3,282	920	8,934
2047	4,755	3,308	925	8,989
2048	4,780	3,334	930	9,044
2049	4,804	3,358	935	9,096
2050	4,827	3,378	939	9,144

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ENVIRONMENTAL DEFENCE

UNDERTAKING NO. JT2.2:

Reference(s): 1B-ED-6

To provide the number of customers who have the ability to connect a DER to the system, versus those who do not have the ability to connect.

RESPONSE:

At the time of the original submission (November 17, 2023), 5.44 percent of Toronto Hydro's customers (42,717 out of 785,027) were serviced by a restricted feeder (see Exhibit 2B, Section E3, Table 1 on pages 9-11 for the list of feeders). It is important to note that this percentage assumes customers who don't currently have DER on the feeder have the intent, means and capability to install one.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ENVIRONMENTAL DEFENCE

UNDERTAKING NO. JT2.3:
Reference(s): 1B-ED-06

To provide the result of calculation of taking the customer base today in terms of the DER population, and extrapolate that against the investments to be made according to the plan, and provide the impact of reduction and constraints on that population we have today.

RESPONSE:
Due to technical restrictions, the utility has not proposed to alleviate the restricted feeders at Leaside TS and install a bus-tie reactor. As such, in 2029, Toronto Hydro estimates that all customers connected to Leaside TS which represent 1.39 percent of the total customer base (10,892 out of 785,027) will be constrained.

This estimate is subject to the following assumptions:

- The restricted feeder list in Exhibit 2B, Section E3, Table 1 at pages 9-11 and the utility’s customer base remain constant.
- The proposed 2025-2029 renewable enabling improvement (“REI”) investments are approved and executed; and
- All technical proposals have been successfully reviewed, approved and executed by all stakeholders. It should be noted that the technical feasibility of solutions at each station are subject to a detailed technical study by multiple stakeholders.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ENVIRONMENTAL DEFENCE

UNDERTAKING NO. JT2.4:

Reference(s): **N/A**

To advise the feasibility of tracking capacity driven future premature retirements, listing the reasons for premature placements, de-recognition expenses, to the extent there are further reasons than those already cited.

RESPONSE:

Below is a list of capital work considerations that contribute to derecognition expenses:

- **Assets with capacity constraints**: System growth and customer connections can trigger the need to upgrade assets, such as overloading transformers or undersized cables.
- **Functional obsolescence of assets or system configurations:** Legacy system configurations such as Rear Lot and Box Conversion trigger asset replacements driven by functionally obsolete distribution system designs and increased safety and failure risks. Furthermore, legacy equipment may be replaced in accordance with latest standards and operating practices when replacement and maintenance supplies are unavailable, when required skill set is in short supply, evolving work practices result in excessively time-consuming or arduous work practices for legacy assets, or when introducing modernization (e.g. enhancing assets to enable automation or SCADA monitoring).
- **Reactive replacements**: Unplanned asset replacements due to events such as equipment failures or foreign interference.

- **Assets causing situational, environmental, or safety risks:** Examples include assets causing encroachment and clearance issues (e.g. new developments closer than safe limits of approach), assets not suited for their conditions (e.g. non-submersible equipment in underground locations), and assets required to be removed by legislation (e.g. PCB contaminated transformers, asbestos materials).
- **Externally Initiated Plant Relocation**: Third-party relocation requests may trigger asset replacement and/or upgrade as part of the relocation. Toronto Hydro must undertake to relocate its infrastructure in response to these requests to resolve conflicts between existing utility infrastructure and third-party capital construction projects.
- **Asset replacements to support other Toronto Hydro projects**: Examples include relocating or rebuilding civil infrastructure in order to permit the construction of new cable chambers or vaults where needed, or upsizing transformers and reconfiguring assets to permit continuity of service to customers while their existing supplies are taken out of service to support work like rebuilds and relocations.
- **Operational efficiency:** When conducting large scale work, such as area rebuilds, it may be more efficient to renew all assets in the area, instead of returning a short period of time later and disrupting the area again to renew other assets that were not targeted originally. In these cases, it is possible that some assets in a renewal project are not past useful life.

Currently there is limited data availability to identify, at an asset-by-asset basis, the driver of replacement within the current information systems. The linkages between the specific asset replaced and the project drivers are not available when the replaced asset is removed from source information systems. To track the requested information, Toronto Hydro would have to develop, administer and monitor new processes for identifying and mapping asset removals in a consistent and verifiable manner. Given the large volume of distribution system capital projects (e.g. Planned Capital programs alone can constitute approximately 290 projects per year) that the utility undertakes in a given year, and the dynamic nature of Toronto Hydro's capital work program, tracking asset removals at this level would be burdensome.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ENVIRONMENTAL DEFENCE

UNDERTAKING NO. JT2.5:

Reference(s): TBC

To advise on tracking and targeting total distribution costs per megawatt-hour delivered.

RESPONSE:

In the first stage of the energy transition that is set to unfold over the 2025-2029 rate period, Toronto Hydro does not view total distribution costs per MWh delivered as a metric conducive to assessing performance in the 2025-2029 rate period. The reasons for this view include:

- **The impact of energy conservation and demand management (CDM) activities** continue in Toronto Hydro's service territory, and it remains to be seen exactly how they will evolve to support energy transition objectives. Historically, the impact of these activities deteriorates the utility's perceived performance in a $/MWh assessment because at the same time that these CDM activities have been undertaken to generate bulk-system value (i.e., avoided generation and transmission level investments), the utility has been investing significant capital in the local distribution grid to renew its aging and deteriorating infrastructure to continue to provide safe and reliable electricity to its customers.

- **The impact of policy, technology and consumer-behaviour changes:** Changes in policy requirements, technology and consumer-behaviour often drive the need for investment in new distribution capabilities and capacity (e.g., new systems, field technology and human capital) that can impact and distort the perceived value of total distribution cost per MWh. For example, some emerging technologies (e.g., more powerful and rapid electric vehicle chargers in residential or commercial contexts) may have a more pronounced impact on the grid and investment needs due to their localized demand impact (i.e., MW), as opposed to their consumption impact (i.e., MWh). Similarly, regulatory policies and consumer needs with respect to DER enablement and integration require utilities to develop new capabilities across a broad range of utility functions.

- **The need for comprehensive assessment of utility performance in the near-and long-term:** Investments in infrastructure upgrades and modernization (including investments in human capital) may initially increase distribution costs but also lead to long-term benefits in reliability, resilience and efficiency. When assessing total distribution cost per MWh, it is important to ensure that other key outcomes such as service quality, reliability, and customer satisfaction are not compromised in the near-and long term.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ENVIRONMENTAL DEFENCE

UNDERTAKING NO. JT2.6:
Reference(s): 2B-ED-17

To describe how transformers are sized, whether that is based on individual analysis of demand or through other means.

RESPONSE:
Transformer sizing depends on a number of factors such as location, density, area landscape, geography, existing and future developments, historical customer load, and other relevant considerations.

Where the transformer is supplying a single customer, Toronto Hydro determines its size based on the customer's requested load. Where the transformer is supplying multiple customers, the utility determines its size by aggregating the requested load from the requesting customer, the aggregate historical loads recorded of existing customers on the transformer (if available), and anticipated future growth in the area.

Consider the following example to illustrate a typical scenario: Twenty customers are connected to a 100kVA pole-top transformer with a coincident peak load of 80 kVA (loaded at 80%). A residential customer connected to this transformer has increased their panel size from 100A to 200A and is requesting an upgrade to their service to accommodate an incremental load of 8 kVA. When factoring in the additional load and applying coincidence factors to adjust for load usage patterns on the transformer, the existing transformer is found to exceed the recommended 80% loading to maintain safety and reliability of operation. Therefore, to ensure sufficient capacity for this customer and facilitate future growth in the area, the transformer is upgraded to 167kVA.

Toronto Hydro’s investments in system observability technologies as part of its Intelligent Grid Strategy for 2025-2029 will enhance its decision-making in right-sizing its assets. For more details please refer to Exhibit 2B, Section D5.2.1.1.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ENVIRONMENTAL DEFENCE

UNDERTAKING NO. JT2.7:

Reference(s): **2B-ED-18**

To describe the basis for the $600 fee and its justification; the average time it takes and the actual labour costs connected to it.

RESPONSE:

As specified in Toronto Hydro's Conditions of Service, when a customer requests a disconnection and a reconnection of its supply of electricity, Toronto Hydro requires the customer to pay a fair and reasonable charge based on cost recovery principles or pay the applicable OEB-approved fees in accordance with the charges presented in the Standard Service Charges listing, as available on Toronto Hydro's website.[1]

Depending upon the type of disconnection, the OEB-approved specific service charges for disconnections during regular business hours are $120 at the meter and $300 at the pole. The type of disconnection required depends upon various customer- and site-specific factors such as access, physical configuration, the customer's needs, etc. Each charge is applied once for disconnection and once for reconnection. These specific service charges were set and approved by the OEB in Toronto Hydro's 2015 Custom Incentive Rate application, according to the utility's prevailing labour and vehicle costs.

[1] Toronto Hydro Conditions of Service (Revision #23, effective January 1, 2024), s. 2.2.1 at p. 29; available at torontohydro.com/conditions-of-service.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ENVIRONMENTAL DEFENCE

UNDERTAKING NO. JT2.8:

Reference(s): **2B-ED-18**

To confirm whether the connection is occurring on the customer property or at the pole level, and speak in more detail to whether Toronto Hydro would be open to considering an arrangement whether the customer's electrician can do that.

RESPONSE:

When a customer requests a temporary service shut-off for purposes of electrical work on their panel, the type of disconnection/reconnection required depends upon various customer- and site-specific factors such as access, physical configuration, the customer's needs, whether the work is happening at the panel or around the meter base, etc.

Toronto Hydro would not be open to an arrangement where a customer's electrician could conduct the temporary service shut-off. There are several reasons for this including, but not limited to, public and worker safety, compliance with applicable legislation, regulations, and technical standards, asset reliability, and to ensure billing accuracy.

Under Ontario Regulation 22/04,[1] which is overseen by the Electrical Safety Authority ("ESA"), Toronto Hydro carries the ultimate responsibility for public, worker, operation and equipment safety of the distribution system. Therefore, as the licensed distributor of electricity within the City of Toronto, Toronto Hydro retains control over any work on the

[1] Under the *Electricity Act, 1998*, SO 1998, c 15, Sched A.

distribution system to promote electrical safety and ensure compliance with O. Reg. 22/04 and all other applicable legislative, regulatory, and technical authorities. In the utility's assessment, the delegation of temporary service shut-offs to customer-retained electricians would create too many unpredictable variables with respect to safety and the reliability of the distribution system and the resulting risks would not be worth any potential efficiency benefits.

Toronto Hydro also notes that this position is aligned with restrictions upon the use of customer-retained electricians/contractors in distinct but similar contexts. For example, although the Distribution System Code ("DSC") contemplates the use of customer-retained qualified contractors for expansion work (known as "alternative bids"),[2] and Toronto Hydro's Conditions of Service[3] allows such arrangements for customer connections and expansion work, work that makes physical contact with Toronto Hydro's existing distribution system is not eligible for such arrangements.[4] In the same context, the DSC also assigns sole responsibility for decisions related to the temporary de-energization of any portion of the existing distribution system to the distributor.

[2] Distribution System Code ("DSC", last revised March 27, 2024), s. 3.2.14
[3] Toronto Hydro Conditions of Service ("CoS", Revision #23, effective January 1, 2024), s. 2.1.2.1 at p. 15; available at torontohydro.com/conditions-of-service.
[4] DSC s. 3.2.15A.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ENVIRONMENTAL DEFENCE

UNDERTAKING NO. JT2.9:

Reference(s): 2B-ED-26

To advise the total typical cost for all connection charges for a micro-gen connection, including baseline, replacing a meter.

RESPONSE:

As noted in interrogatory responses 2B-ED-26(a) and (c), for the connection of micro-embedded generation facilities, where a site assessment is required, Toronto Hydro charges a $500 connection deposit plus HST,[1] which is applied towards any connection costs that may arise under the offer to connect. Toronto Hydro also collects a variable connection charge[2] to recover any costs above and beyond those covered by the $500 connection deposit, including the meter replacement costs, which may vary depending upon the size and complexity of the connection project and site conditions. The variable connection charge is typically under $1,200.

[1] In accordance with section 5.3.6 of the OEB's Distributed Energy Resource Connection Procedures.
[2] In accordance with section 3.1.6 of the Distribution System Code.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ENVIRONMENTAL DEFENCE

UNDERTAKING NO. JT2.10:

Reference(s): N/A

To justify the fees the connection charge in terms of the actual costs incurred by Toronto Hydro.

RESPONSE:

Please refer to undertaking JT2.9.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ENVIRONMENTAL DEFENCE

UNDERTAKING NO. JT2.11:

Reference(s): 2B-ED-26

To provide a document where Toronto Hydro defines a basic connection with respect to micro-generate facilities and provide that except in that document; or if it isn't indicated in a public-facing document, to explain why.

RESPONSE:

Toronto Hydro's Distributed Energy Resource Application and Connection Guidelines, available on the utility's website,[1] show estimated connection application costs on page 3 for projects of varying nameplate capacity, which is $500 for micro-embedded generation facilities, i.e. those with a nameplate rated capacity of 10 kW or less.

[1] Toronto Hydro Distributed Energy Resource Application and Connection Guidelines, online: https://www.torontohydro.com/documents/d/guest/2023-distributed-energy-resource-application-and-connection-guidelines.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO COALITION OF CONCERNED MANUFACTURERS AND BUSINESSES OF CANADA

UNDERTAKING NO. JT2.12:

Reference(s): **2B-ED-43**

Referencing 2B-ED-43, to confirm if the figures include upstream losses and both transmission and distribution losses.

RESPONSE:

In reviewing transcript, Toronto Hydro notes that this undertaking does not capture the request by Coalition of Concerned Manufactures and Businesses of Canada. The scope of the undertaking is to confirm that the comparison of distribution line losses provided in Figure 1 is a direct "apples to apples" comparison, particularly in relation to Hydro Ottawa, including only distribution losses and not also distribution and transmission losses.

Toronto Hydro confirms that the comparison of distribution line losses provided in Figure 1 is a direct “apples to apples” comparison using published RRR data. Toronto Hydro further confirms that the line losses provided in Figure 1 include only distribution losses.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO COALITION OF CONCERNED MANUFACTURERS AND BUSINESSES OF CANADA

UNDERTAKING NO. JT2.13:

Reference(s): **2B-ED-43**

To advise how the value of losses are quantified, whether it includes the all-in price of electricity, or just the HOEP, or otherwise.

RESPONSE:

When evaluating transformers for procurement, Toronto Hydro calculates the present value of the proposed transformer losses and adds it to the respective proposed prices using the formula below. This approach consistent with the methodology set out in CSA Standard C802.1 – Minimum efficiency values for liquid-filled distribution transformers:

Present Value of cost of losses in dollars = XN + YL

where N = no-load losses in watts
L = total-losses in watts
X = cost of no-load losses per watt in dollars
Y = cost of full-load losses per watt in dollars

The values for N and L are provided by the manufacturer. The values for X and Y factor are derived from a number of variables including but not limited to electricity price, load factor, and useful life. HOEP + GA (Global Adjustment) is used as the electricity price.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO COALITION OF CONCERNED MANUFACTURERS AND BUSINESSES OF CANADA

UNDERTAKING NO. JT2.14:

Reference(s): Technical Conference Transcript, Day 1, Pages 43-47

To provide the figures behind the Alteryx model for each year 2023-2029.

RESPONSE:

The table below provides the output of the Alteryx model used for Defective Equipment modelling for SAIFI and SAIDI. Please note that the outputs of the model reflect the annual projected values for SAIFI and SAIDI, however a 5-year rolling average projection of these results are used within the reliability forecast presented for Outage Duration and Outage Frequency in Exhibit 1B, Tab 3, Schedule 1, at pages 10 and 17, and the updated projections shown in Figures 1 and 2 provided in response to interrogatory 2B-SEC-42 part (c).

Measure	2023F[1]	2024P	2025P	2026P	2027P	2028P	2029P
Defective Equipment – SAIFI	0.38	0.44	0.45	0.44	0.42	0.42	0.43
Defective Equipment – SAIDI	15.91	21.68	21.94	21.58	21.01	20.95	21.34

[1] Year-end forecast as of October 15, 2023

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO COALITION OF CONCERNED MANUFACTURERS AND BUSINESSES OF CANADA

UNDERTAKING NO. JT2.15:

Reference(s): **2B-CCMBC-06**

Referring to 2-CCMBC-6e, to make best efforts to inquire of Stantec whether low temperature would have been selected as a climate parameter.

RESPONSE PROVIDED BY STANTEC:

In more recent studies conducted by Stantec for other utilities, we have included a low temperature parameter to reflect potential impacts on health and safety of personnel (working in cold conditions) as well as potential for increased load demand in extreme winter conditions. In most cases, this is reflected by cold snap (multiple days below a relevant temperature threshold) or extreme cold days (a very cold temperature for the region). Based on the decreasing likelihood of cold events in the future and data from similar studies, it is not likely that the addition of the low temperature parameter would materially change the risks determined in this study as the likelihood of cold events drops off in all future climate scenarios.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO COALITION OF CONCERNED MANUFACTURERS AND BUSINESSES OF CANADA

UNDERTAKING NO. JT2.16:

Reference(s): **2B-CCMBC-8**

To confirm whether the region described in 2B-CCMBC-8 is only the Toronto Hydro service area or is southern Ontario.

RESPONSE PROVIDED BY STANTEC:

Confirmed that the region described is only the Toronto Hydro service area.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ENERGY PROBE

UNDERTAKING NO. JT2.17:

Reference(s): 1B-EP-5

To respond to 1B-EP-5(b), and describe how Toronto Hydro applies the Distribution System Code.

RESPONSE:

Toronto Hydro recovers from individual customers the costs of connecting distributed energy resource ("DER") to the distribution system, including capital contributions where applicable, in accordance with the applicable authorities such as the Distribution System Code ("DSC") and the DER Connection Procedures ("DERCP"). Since customers' DER projects vary in size and complexity, the costs incurred and recovered by the utility to enable such projects are not uniform and depend upon the particular circumstances of each connection request. Below is a non-exhaustive list of the provisions that authorize Toronto Hydro to recover DER connection costs in a range of connection scenarios:

- **Basic Connection Charge for Micro-Embedded Generation Facilities:** Recovery of the basic connection charge including the supply and installation of any new or modified metering in accordance with section 3.1.5A of the DSC;
- **Connection Deposit for Preparation of Offers to Connect with Site Assessment:** $500 connection deposit in accordance with section 5.3.6 of the DERCP;
- **Preparation Fee for Detailed Cost Estimates for Mid-Sized or Large Generation Facilities**: Fees for preparing detailed cost estimates in accordance with section 6.2.16 of the DSC and section 5.1.4 of the DERCP;

- **Capital Contribution for Constructing Expansions to Connect a Generation Facility:** The generator's share of the present value of projected capital costs and ongoing maintenance costs for new/modified distribution facilities to accommodate the connection, where projected revenue and avoided costs are assumed to be zero, in accordance with section 3.2.5 and Appendix B of the DSC.[1] Toronto Hydro also notes that the cost recovery rules in Chapter 3 of the DSC apply to all generation facilities, including storage facilities, connecting to the distribution system, in accordance with section 6.2.31 of the DSC;
- **Preparation Costs for More than 3 Preliminary Consultation Reports Per Year:** Recovery of the reasonable costs incurred in preparing a Preliminary Consultation Report beyond the initial 3 reports provided free of charge per person in a calendar year, in accordance with subsection 6.2.9.1(a) of the DSC;
- **Passthrough of Transmitter's Costs:** Recovery of costs paid to a transmitter under a Capital Cost Recovery Agreement with the transmitter, in accordance with section 6.2 of the DERCP.

[1] Subject to exceptions laid out in sections 3.2.5B and 3.2.5C of the DSC.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT2.18:

Reference(s): 1B-Staff-89

To complete the OEB's BCA calculator, named the Draft Phase 1 BCA reporting template, with the inputs included in THESL's BCA calculator

RESPONSE:

Please see JT2.18 Appendix A for the BCA calculator spreadsheet.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT2.19:

Reference(s): **Exhibit 2B, Section D4.1.1.4, Figure 1**

To provide reference to the data input sources used to forecast EV update.

RESPONSE:

The following inputs were used to forecast the volume of EVs in Toronto Hydro’s system.

Table 1: Inputs Used to Forecast EV Volume

Input	Source	Purpose
Table 20-10-0024-01 New motor vehicle registrations, quarterly	Statistics Canada	Annual total vehicle purchases and annual EV purchases for Ontario
EVs Registered in the City of Toronto	Ontario Ministry of Transportation	Annual total EV population in the City of Toronto
City of Toronto Electric Vehicle Strategy	City of Toronto	Estimate total vehicles registered in the City of Toronto in 2018
TransformTO Net Zero Strategy	City of Toronto	Inform forecasted adoption
2030 Emissions Reduction Plan	Government of Canada	Inform forecasted adoption
TTC Green Bus Program	Toronto Transit Commission	Inform forecasted HDEV adoption, and historical actuals

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT2.20:

Reference(s): **Exhibit 2B, Section D4.1.1.4, Figure 1 [Updated Jan 29, 2024]**

Please provide the references used for vehicle charging profiles, and insurance data regarding EV driving habits locally.

RESPONSE:

To understand typical light-duty electric vehicle charging, Toronto Hydro referenced charging profiles provided in:

- the *Summary Report on EVs at Scale and the U.S. Electric Power System* by the U.S. DRIVE Grid Integration Tech Team and Integrated Systems Analysis Tech Team, available here: https://www.energy.gov/eere/vehicles/articles/summary-report-evs-scale-and-us-electric-power-system-2019; and
- the *National Plug-In Electric Vehicle Infrastructure Analysis* by the National Renewable Energy Laboratory, available here: https://www.nrel.gov/docs/fy17osti/69031.pdf.

For typical medium-duty electric vehicle and heavy-duty electric vehicle charging, Toronto Hydro engaged METSCO Energy Solutions Inc., who worked with Lawrence Berkeley National Laboratory (“Berkeley Lab”). Berkeley Lab modelled charging profiles for several MDEV and HDEV fleets, and METSCO aggregated these profiles into system-level averages for each of MDEVs and HDEVs, based on fleets applicable to Toronto’s environment.

For light-duty electric vehicles, the referenced charging profiles were modelled for US cities or states. Toronto Hydro adjusted these by scaling the hourly charging profiles such that the energy consumed by the profile equals the estimated average daily energy consumed by a light-duty EV in Toronto. The estimated average daily energy was produced by considering the average distance driven by Ontario drivers in 2019 (2020 excluded due to COVID considerations), available here: https://www.insurancehotline.com/resources/did-ontario-motorists-drive-fewer-kilometres2020#:~:text=According%20to%20InsuranceHotline.com's%20data,14%2C725%20kilometres%20driven%20in%202019.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT2.21:

Reference(s): 2B-ED-7

To review and provide any customer end use surveys or any analysis of data or trends related to energy efficiency retrofit projects or publicly available energy consumption data that have been used to inform its understanding of consumer behaviour with respect to building electrification, on a best-efforts basis.

RESPONSE:

Toronto Hydro did not consider end-use surveys or specific energy efficiency retrofit models related to building electrification in the preparation of its plans. However, the utility considered the potential impacts of building electrification in preparing a system peak demand scenario as part of the IESO's Integrated Regional Resource Plan ("IRRP") process. To inform its input to the 25-year IRRP Forecast, Toronto Hydro considered four space and water heating electrification scenarios. The rate of adoption in each scenario was developed using the City of Toronto's TransformTO Net Zero Strategy targets. The assumptions used in each scenario are provided in Table 1, and the adoption rates estimated from these assumptions in Table 2. The adoption rates are provided relative to the total building stock in a given year (please note that building stock is forecasted to grow).

Table 1: Pacing assumptions for building electrification

Scenario	Pacing Assumptions
High	Achieve TransformTO Net Zero Strategy targets for buildings by 2040

Scenario	Pacing Assumptions
Medium	Achieve TransformTO Net Zero Strategy targets for buildings by 2050
Low	Achieve TransformTO Net Zero Strategy targets for buildings by 2060
Business as Usual	Model building retrofits based on Business as Planned targets for buildings in TransformTO Net Zero Strategy Technical Report

Table 2: Building electrification adoption rates, in percentage of total building stock

Year	Residential (Dwellings)				Commercial & Industrial (GFA)			
	High	Med	Low	BAU[1]	High	Med	Low	BAU[1]
2023	31%	29%	28%	27%	3%	2%	1%	2%
2029	60%	49%	44%	35%	22%	13%	10%	12%
2034	79%	63%	55%	40%	55%	23%	17%	20%
2039	97%	76%	65%	44%	92%	45%	24%	28%
2044	100%	87%	74%	48%	100%	70%	40%	35%

Toronto Hydro referenced the Transform TO Net Zero Strategy Technical Report[2] in developing its assumptions with regards to how consumer behaviour scenarios could affect building electrification.

[1] Business as Usual
[2] https://www.toronto.ca/legdocs/mmis/2021/ie/bgrd/backgroundfile-173759.pdf

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT2.22:

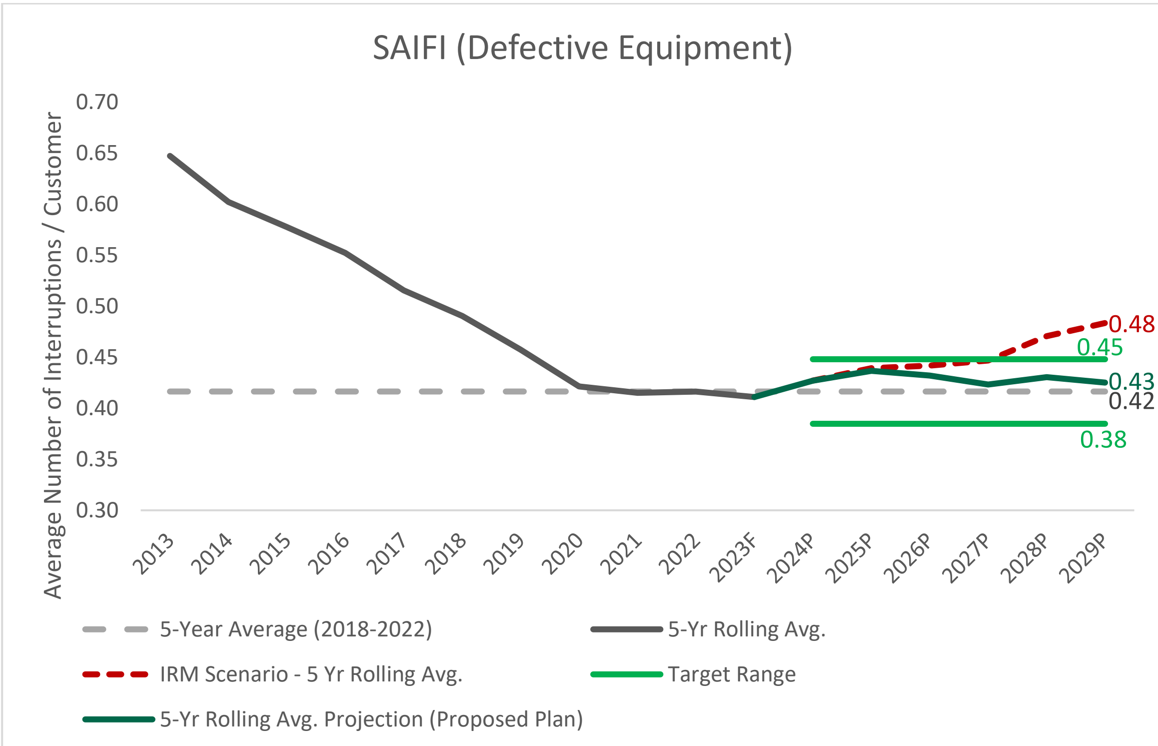
Reference(s): 1B-Staff-91

To update the graph in 1B-Staff-91 to include the five-year rolling average back to 2013.

RESPONSE:

In reviewing transcript, Toronto Hydro notes that this undertaking does not capture the request made by OEB Staff. The scope of the undertaking is to provide Figure 2 from 1B-Staff-91 using a 5-year average over the 2013-2023 period.

The utility also notes that the data underpinning the original Figure which was provided in Exhibit 1B, Tab 3, Schedule 1, at page 17 was corrected in Figure 2 in the response to 2B-SEC-42 part (c). The chart provided below aligns with the updated data. Appendix A to this response provides the supporting tabular data.


SAIFI (Defective Equipment)
Average Number of Interruptions / Customer
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023F
2024P
2025P
2026P
2027P
2028P
2029P
0.48
0.45
0.43
0.42
0.38
5-Year Average (2018-2022)
5-Yr Rolling Avg.
IRM Scenario - 5 Yr Rolling Avg.
Target Range
5-Yr Rolling Avg. Projection (Proposed Plan)

SAIFI (Defective Equipment)

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023F	2024P	2025P	2026P	2027P	2028P	2029P
5-Yr Rolling Avg.	0.65	0.60	0.58	0.55	0.52	0.49	0.46	0.42	0.42	0.42	0.41						
5-Yr Rolling Avg. Projection (Proposed Plan)												0.43	0.44	0.43	0.42	0.43	0.43
Target (Lower Bound)												0.38	0.38	0.38	0.38	0.38	0.38
Target (Upper Bound)												0.45	0.45	0.45	0.45	0.45	0.45
IRM Scenario - 5 Yr Rolling Avg.												0.43	0.44	0.44	0.45	0.47	0.48

5-Year Average (2018-2022)	**0.42**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT2.23:

Reference(s): 2A-Staff-108

To confirm the actual numbers of MCS and antenna installation programs and MCS buyback programs that are included this the RGCRP funding requested for clearance from 2020 through 2022.

RESPONSE:

Over the 2020-2022 period, 40 Monitoring and Control Systems (SCADA enclosure with Meter and RTU) were issued by Toronto Hydro and 110 antennas were installed. Please see the Table 1 below for the annual breakdown.

Table 1: MCS Issued and Antennas Installed in 2020-2022 Period

	2020	2021	2022	Total
Monitoring and Control Systems	16	11	13	**40**
Antenna Installations	19	91	0	**110**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT2.24:

Reference(s): 2A-Staff-109

To provide a breakdown of the calculation of the 27.5-year depreciation period shown in 2A-Staff-109, Appendix B; to redo the calculation using the updated depreciation rates from the Concentric study proposed in this application.

RESPONSE:

The 27.5 useful life is based on the average[1] of the assets identified in Table 1. Toronto Hydro notes that the asset classes used for the calculation are based on the potential distribution assets originally included in the 2-FB templates in the 2020-2024[2] and the 2015-2019[3] models as noted in the response to 2A-Staff-109, Appendix B for the purposes of simplifying the approach to calculating DVA balances. This excludes Energy Monitoring and Control software which are IT related assets.

Table 1: Useful Life used in 2A-Staff-104- Appendix A

Asset Class Description	Useful Life in 2-FB	Updated Useful Life	
SCADA Assets	15	20	**A**
Bus Tie Reactor[4]	40	40	**B**
Simple Average	**27.5**	**30**	**(A+B)/2**

[1] Technical Conference Transcript Day 2 (April 9, 2024) page 157, lines 18-19
[2] EB-2018-0165, Exhibit 2A, Tab 6, Schedule 5
[3] EB-2014-0116, Exhibit 2A, Tab 8. Schedule 1
[4] Bus Tie reactor assets did not exist in Toronto Hydro's asset base at the time of the Concentric Depreciation Useful life study

Appendix A to this response provides an updated schedule to reflect the change in the useful life as of 2023.

Toronto Hydro notes that the actual depreciation expense for the assets, such as the amounts reflected in Appendix 2-BA, follows the specific useful life of the assets put in-service each year, such as SCADA assets, IT software assets, etc.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT2.25:

Reference(s): 2B-Staff-135

To break out the costs for decommissioning of MSs in the forecast period where they are included in the DSP (ref: 2B-Staff-135).

RESPONSE:

Please see Table 1 below for the breakdown of the costs estimated to decommission the Municipal Stations from 2025-2029. Toronto Hydro notes that depending on the nature of the station egress, or the drivers of the conversion projects, costs to convert these assets may be incurred in the Overhead System Renewal (Exhibit 2B, Section E6.5), Underground System Renewal – Horseshoe (2B, E6.2), Underground System Renewal – Downtown (2B, E6.3) and Area Conversions (2B, E6.1) programs.

Table 1: Estimated Costs to Decommission Municipal Stations (2025-2029)

	2025	2026	2027	2028	2029
Planned Units	3	5	1	2	6
Planned Cost 2025-2029	$365K	$850K	$115K	$420K	$680K

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT2.26:

Reference(s): 2B-Staff-188

To describe any agreement between Toronto Hydro and Metrolinx regarding the apportionment of relocation costs under the Building Transit Faster Act, part IV, Section 51 (ref: 2B-Staff-188).

RESPONSE:

Please refer to Exhibit 2B, Section E5.2, at page 6, lines 16-17 and Toronto Hydro's subsequent testimony from Day 3 of the Technical Conference.[1]

[1] Technical Conference Day 3 Transcript (April 10, 2024), at p. 126, lines 2-8.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT2.27:

Reference(s): 2B-Staff-162(c)

To provide an approximate value for how much of the Horseshoe system has overhead feeders, versus underground.

RESPONSE:

As of the end of Q1 2024, 45% of the Horseshoe system is underground with the remaining 55% being overhead. These estimates are based on the length of linear assets (i.e. cables and wires) within the horseshoe system.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT3.1:

Reference(s): **N/A**

To provide any third-party reports assessing the effectiveness of distribution capital and maintenance planning and execution processes that Toronto Hydro relies upon, in whole or in part, to plan and deliver its plan.

RESPONSE:

Please see Table 1 below for a list of third-party reports produced to inform effectiveness of processes related to the planning or delivery of Toronto Hydro's distribution capital and maintenance programs.

Please note, Toronto Hydro has already produced a number of third-party benchmarking studies in its response to interrogatory 1B-SEC-5. In addition, within Toronto Hydro's response to interrogatory 2B-AMPCO-33, it provided descriptions of asset studies which may inform its planning processes. Relevant studies are produced as appendices to this response, or to another undertaking as indicated in Table 1.

Table 1: Third-Party Reports Related to Planning or Delivery of Distribution Capital and Maintenance

Third Party Study	Description	Location
Preventative Maintenance Optimization Overhead Switches	Conducted by METSCO Energy Solutions Inc. in 2022 to review Toronto Hydro's existing preventative maintenance practices for overhead three-phase gang-operated and SCADA-mate switches to identify opportunities for improvement.	Appendix A
ISO55001 Gap Assessments	Studies conducted by AMCL in 2020 and 2023 to review Toronto Hydro's Asset Management System to assess against maturity towards ISO55001 certification.	Latest 2023 report was filed as Appendix A to 2B-SEC-34. The 2020 Gap Assessment is produced as Appendix B.
Third Party Auditor Reports Supporting Toronto Hydro's Project Management	Example of a daily activity report (also known as a daily site log) by NBM Engineering, where auditor visits the project execution site and captures and documents observations.	Appendix C
	Example of a final audit report (also known as Green Construction Folder, "GCF" finalization report) by NBM Engineering. Auditor performs final checks upon project completion, which includes various aspects such as project summary, auditor site observations, deficiencies, billing validation, as-constructed verification, etc.	Appendix D
	Another example of a final audit report by WSP.	Appendix E
	Another example of a final audit report by AtkinsRealis	Appendix F
PMO Best Practices Assessment	Study conducted by Comtech in 2022 to inform best practices for processes pertaining to program and project management.	Appendix B to Toronto Hydro's response to undertaking JT4.12
Project Variance Analysis ("PVA") Process Review	Study conducted by Validation Estimating LLC in 2022 to review Toronto Hydro's Project Variance Analysis (PVA) process to identify recommendations for practice improvement.	Appendix C to Toronto Hydro's response to undertaking JT4.12.

Toronto Hydro-Electric System Limited
EB-2023-0195
JT3.1
Appendix A
REDACTED
FILED: April 22, 2024
(38 Pages)

METSCO
MAKING IT POSSIBLE

PREVENTATIVE MAINTENANCE OPTIMIZATION
OVERHEAD SWITCHES

Prepared by

METSCO Report no. 21-181-001-R1

June 2022

Disclaimer

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Table of Contents

1 Qualitative Analysis

1.1 Introduction

Toronto Hydro-Electric System Limited ("THESL") engaged METSCO Energy Solutions Inc. ("METSCO") to review of THESL's existing preventative maintenance practices for overhead three-phase gang-operated and SCADA-mate switches to identify opportunities for improvement. One component of this initiative is the completion of a qualitative review that aims to compare THESL's existing practices against the practices used by select peer group utilities, manufacturers' recommendations, and the ANSI/NETA *Maintenance Testing Specifications* ("MTS") 2019 standard. The objectives of these benchmarking exercises and the qualitative review are listed below:

1. Determine if relevant peer group utilities complete time-based condition-based maintenance (or some other approach).
    - If time-based maintenance is completed, the analysis aims to determine the cycle lengths used by peer group utilities.
    - If condition-based maintenance was completed, the analysis aimed to determine the specific condition required to trigger maintenance.
2. Compare the activities completed as part of THESL's switch inspection and maintenance practice to those completed by its peer group utilities.
3. Compare the activities completed as part of THESL's switch inspection and maintenance practice to those recommended by manufacturers.
4. Compare the activities completed as part of THESL's switch inspection and maintenance practice to those recommended by the ANSI/NETA MTS 2019 standard.
5. Based on the above steps, provide recommendations on additional activities that THESL should complete, if applicable.

1.2 Current-State Practices

The benchmarking exercise requires the establishment of THESL's current-state practices. These current-state practices are documented in THESL's maintenance manuals, which METSCO has summarized below for the two switch sub-classes.

1.2.1 Overhead Three-Phase Gang-Operated Switches

THESL currently has approximately 950 overhead three-phase gang-operated switches in its system. The expected typical useful life of these devices is 50 years. These units are subject to the maintenance and inspection procedures provided in Table 1-1 below on a four-year cycle. In addition, THESEL completes IR scans of overhead line components on an annual basis and performs a line patrol (i.e., including visual inspection) every three years. THESL is currently experiencing a backlog of units that require maintenance.

Table 1-1: Summary of THESL's Overhead Three Phase Gang-Operated Switch Maintenance Practices

No.	Activity
1	Inspect physical and mechanical condition
2	Clean the unit
3	Verify correct blade alignment, blade penetration, travel stops, arc interrupter operation, and mechanical operation - make minor repair or parts replacement to ensure switch is in good working order
4	Redress the switch contacts by first cleaning off any old grease. Next, remove the oxidization layer with a light grit sandpaper and wipe clean. Next, apply a light coating of Shell Darina lubricant to the contact surfaces
5	Do not apply any grease or lubricant on the interrupter part of the switch
6	Verify correct operation
7	Inspect Pigtail connectors for corrosion and/or damage and report it under connection deficiency question in the inspection form. Mention the color of the phase that has the issue under comments section when the deficiency is flagged in the inspection form.
8	Exercise caution if corrosion is noticed around the pigtail connectors, just conduct a visual inspection if it is a “normally open” switch and do not operate the switch until the connectors are fixed.
9	If any follow-up repair is required, please indicate the deficiency on inspection form corresponding to the item that needs attention and provide description of the issue in comments section. If an emergency condition (equipment / public / crew safety hazard) exists, please inform your supervisor immediately and follow the instructions
10	Report any non-standard installation in the “Other/Unusual conditions” field on the inspection form

1.2.2 SCADA-Mate Switches

THESL currently has approximately 900 SCADA-Mate in its system with an expected typical useful life of 45 years. These units are subject to the maintenance and inspection procedures provided in Table 1-2 below on a four-year cycle. In addition, THESEL completes IR scans of overhead line components on an annual basis and performs a line patrol (i.e., including visual inspection) every three years. THESL is currently experiencing a backlog of units that require maintenance.

Table 1-2: Summary of THESL's SCADA Mate Switch Maintenance Practices

No.	Activity
1	Perform open and close operation from Control Room
2	Report any warning signal or malfunction of switch, RTU, Battery, etc. for follow-up repair
3	Perform local open/close operation of both SF6 interrupter and manual disconnect switch
4	Lubricate manual switch contacts and hinges. Do not apply grease or any lubricant on the Interrupter part
5	Inspect for signs of corrosion on the handle and switch base
6	Inspect insulators for tracking and cracks
7	Inspect interphase operating link for damage/joints worn out
8	Inspect for loose/damaged connections
9	Inspect Pigtail connectors for corrosion and/or damage and report it under connection deficiency question in the inspection form. Mention the color of the phase that has the issue under comments section when the deficiency is flagged in the inspection form.
10	Exercise caution if corrosion is noticed around the pigtail connectors, just conduct a visual inspection if it is a "normally open" switch and do not operate the switch until the connectors are fixed.
11	Inspect for ground deficiencies
12	Inspect for surge arrester deficiencies
13	Record counter reading
14	If any follow-up repair is required, please indicate the deficiency on inspection form corresponding to the item that needs attention and provide description of the issue in comments section. If an emergency condition (equipment / public / crew safety hazard) exists, please inform your supervisor immediately and follow the instructions
15	Report any non-standard installation in the "Other/Unusual conditions" field on the inspection form

1.3 Peer Group Utilities Benchmarking

1.3.1 Peer Group Utilities Selection

A list of peer group utilities was established to benchmark THESL's current-state practices against comparable utilities. The selection of peer group utilities was completed through an analysis of key variables found in the publicly available *OEB 2020 Yearbook of Electricity Distributors*. The criteria listed below were used to select the peer group utilities.

- Total customers;
- Proportion of rural/urban service area;
- Total km of line;
- Average peak load; and
- Customer density.

If a utility was determined to be comparable to THESL in terms of multiple criteria, it was selected as a peer group utility. The final list of peer group utilities is provided below:

- Alectra Utilities;
- Elexicon Energy;
- Burlington Hydro;
- Hydro Ottawa;
- London Hydro; and
- Oakville Hydro.

1.3.2 Utility-Specific Analysis

As outlined in Section 1.1, the objectives of the peer group utilities benchmarking component of the qualitative review are as follows:

1. Determine if relevant peer group utilities complete time-based maintenance or condition-based maintenance.
    - If time-based maintenance is completed, the analysis aims to determine the cycle lengths used by peer group utilities.
    - If condition-based maintenance was completed, the analysis aimed to determine the specific condition required to trigger maintenance.
2. Compare the activities completed as part of THESL's switch inspection and maintenance practice to those completed by its peer group utilities and provide recommendations on additional activities that THESL should complete, if applicable.

The information used to complete this exercise was compiled from publicly available documentation for each of the peer group utilities, namely from their latest available Distribution System Plans and supporting documentation filed with the OEB. The following subsections compare THESL's maintenance program to the peer group utilities' programs with the intention of addressing the objectives listed above.

1.3.2.1 Alectra Utilities Benchmarking

The activities completed as part of Alectra Utilities' switch maintenance program are summarized in Table 1-3 below. Alectra completes routine activities such as visual inspections and infrared ("IR") scanning on a three-year cycle and Load-Interrupting Switch ("LIS") maintenance on a six-year cycle. In comparison, THESL completes visual inspections during line patrols on a three-year cycle, IR scanning on an annual basis, and all other maintenance activities on a four-year cycle. Based on the available information, THESL's inspection practices appear to be more comprehensive than Alectra's. THESL's maintenance manuals contain more detail than Alectra's latest DSP and specify additional activities beyond visual and mechanical inspections. However, there is one activity that Alectra performs that THESL does not: electrical testing.

Table 1-3: Summary of Alectra Utilities Switch Maintenance Practices

Activity	Cycle	Description
Visual Inspection	3 years	• Visual inspection only
IR Scanning	3 years	• IR scanning only
LIS Maintenance	6 years	• Detailed inspection including electrical testing and mechanical adjustments in accordance with manufacturer specifications • Observations are recorded in standardized checklist

Key Takeaways

- Alectra does not complete condition-based maintenance.
- Alectra completes visual inspections at the same frequency as THESL (i.e., three-year cycle), IR scanning less frequently than THESL (i.e., three-year cycle vs. THESL's annual program), and additional maintenance activities are less frequently than THESL (i.e., six-year cycle vs. THESL's four-year cycle).
- THESL's maintenance program is generally more comprehensive than Alectra's, but Alectra does complete one activity that THESL does not: electrical testing.

1.3.2.2 Elexicon Energy Benchmarking

The activities completed as part of Elexicon Energy's switch maintenance program are summarized in Table 1-4 below. Elexicon completes all maintenance activities on a three-year cycle – in comparison, Toronto Hydro's maintenance activity cycles range from one to four years. Based on the available information, THESL's inspection practices appear to be more comprehensive than Elexicon's. THESL's maintenance manuals contain more detail than Elexicon's latest DSP and specify additional activities beyond visual inspections, mechanical inspections, and reactive repairs.

Table 1-4: Summary of Elexicon Energy Switch Maintenance Practices

Activity	Cycle	Description
Visual Inspection	3 years	• Visual inspection only
IR Scanning	3 years	• IR scanning only
Mechanical Check	3 years	• Mechanical check only
In Field Repairs	N/A	• In Field Repairs as required

Key Takeaways

- Elexicon does not complete condition-based maintenance.

- Elexicon completes visual inspections at the same frequency as THESL (i.e., three-year cycle), IR scanning less frequently than THESL (i.e., three-year cycle vs. THESL's annual program), and all other maintenance activities more frequently than THESL (i.e., three-year cycle vs. THESL's four-year cycle).THESL's maintenance program is generally more comprehensive than Elexicon's in terms of the scope of maintenance activities.

1.3.2.3 Burlington Hydro Benchmarking

The activities completed as part of Burlington Hydro's switch maintenance program are summarized in Table 1-5 below. Burlington Hydro generally completes all maintenance activities more frequently than THESL as comparable activities are completed on the same cycle as THESL or on a shorter cycle (i.e., all activities are performed on a one or three-year cycle).. Based on the available information, THESL's inspection practices appear to be more comprehensive than Burlington Hydro's as they include additional activities beyond visual inspections and operational/mechanical checks.

Table 1-5: Summary of Burlington Hydro Switch Maintenance Activities

Activity	Cycle	Description
Visual Inspection	1 year	• Visual inspection only
IR Scanning	1 year	• IR Scanning only
LIS Maintenance	3 years	• Switches are isolated and crews open/close switches to make repairs • Includes operational checks and the addition of lubricant if necessary

<u>Key Takeaways</u>

- Burlington Hydro does not complete condition-based maintenance.
- Burlington Hydro completes visual inspections more frequently than THESL (i.e., annual vs. THESL's three-year line patrol cycle), IR scanning at the same frequency as THESL (i.e., annually) and all other maintenance activities more frequently than THESL (i.e., three-year cycle vs. THESL's four-year cycle).
- THESL's maintenance program is generally more comprehensive than Burlington Hydro's in terms of the scope of maintenance activities

1.3.2.4 Hydro Ottawa Benchmarking

The activities completed as part of Hydro Ottawa's switch maintenance program are summarized in Table 1-6 below. Hydro Ottawa completes visual inspections at the same frequency as THESL and IR scanning less frequently than THESL (three-year cycle vs. THESL's annual program). However, its switch-specific maintenance is only completed on critical switches (i.e., switches with a high reliability consequence) and is completed less frequently (eight-year cycle) than comparable activities in THESL's maintenance program. Overall, THESL's switch maintenance program is more comprehensive than Hydro Ottawa's as its maintenance manuals include activities beyond visual inspections and preventative switch maintenance on critical switches only.

Table 1-6: Summary of Hydro Ottawa Switch Maintenance Practices

Activity	Cycle	Description
Visual Inspection	3 years	• Visual inspection only
IR Scanning	3 years	• IR Scanning only
Critical Switch Maintenance	8 years	• Targets gang operated switches with a higher reliability consequence • Includes visual inspection and additional preventative maintenance

Key Takeaways

- Hydro Ottawa does not complete condition-based maintenance but considers criticality during maintenance planning.
- Hydro Ottawa performs visual inspections at the same frequency as THESL (i.e., three-year cycle) but performs IR scanning less frequently than THESL (i.e., three-year cycle vs. Toronto Hydro's annual program).
- Hydro Ottawa performs switch-specific maintenance less frequently than THESL (eight-year cycle vs. THESL's four-year cycle).
- Hydro Ottawa's switch-specific maintenance activities target critical switches only, as defined by their reliability consequence.
- THESL's maintenance program is generally more comprehensive than Hydro Ottawa's in terms of the scope of maintenance activities.

1.3.2.5 London Hydro Benchmarking

The activities completed as part of London Hydro's switch maintenance program are summarized in Table 1-7 below. London Hydro performs routine maintenance activities on the same cycle as Toronto Hydro – specifically, it completes visual inspections on a three-year cycle and IR scanning annually. However, its switch-specific maintenance is performed less frequently than THESL's as it is completed on a five-year cycle. In addition, this targeted switch maintenance only addresses gang-operated switches whereas THESL completes targeted activities on both gang-operated and SCADA-mate switches. THESL's switch maintenance program is more thorough than London Hydro's as it specifies detailed activities beyond the scope of London Hydro's program in addition to addressing both gang-operated and SCADA mate switches.

Table 1-7: Summary of London Hydro Switch Maintenance Activities

Activity	Cycle	Description
Visual Inspection	3 years	• Visual inspection only
IR Scanning	1 year	• IR Scanning only
Gang-Operated Switch Maintenance	5 years	• Assessed based on operability, frequency of use, and hot spots

Key Takeaways

- London Hydro does not complete condition-based maintenance.
- London Hydro completes visual inspections and IR scanning on the same cycle as THESL (i.e., three years and one year, respectively).
- London Hydro performs switch-specific maintenance less frequently than THESL (five-year cycle vs. THESL's four-year cycle).
- London Hydro's switch-specific maintenance activities target gang-operated switches only.
- THESL's maintenance program is generally more comprehensive than London Hydro's in terms of the scope of maintenance activities.

1.3.2.6 Oakville Hydro Benchmarking

The activities completed as part of Oakville Hydro's switch maintenance program are summarized in Table 1-8 below. Oakville Hydro maintenance program consists of visual inspections and IR scanning on a three-year cycle, meaning that it performs visual inspections at the same frequency as THESL but performs IR scanning less frequently than THESL. However, it is important to note that THESL's switch maintenance program is significantly more comprehensive than Oakville Hydro's as it includes switch-specific maintenance activities. Oakville Hydro is the only peer group utility that does not perform any switch specific maintenance.

Table 1-8: Summary of Oakville Hydro Switch Maintenance Activities

Activity	Cycle	Description
Visual Inspection	3 years	• Visual inspection only
IR Scanning	3 years	• IR Scanning only

Key Takeaways

- Oakville Hydro does not complete condition-based maintenance.
- Oakville Hydro performs visual inspections at the same frequency as Toronto Hydro (i.e., three-year cycle) and IR scanning less frequently than Toronto Hydro (i.e., three-year cycle vs. annual program).
- THESL's maintenance program is significantly more complete than Oakville Hydro's as the latter does not perform any switch-specific maintenance.

1.3.2.7 Key Conclusions

Through an analysis of available documentation published by the peer group utilities, it was determined that no peer group utilities complete condition-based maintenance. All peer group utilities complete time-based maintenance and apply varying cycle lengths to their maintenance programs. The peer group utilities and Toronto Hydro complete routine activities – specifically visual inspection and IR scanning – and switch-specific maintenance activities on different cycles. The cycle lengths for routine maintenance activities range from one to three years for both Toronto Hydro and its peer group utilities. The cycle lengths for switch-specific maintenance activities completed by peer group utilities range from three to eight years, meaning that most peer group utilities complete these activities less frequently than THESL.

It was also discovered that THESL generally has a more comprehensive maintenance program than all its peer group utilities. In comparing the switch maintenance program descriptions provided in the peer group utilities' Distribution System Plans and THESL's switch maintenance manuals, it is evident that THESL completes all maintenance activities that its peer group utilities complete. In addition, THESL completes several activities that are not included in the peer group utilities switch maintenance program descriptions. The only exception is electrical testing, which is only completed by Alectra. In addition, Hydro Ottawa and London Hydro's strategies vary from other peer group utilities as they only complete targeted maintenance on critical switches (as defined by reliability consequence) and gang-operated switches, respectively.

Overall, THESL's switch maintenance program has been determined to be more effective than its peer group utilities based on this qualitative review. This claim is supported by the fact that THESL completes switch-specific maintenance more frequently than most peer group utilities and that the activities included in THESL's program are more comprehensive than its peer group utilities' programs. While some peer group utilities complete some activities that THESL does not, such as electrical testing, these activities were not deemed to be critical or cost efficient by METSCO subject matter experts. However, the review of the peer group utilities' programs revealed some potential areas of improvement – these suggestions are not critical but have been listed below in case THESL chooses to explore further enhancements in the future.

- THESL should explore the inclusion of electrical testing in its maintenance program if:
    - Additional budget is available; and
    - Reliability performance is significantly poor and requires improvement.
- THESL should explore completing routine activities (such as visual inspections and basic mechanical checks) and comprehensive maintenance activities (such as cleaning or lubrication) more frequently if:
    - the utility wishes to pursue the implementation of a best in class maintenance program
    - Work crews have sufficient availability or budget is available to expand resources; and
    - A focus on operational efficiency becomes higher priority.

1.4 Manufacturer Recommendations Benchmarking

As outlined in Section 1.1, the objective of the manufacturer recommendations benchmarking component of the qualitative review is to compare the activities completed as part of THESL's switch inspection and maintenance practice to those recommended by manufacturers and provide recommendations on additional activities that THESL should complete, if applicable.

The asset registry data used for this initiative did not have sufficient detail to identify the manufacturer and model of all gang-operated and SCADA-mate switches in deployment. Therefore, a set of manufacturer recommendations published by S&C Electric for similar switch types was leveraged to complete this analysis.

1.4.1 Overhead Gang-Operated Three-Phase Switches

1.4.1.1 Comparison of THESL and Manufacturer-Recommended Maintenance Practices

The manufacturer recommendations for overhead gang operated three phase switches are provided in the tables below – Table 1-9 provides an overview of the manufacturer recommendations for inspection practices and Table 1-10 provides an overview of the manufacturer alignment recommendations. In Table 1-1 above, all of THESL's current practices are enumerated and the tables below contain references to THESL's current practice using this numeric identifier. Using this information, the reader can understand which manufacturer recommended practices are included in THESL's current maintenance program. Any items requiring additional clarification or action are highlighted and discussed in Section 1.4.1.2.

Table 1-9: Manufacturer Recommendations – Inspection Practices

Activity Description	THESL Activity Reference (Table 1-1)
General	
Make sure the switch and operating mechanism have been installed per the appropriate installation and operation instruction sheets provided with each switch.	1, 3, 9, 10
Make sure all clamping bolts are tight and the piercing set screws are installed properly. Check the through-bolts, pole-band (if furnished), and J-bolts (if furnished) securing the switch to the pole or mounting structure. Tighten the hardware, if necessary.	1, 3, 7, 8, 9
Examine insulators, live parts, and the switch base for signs of tracking, contamination, arc damage, and soot. Clean the insulators, if necessary, with a clean cloth and a mild soap and water solution. Follow by rinsing with clean water.	1, 2, 3
Check that the switch is free from wildlife nests, tree limbs, and debris. Remove any impediments if present.	1, 9
Interrupter	
Do not rework the interrupters. Replace the entire interrupter if any of the conditions below are not met.	N/A
Check that all interrupter end caps are in place and secure.	1
Make sure all interrupters operate smoothly and the shunt arm automatically resets to its **Closed** position after opening.	3, 6
Check all interrupters for damage or soot.	1, 9
Live Parts	
Check the condition of the shunt contact. If any shunt contacts exhibit signs of damage or excessive wear, replace the associated blade and operating cam assembly.	1, 9
Clean and grease the contacts (for switches without catalog number suffix "-C"), if required. Wipe dirt and grease from both the blade and jaw contacts with a clean dry cloth. Remove any oxidation by lightly polishing the contacts with steel wool or fine-grit sandpaper and wiping excess grit off with a dry cloth. Apply a light coating of Shell Gadus S2 U1000 (available from S&C) to the contact surface.	4
The graphite-impregnated contacts (catalog number suffix "-C") do not require grease. Grease may be applied, but once used on graphite-impregnated contacts,	N/A

Activity Description	THESL Activity Reference (Table 1-1)
the contacts must be maintained in the same manner as non-graphite-impregnated contacts.	
Operating Mechanism	
For rotating-type operating mechanisms, make sure the operating handle is adjusted to create an "overtoggle" in the operating-mechanism linkage when the switch is in the **Closed** position. To adjust the overtoggle, move the handle stops as necessary. (When power-operated, the overtoggle should not be present.)	6
For reciprocating-type operating mechanisms, make sure the operating handle is adjusted so all slack in the operating linkage is taken up when the handle is fully closed (and over center). When operated to the fully **Closed** position, a definite resistance should be felt at the end of the stroke.	
For hookstick-type operating mechanisms, make sure that the stop pin on the operating mechanism engages with the detent spring when the switch is in the **Open** position and an "overtoggle" is present in the operating-mechanism linkage when the switch is in the **Closed** position.	
Options	
If furnished, examine ice shields (catalog number suffix "-B") for signs of tracking, contamination, arc damage, and soot.	1, 9
If furnished, examine wildlife protection (catalog number suffix "-U" or "-W") for signs of tracking, contamination, arc damage, and soot.	

Table 1-10: Manufacturer Recommendations – Alignment Recommendations

Activity Description	THESL Activity Reference (Table 1-1)
Move the Operating handle slowly to the fully open position (The interrupter and interrupter shunt arm must be parallel to the sweep of the blade.)	N/A
The operating cam shunt contact should engage the interrupter shunt arm on the copper-bronze surface of the shunt contact.	1, 3, 6
When the blade reaches its full travel, the interrupter shunt arm will be released and will quickly snap back to its **Closed** position, reset for the next operation.	
With the operating handle as far as it will go in the opening direction, the switch blades should be 90 degrees from the **Closed** position.	
Move the operating handle slowly to the fully closed position The interrupter shunt arm should be guided into position by the curved back of the shunt contact.	N/A
With the operating handle as far as it will go in the closing direction:	
All switch blades move into the jaw contact guide fingers on center and are fully seated in the jaw contacts.	1, 3, 6
The interrupter shunt arms are no more than **1/8**-inch (3 mm) from the auxiliary return arm of the multipurpose operating cam, and the shunt arm and return arm do not touch each other.	

1.4.1.2 Key Conclusions

The maintenance practices currently used by THESL for overhead gang-operated three-phase switches generally satisfy the manufacturer recommendations. For each specific activity outlined by the manufacturer, THESL has a comparable activity in its maintenance/inspection practice. It should be noted that the manufacturer's recommendations are provided at a greater level of detail than the practices outlined in THESL's maintenance manuals. However, this does not imply that THESL's switch maintenance practices are insufficient, particularly since the utility's practices are more comprehensive than all its peer group utilities (as outlined in Section 1.3.2.7). METSCO subject matter experts have determined that THESL does not need to make significant changes to the activities completed as part of its switch maintenance program based on these manufacturer recommendations. If the utility wishes to enhance its practices in the future, it can review these manufacturer recommendations to identify areas of improvement. However, it is recommended that THESL considers other benchmarking exercises to identify these future enhancements as its current practices generally satisfy the recommendations above.

1.4.2 SCADA-Mate Switches

1.4.2.1 Comparison of THESL and Manufacturer-Recommended Maintenance Practices

The manufacturer recommendations for SCADA-mate switches are provided in the tables below – Table 1-11 provides an overview of the manufacturer recommendations for inspection practices and Table 1-12 provides an overview of the manufacturer cleaning and lubrication recommendations. In Table 1-2 above, all THESL's current practices are enumerated and the tables below contain references to THESL's current practice using this numeric identifier. Using this information, the reader can understand which manufacturer recommended practices are included in THESL's current maintenance program. Any items requiring additional clarification or action are highlighted and discussed in Section 1.4.2.2.

Table 1-11: Manufacturer Recommendations – Inspection Practices

Activity Description	THESL Activity Reference (Table 1-2)
General	
Check with your local S&C Sales Office to verify whether there are any outstanding field notifications for inspection, maintenance, or retrofit of your model switch.	None
Check the switch for overall cleanliness of the insulators, live parts, and control cabinet. The switch should be free from wildlife nests, tree limbs, or other debris that could affect dielectric clearances.	5 to 12, 14
Check the through bolts, pole-band and J-bolts, and cross-arms (if furnished) securing the switch to the pole or mounting structure. Tighten the mounting hardware, if necessary.	7, 14
Insulation and Sensors	
Check for evidence of arc damage, tracking, or soot.	6, 14
Check that the insulation is free from contamination or debris from wildlife or the environment. Clean the insulators if necessary.	
Disconnect Live Parts	
Check that the disconnect current carrying contact enters the jaw contact on-center.	3, 14
Check that the disconnect operates smoothly and freely through its full travel, without binding. Clean and lubricate the contacts, if necessary.	3, 4, 14
Control Cabinet (CCU) and Control Cable	
Check for evidence of water ingress, damage, excessive corrosion, or wear.	2, 8, 9 10, 14
Check electrical operation using local control trip and close buttons.	3
Check for loose wiring inside enclosure and proper functioning of all LED indicating lights, operation counter, 6801 Automatic Switch Control, remote terminal unit (RTU), etc.	2, 8, 14
Check the key interlocks, if furnished, mechanically and electrically.	14
Inspect the control cable and connectors for evidence of damage or moisture ingress.	8, 14
Inspect the ground wires to ensure the switch and communication and control unit (CCU) are properly grounded.	11, 14
Perform the Battery Charger Recalibration Procedure detailed in RD-3808.	None
Options	
Check that the lightening arresters are in good condition and properly grounded.	11, 12
Check the condition of the wildlife covers, if furnished, to make sure they are in place and secure.	14
Operation	
Manually operate the switch	3
Operate the 6801 Automatic Switch Control or the Communication and Control Unit open and closed 3 times to ensure that the controls, control cable, and switch are working properly.	1, 3

Table 1-12: Manufacturer Recommendations – Cleaning and Lubrication Recommendations

Activity Description	THESL Activity Reference (Table 1-2)
General	
Remove any wildlife nests or debris if present	14
Trim trees around switch to the distance specified by standard utility practices.	14
When connector/jumper connections are adjusted, wire-brush the surface of the Scada-Mate terminal pads and re-apply a suitable aluminum connector compound before replacing connectors/jumpers.	None
Insulators	
Check for evidence of arc damage, tracking, or soot. Check that the insulation is free from contamination or debris from wildlife or the environment. Clean the insulators if necessary.	6, 14
Wipe dirt and grease from both hinge and jaw contact with a clean cloth. Dirt or contamination can be cleaned off of the blade and hinge with a mild soap and water solution and a clean cloth. Follow by rinsing with clean water. Manual cleaning of the live parts must be performed with the switch de-energized.	None
Apply a light coating of Shell Aeroshell #7 or an equivalent non-sulfur containing contact lubricant. (Shell Aeroshell #7 is available from S&C Electric Company.)	4
Power Washing	
DO NOT power wash with water or other liquid solvent. A ventilator hole is located at the base of the switch operating mechanism. Power washing with water or another liquid solution can force liquid inside the operating mechanism causing damage.	N/A
S&C recommends hand washing the de-energized switch with a mild soap and water solution and a clean, lint-free cloth.	None

1.4.2.2 Key Conclusions

In comparison to the benchmarking between the manufacturer recommendations and THESL's current practice for overhead gang-operated three-phase switches, this benchmarking exercise for SCADA-mate switches revealed several potential areas for improvement. There are several manufacturer-recommended practices that are either not completed or only partially completed by THESL. These items are highlighted in Table 1-11 and Table 1-12 above and are discussed in further detail below. It is important to note that while this benchmarking exercise reveals several potential improvements, these conclusions should be interpreted as recommendations and not explicit requirements. Although THESL's maintenance program may not satisfy all manufacturer recommendations, its program is more comprehensive than its peer group utilities (see Section 1.3.2.7). METSCO subject matter experts recommend that the utility should explore these enhancements if reliability performance is poor and the additional cost can be justified.

- (Table 1-11) Check with your local S&C Sales Office to verify whether there are any outstanding field notifications for inspection, maintenance, or retrofit of your model switch.

  - THESL current maintenance program does not include any activities related to this manufacturer recommendation. Although THESL may not exclusively use S&C products, it is recommended that the utility routinely check for updated notices regarding switch maintenance from relevant manufacturers.
- (Table 1-11) Check the through bolts, pole-band and J-bolts, and cross-arms (if furnished) securing the switch to the pole or mounting structure. Tighten the mounting hardware, if necessary.
  - THESL currently has several activities (items 7 and 14 in Table 1-2) that would entail completing certain tasks outlined in this manufacturer recommendation. However, it is not clear if all these tasks are completed based on the available information from THESL's maintenance manual. THESL should explore the addition of a new checklist item for the inspection of mounting hardware.
- (Table 1-11) Control Cabinet (CCU) and Control Cable
  - There are several maintenance tasks recommended by the manufacturer within this inspection category. While THESL's inspection and maintenance checklist would likely include inspections for the majority of the manufacturer's recommendations, it is recommended that the utility explore the addition of a new checklist item for the inspection of the control cabinet and related accessories.
- (Table 1-11) Check that the lightening arresters are in good condition and properly grounded.
  - THESL's current inspection practice includes a checklist item for the inspection of ground deficiencies. However, there are no inspection checklist items for lightning arresters – the utility should explore the addition of a new inspection checklist item for these assets.
- (Table 1-11) Check the condition of the wildlife covers, if furnished, to make sure they are in place and secure.
  - THESL's current practices do not include any specific activities intended to inspect switches for wildlife damage. If this activity is not completed as part of a separate program, THESL should explore the addition of a new checklist item for the inspection of switches for wildlife damage.
- (Table 1-12) Remove any wildlife nests or debris, if present.
  - THESL's current practices do not include any specific activities intended to inspect switches for wildlife impact. If this activity is not completed as part of a separate program, THESL should explore the addition of a new checklist item for the inspection of switches for wildlife impact.
- (Table 1-12) Trim trees around switch to the distance specified by standard utility practices.
  - THESL's current practices do not include any specific activities intended to address vegetation interference. If this activity is not completed as part of a separate program, THESL should explore the addition of a new checklist item for the inspection of switches for vegetation interference.
- (Table 1-12) When connector/jumper connections are adjusted, wire-brush the surface of the Scada-Mate terminal pads and re-apply a suitable aluminum connector compound before replacing connectors/jumpers.
  - THESL should explore the inclusion of this activity in its maintenance practices as the current inspection checklist may not contain any similar activities.

- (Table 1-12) Apply a light coating of Shell Aeroshell #7 or an equivalent non-sulfur containing contact lubricant. (Shell Aeroshell #7 is available from S&C Electric Company.)
    - While THESL's current inspection practices include the lubrication of switch components, the utility should consider if the type of lubricant used differs significantly from the manufacturer recommendation as this information is not currently captured in its switch maintenance manuals.
- (Table 1-12) S&C recommends hand washing the de-energized switch with a mild soap and water solution and a clean, lint-free cloth.
    - THESL's current practices do not include any switch cleaning practices for SCADA mate switches. The utility should explore the inclusion of this activity as part of its standard procedures.

1.5 ANSI/NETA Maintenance Testing Specifications 2019 Standard Benchmarking

As outlined in Section 1.1, the objective of the ANSI/NETA MTS 2019 standard recommendations benchmarking component of the qualitative review is to compare the activities completed as part of THESL's switch inspection and maintenance practice to those recommended by the ANSI/NETA MTS 2019 standard and provide recommendations on additional activities that THESL should complete, if applicable

The ANSI/NETA MTS 2019 standard contains a set of recommendations for visual and mechanical inspections and a set of recommendations for electrical testing. These two sets of recommendations are discussed below with references to specific maintenance activities for gang-operated and SCADA-mate switches (see Table 1-1 and Table 1-2 for activity numbers, respectively).

1.5.1 Visual and Mechanical Inspections

The ANSI/NETA MTS 2019 standard contains a list of recommended maintenance practices for visual/mechanical inspections as well as electrical testing – this subsection pertains to the former. All recommended visual/mechanical inspection practices are summarized in Table 1-13 below. If THESL's current maintenance practices (as defined in the switch maintenance manuals) contain a similar activity, its numeric identifier is provided in the "Gang-Operated Reference" or "SCADA-Mate Reference" column (see Table 1-1 and Table 1-2, respectively). Some of the recommended practices are only applicable to certain switch sub types, as identified in the "Switch Type" column. This benchmarking exercise reveals that there are several practices recommended by the ANSI/NETA MTS 2019 standard that THESL does not complete in its program. These practices are highlighted in the table below and further discussed in Section 1.5.3 Key Conclusions.

Table 1-13: Summary of ANSI/NETA MTS 2019 Visual/Mechanical Inspection Recommendations

Activity	Switch Type	Gang-Operated Activity Reference (Table 1-1)	SCADA-Mate Activity Reference (Table 1-2)
Inspect physical and mechanical condition.	All	1	5 to 12, 14
Inspect anchorage, alignment, grounding, and required clearances.	All	3, 9	14
Prior to cleaning insulators/unit, perform as-found tests, if required.	All	None	None
Clean the insulators/unit.	All	2	None
Verify correct blade alignment, blade penetration, travel stops, arc interrupter operation, and mechanical operation.	Air	3	None
Verify that fuse sizes and types are in accordance with drawings, short-circuit studies, and coordination study.	All	None	None
Verify that each fuseholder has adequate mechanical support and contact integrity.	All	None	None
Inspect bolted electrical connections for high resistance using one or more of the following methods:	All	None	None
Use of a low-resistance ohmmeter in accordance with Section 7.5.1.3.B.1.	All	None	None
Verify tightness of accessible bolted electrical connections by calibrated torque wrench method in accordance with manufacturer's published data or Table 100.12.	All	None	None
Perform a thermographic survey in accordance with Section 9.	All	None	None
Verify operation and sequencing of interlocking systems.	All	6	1, 3
Perform mechanical operator tests in accordance with manufacturer's published data.	All	6	1, 3
Verify correct operation and adjustment of motor operator limit switches and mechanical interlocks.	Air, Vacuum	6	1, 3
Use appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.	All	None	4
Perform as-left tests.	All	None	None
Record as-found and as-left operation counter readings.	Air, SF6	None	13
Verify correct operation of SF6 gas pressure alarms and limit switches as recommended by the manufacturer.	SF6	None	None
Measure critical distances as recommended by the manufacturer.	SF6, Vacuum	None	None
Test for SF6 gas leaks in accordance with manufacturer's published data.	SF6	None	None

Activity	Switch Type	Gang-Operated Activity Reference (Table 1-1)	SCADA-Mate Activity Reference (Table 1-2)
Inspect insulating assemblies for evidence of physical damage or contaminated surfaces.	Vacuum	9	14
Verify that insulating oil level is correct.	Vacuum	None	None

1.5.2 Electrical Testing

The ANSI/NETA MTS 2019 standard contains a list of recommended maintenance practices for visual/mechanical inspections as well as electrical testing – this subsection pertains to the latter. All recommended electrical testing practices are summarized in Table 1-14 below. THESL does not perform any type of electrical testing on its overhead gang operated three phase switches or SCADA mate switches. Although this presents a potential area of improvement, METSCO subject matter experts have determined that the addition of electrical testing may not provide sufficient incremental value to justify expenditures. The utility should only explore completing these activities if it wishes to further enhance performance metrics such as reliability and the additional cost of testing can be justified.

Table 1-14: Summary of ANSI/NETA MTS 2019 Electrical Testing Recommendations

Activity	Type
Perform resistance measurements through bolted connections with a low-resistance ohmmeter in accordance with Section 7.5.1.3.A.8.1.	All
Perform a contact-resistance test.	All
Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase to ground with switch closed and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1.	All
Perform insulation-resistance tests on all control wiring with respect to ground. The applied potential shall be 500 volts dc for 300-volt rated cable and 1000 volts dc for 600-volt rated cable. Test duration shall be one minute. For units with solid-state components or control devices that cannot tolerate the applied voltage, follow manufacturer's recommendation.	All
Perform a dielectric withstand voltage test on each pole with switch closed. Test each pole to ground with all other poles grounded. Test voltage shall be in accordance with manufacturer's published data or Table 100.19.	Air
Perform a dielectric withstand voltage test across each gas bottle with the switch in the open position in accordance with manufacturer's published data.	SF6
Perform a vacuum bottle integrity (dielectric withstand voltage) test across each vacuum bottle with the switch in the open position in strict accordance with manufacturer's published data.	Vacuum
Measure fuse resistance.	All
Remove a sample of SF6 gas and test in accordance with Table 100.13.	SF6

Activity	Type
Perform a dielectric withstand voltage test in accordance with manufacturer's published data.	SF6, Vacuum
Verify open and close operation from control devices.	SF6, Vacuum
Perform magnetron atmospheric condition (MAC) test on each vacuum interrupter.	Vacuum
Remove a sample of insulating liquid in accordance with ASTM D923. The sample shall be tested in accordance with the referenced standard.	Vacuum
Dielectric breakdown voltage: ASTM D877	Vacuum
Color: ASTM D1500	Vacuum
Visual condition: ASTM D1524	Vacuum

1.5.3 Key Conclusions

As outlined above, the ANSI/NETA MTS 2019 standard provides a set of recommendations for visual and mechanical inspections and another set of recommendations for electrical testing. THESL's switch maintenance program includes the completion of some visual/mechanical inspection recommendations but does not include any electrical tests. Generally, these activities are more technical than the utility's current procedures and represent a more comprehensive maintenance plan. While there is value in completing these additional visual/mechanical inspection activities and electrical tests, METSCO subject matter experts determined that they may not provide sufficient incremental value to justify the additional expenditures. This is further supported by the fact that the peer group utilities benchmarking exercise revealed that THESL's current switch maintenance program is already more comprehensive than comparable utilities (see Section 1.3.2.7). The utility should only consider completing these activities if switch reliability performance requires significant improvement and the required expenditures can be justified.

1.6 Conclusions

The peer group utilities benchmarking exercise revealed that all comparable utilities complete time-based maintenance with varying cycle lengths. The peer group utilities typically complete routine maintenance activities such as visual inspections and IR scanning on the same inspection cycle as Toronto Hydro (i.e., on a one to three-year cycle). However, they complete specialized switch-specific maintenance activities less frequently than THESL's four-year inspection cycle (i.e., on a three to eight-year inspection cycle). THESL's maintenance program is generally more comprehensive than its peer group utilities as it generally completes all activities that its peer complete and more. The only exception is electrical testing, which is completed by Alectra only. This implies that THESL's practices are in alignment with its peers in terms of the maintenance type (i.e., time-based) and the cycle lengths and they generally exceed the peers' practices in terms of the scope of activities that are completed. The final conclusions and recommendations of the peer group benchmarking are listed below (please refer to Section 1.3.2.7 Key Conclusions for additional information).

- THESL and its peer group utilities both complete time-based maintenance on similar cycles, but the peer group utilities cycle lengths vary depending on the maintenance type (i.e., routine maintenance such as visual inspection vs. switch-specific maintenance such as mechanical/operational checks).

  - THESL may wish to explore completing routine activities (such as visual inspections and basic mechanical checks) and comprehensive maintenance activities (such as cleaning or lubrication) more frequently if it wishes to further enhance its maintenance program, work crews have sufficient availability, budget is available, and/or additional operational efficiency is required.
- THESL's maintenance practices are generally more comprehensive than its peer group utilities – the only activity that THESL does not complete is electrical testing.
  - METSCO subject matter experts determined that electrical testing would not provide significant incremental value, but the utility can explore the addition of such activities if additional budget is available and switch reliability performance (or other KPI performance) is sufficiently poor to justify additional expenditures.

The manufacturer recommendations benchmarking exercise revealed that THESL's switch maintenance program generally satisfies the manufacturer maintenance recommendations around overhead three phase gang-operated switches. These recommendations are provided at a greater level of detail than the information captured in THESL's maintenance manuals. METSCO subject matter experts determined that THESL does not need to make significant changes to its maintenance program based on these recommendations, but the utility can explore them in further detail if it wishes to enhance its program in the future. In comparison, the manufacturer recommendations benchmarking exercise for SCADA-mate switches revealed that there are several manufacturer-recommended activities that the utility does not complete. However, this does not necessarily imply that the utility must improve its current practices as the peer group benchmarking exercise indicated that THESL's switch maintenance program is more comprehensive than comparable utilities. METSCO subject matter experts recommend that the utility explores these enhancements (as outlined in Section 1.4.2.2) if switch reliability performance (or other KPI performance) indicates the need for additional maintenance and the incremental cost can be justified.

The ANSI/NETA MTS 2019 standards provide a set of visual/mechanical inspection recommendations and electrical testing recommendations. The benchmarking exercise revealed that THESL's current switch maintenance program satisfies some of the visual/mechanical inspection recommendations but does not satisfy any of the electrical testing recommendations. The visual/mechanical inspection recommendations that THESL does not complete are provided in Section 1.5.1. While there is value in completing these additional activities, METSCO subject matter experts determined that the incremental value provided may not be justifiable as THESL's activities are already comprehensive in comparison to other comparable utilities. The same verdict was given to the electrical testing recommendations – while THESL does not complete any type of electrical test, the inclusion of such activities would not provide material value such that the cost can be justified. However, it is recommended that THESL explore these activities in the future if additional enhancements are required due to poor reliability performance (or other KPIs) such that the additional cost can be justified.

2 Quantitative Analysis

2.1 Introduction

The purpose of the quantitative analysis is to derive key insights by investigating the following questions:

- What is the optimal maintenance frequency?
- What is the ideal start age for maintenance?
- Should the utility replace overhead switches proactively or employ a run-to-failure strategy?

This analysis is undertaken based on the risk mitigated by the maintenance activities relative to the cost of the maintenance. The characteristics defining the risk of a given switch in THESL's distribution system can vary. For example, factors such as the condition, age, number of connected customers, and other risk factors such as location can differ significantly from switch to switch. This study aims to standardize part of this variability by creating a set of predetermined risk profiles that will guide the analyses. In absentia of a comprehensive quantitative risk assessment for all the overhead switches on THESL's system, Table 2-1 shows a simple risk matrix that THESL can immediately apply to estimate the risk of switches based on the effective age (i.e., condition-adjusted age) and the number of connected customers. These two dimensions of the matrix are intended to broadly represent the probability and consequence of failure, respectively. The numbers within the matrix cells are identifiers for a given risk profile and the colours indicate the meaning of the risk profile, as outlined in **Error! Reference source not found.** below. The interpretations presented in **Error! Reference source not found.** are based on a total risk calculation that is detailed in subsequent sections of this report.

Table 2-1: Risk Matrix for Switches based on Effective Age and Customer Count

	Number of Connected Customers		
Effective Age	≤ 100	101-1000	>1000
Age <60% of TUL	1	2	3
Age >= 60% of TUL and <TUL	4	5	6
Age >= TUL	7	8	9

Legend
Low
Medium
High

2.2 Optimal Maintenance Frequency

2.2.1 Overview

THESL's current maintenance cycle length is four years for comprehensive maintenance activities (as outlined in 1.2 Current-State Practices). This analysis entailed the comparison of several maintenance frequencies using a Benefit-Cost ratio. In the context of this analysis, benefit is defined as the risk reduction from one maintenance cycle length to another. If maintenance is completed more frequently, it becomes more likely that issues that would otherwise cause in-service failure are identified and addressed before the failure occurs. In this manner, the outage impact can be minimized. Risk is presented as a monetary value and is calculated as the product of failure probability and impact – the complete risk calculation methodology is detailed in Section 2.2.2 below.

The cost component of the Benefit-Cost ratio is defined as the incremental cost from one maintenance cycle to another. For example, if a given maintenance activity has an average unit cost of $3600 on a four-year maintenance cycle, increasing the maintenance frequency would result in the maintenance expense being incurred more frequently.

This analysis considers the trade off between the reduction in risk and the increase in cost due to increased maintenance frequency. Given that there are multiple risk profiles for various switches (as outlined in Section 0), this analysis was completed separately for each profile to identify optimal practices depending on the switch risk level. For example, given that a switch within risk category 1 (as defined in Table 2-1 above) has a lower initial risk value, the risk reduction benefit will not be as significant as it would be for a switch within risk category 9 – this difference significantly affects the benefit-cost ratio calculation. This process is further detailed in the subsequent sections which detail the methodology and results of this analysis.

2.2.2 Methodology

[redacted]

[redacted]

[redacted]

2.2.3 Results

As outlined above, the complete analysis involved comparing all maintenance plans to identify the optimal maintenance frequency depending on the switch risk profile. Each maintenance plan was compared to subsequent maintenance plans only – for example, the four-year maintenance plan was compared to the three-year and five-year plans. This strategy allowed the analyst to identify if increasing or decreasing the maintenance frequency resulted in more optimized and cost-efficient practices. The analysis revealed that increasing the maintenance frequency was a worthwhile decision for high-risk switches and decreasing the maintenance frequency was a worthwhile decision for low-risk switches. The analysis results presented below provide the details of this analysis. The example presented in Section 2.2.2.5 suggests that a benefit-cost ratio greater than one would indicate that the increased maintenance frequency is cost-efficient. However, a benefit-cost ratio threshold of 2.5 was used for the analysis to add an additional safety factor and ensure that the results of the analysis will still be valid if inputs change (i.e., ratio must be greater than or equal to 2.5).

Table 2-6 presented an overview of the benefit-cost ratio calculation for a three-year maintenance cycle compared to a four-year maintenance cycle. A similar calculation was completed for all consecutive plans. The benefit-cost ratios resulting from this analysis are presented in Table 2-7. As outlined above, a benefit-cost ratio of 2.5 would indicate that there is sufficient benefit in increasing the maintenance frequency. In analyzing the results presented below, it is evident that there are similarities between switches in the same risk category.

Table 2-7: Summary of Final Benefit-Cost Ratio Results for Optimal Maintenance Frequency Analysis

Risk Identifier	Risk Category	1 year vs. 2 years	2 years vs. 3 years	3 years vs. 4 years	Current Plan – 4-year Cycle	4 years vs. 5 years	5 years vs. 6 years
1	Low	0.01	0.02	0.05		0.08	0.11
2	Low	0.07	0.21	0.43		0.71	0.98
3	Medium	0.41	1.22	2.45		4.08	5.62
4	Low	0.05	0.15	0.30		0.50	0.69
5	Medium	0.44	1.31	2.62		4.36	6.02
6	High	2.50	7.49	14.97		24.95	34.44
7	Medium	0.20	0.60	1.20		2.00	2.77
8	High	1.74	5.23	10.47		17.45	24.08
9	High	9.98	29.95	59.89		99.82	137.75

In addition to the comparison of subsequent plans provided in Table 2-7 above, an additional analysis was completed to compare all potential maintenance plans (i.e., 1-year cycle to 6-year cycle) to the current 4-year maintenance cycle. The results of this analysis are presented in Table 2-8 below and demonstrate alignment with the results of the overall benefit-cost ratio calculation presented in Table 2-7 above. The final conclusions and recommendations of these analysis are provided below. In general, however, THESL should be mindful of the fact that any significant changes to input values (such as maintenance costs) may impact the accuracy of this recommendation.

Table 2-8: Summary of Final Benefit-Cost Ratio Results in Comparison to 4-Year Maintenance Cycle

Risk Identifier	Risk Category	1 year vs. 4 years	2 years vs. 4 years	3 years vs. 4 years	4 years vs. 5 years	4 years vs. 6 years
1	Low	0.02	0.03	0.05	0.08	0.09
2	Low	0.14	0.28	0.43	0.71	0.82
3	Medium	0.82	1.63	2.45	4.08	4.70
4	Low	0.10	0.20	0.30	0.50	0.58
5	Medium	0.87	1.74	2.62	4.36	5.03
6	High	4.99	9.98	14.97	24.95	28.75
7	Medium	0.40	0.80	1.20	2.00	2.31
8	High	3.49	6.98	10.47	17.45	20.10
9	High	19.96	39.93	59.89	99.82	114.99

Low-Risk Switches

Low-risk switches are represented by risk identifiers 1, 2, and 4 – these switches are characterized as low risk since they represent units that have yet to reach the TUL and do not serve a large number of customers. As shown in Table 2-7 above, none of the plan comparisons yield a benefit-cost ratio greater than 2.5 (and are in fact all less than 1). This indicates that the risk reduction benefit provided by increasing the maintenance frequency is not sufficient to justify the incremental maintenance cost. In addition, the comparison between the current four-year cycle and a five-year cycle indicates that there is insufficient benefit in completing maintenance on the current cycle vs. a five-year cycle. This implies that the current maintenance cycle is too frequent and the utility should decrease the maintenance frequency for switches in this risk category. The comparison between the five-year cycle and the six-year cycle yields the same conclusion – there not enough benefit in completing maintenance on a five-year cycle versus a six-year cycle. The scope of this analysis was limited to a maximum maintenance frequency of six years as anything greater would not be practical due to potential deterioration of switch sub-components. Therefore, it is recommended that THESL switch to a six-year maintenance cycle for switches in the low-risk category.

Medium-Risk Switches

Medium-risk switches are represented by risk identifiers 3, 5, and 7 – these switches are categorized as medium risk since they represent units that are well below the TUL but serve a large number of customers, are approaching the TUL and serve a moderate number of customers, or are past the TUL but serve a low number of customers. The results of the benefit-cost ratio analysis are slightly different for each of these risk identifiers. Based on the benefit-cost ratio threshold of 2.5, the recommended maintenance frequency is between three and five years. It is recommended that THESL maintains its current four-year plan for medium-risk switches.

High Risk Switches

High-risk switches are represented by risk identifiers 6, 8, and 9 – these switches are categorized as high risk because they represent units that are approaching or past the TUL threshold and serve a moderate or high number of customers. The comparison of the two-year plan and the three-year plan indicates that there is sufficient value in completing maintenance on a two-year cycle for all three risk identifiers in this category as they all meet the 2.5 benefit-cost ratio threshold. The comparison between the one-year plan and the two-year plan for risk identifiers 6 and 9 indicates that there is significant value in completing maintenance on a one-year cycle for these switches. It is recommended that THESL adopts a one-year maintenance cycle for all high-risk switches. Although risk identifier 8 switches do not meet the 2.5 benefit cost threshold under a one-year plan, the benefit cost ratio is still greater than 1.

This analysis suggests that THESL should vary the maintenance frequency based on the switch's risk profile. Based on the analysis results, the final recommendations for each switch risk profile have been compiled and are summarized in Table 2-9 below.

Table 2-9: Summary of Final Recommendations for Optimal Maintenance Frequency Analysis

Risk Category	Optimal Frequency
Low	6 years
Medium	4 years
High	1 year

2.3 Maintenance Start Age

2.3.1 Overview

THESL's current maintenance program is completed on a four-year cycle. This means that all switches within the scope of this analysis are included in the maintenance cycle starting at age four. The purpose of this analysis is to determine the optimal start age for THESL's maintenance program. Similar to the Optimal Maintenance Frequency analysis described in Section 2.2, this analysis is also completed through the calculation of a benefit-cost ratio. Given that asset maintenance reduces the risk of failure, the benefit is defined as the difference in asset risk when the THESL's maintenance program is applied and when it is not applied. The cost is defined as the annual maintenance cost. This analysis is based on the optimal maintenance frequencies recommended by the Optimal Maintenance Frequency analysis (see Section 2.2.3). The analysis methodology is detailed in the following subsection.

2.3.2 Methodology

As outlined above, this analysis is completed using a benefit-cost ratio where the benefit is defined as the reduction in risk due to the implementation of a maintenance plan and the cost is defined as the annual maintenance cost. The risk and maintenance cost calculations are the same as the calculations described in Section 2.2.2. However, the overall methodology does differ – please see the following subsections for a complete explanation of the Maintenance Start Age analysis methodology.

2.3.2.1 Risk Calculation (Benefit)

The first component of this analysis is the calculation of risk under two scenarios: with a maintenance program and without a maintenance program. Similar to the Optimal Maintenance Frequency Analysis, the risk is comprised of the financial risk and customer risk. The methodologies for calculating these two variables will not be repeated in this section as they are essentially the same as described in Section 2.2.2.2 and Section 2.2.2.3. One key difference is that risk is calculated for each year over the asset's lifecycle as opposed to a current risk estimation based on the general categories outlined in Table 2-1. This means that annual failure probabilities derived from failure curves are used in place of the average failure probabilities described in Table 2-2.

There are also some differences between the calculation of year-over-year risk for the with maintenance and without maintenance scenario. The calculation for the with maintenance scenario is the same as the calculation described in Section 2.2.2 above. However, the without maintenance scenario assumes that there is a zero percent chance of inspection defined as the likelihood of discovering significant deficiencies is minimal in the absence of a detailed maintenance program.

Given that this analysis entails the calculation of year-over-year risk values, the risk matrix can be simplified to three categories that align to customer counts. The asset's effective age is not a risk factor in this analysis as risk values are calculated for every year over the asset's expected lifespan. The analysis was completed for three types of switches based on their criticality:

- Criticality 1 – Number of customers on circuit is less than or equal to 100
- Criticality 2 – Number of customers on the circuit is between 101 and 1000
- Criticality 3 – Number of customers on the circuit is more than 1000

The risk methodology presented in Section 2.2.2 is used to calculate the year-over-year asset risk. Example results are provided in Table 2-10 below. The benefit is calculated as the risk reduction through the implementation of a maintenance program.

2.3.2.2 Cost Calculation (Cost)

The cost calculation consists of calculating the annual maintenance cost using the formula below.

$$Annual\ Maintenance\ Cost = \frac{Maintenance\ Cycle\ Unit\ Cost}{Maintenance\ Cycle\ Frequency}$$

2.3.2.3 Benefit-Cost Ratio

After the risk reduction benefit and annual costs have been calculated for every year over the asset's expected lifecycle, the benefit-cost ratio is also computed. The point at which the benefit-cost ratio exceeds a value of one can be considered the optimal maintenance start age. Example results are provided in Table 2-10 – these results are truncated at the point where the benefit-cost ratio exceeds one.

2.3.3 Results

Example results are provided in Table 2-10 below – these results are for a criticality 3 switch (i.e., more than 1000 customers). Although this analysis was completed for criticality 1 and criticality 2 switches as well, the recommendations provided are based on the example results for a criticality 3 switch below. The reasoning behind this decision is that customer count may not be adequate indicator of switch criticality as single customers can serve vital functions (e.g., hospitals). Therefore, if the recommendations are provided based on the most critical switch category, they can provide insights based on the most stringent scenario.

Table 2-10: Example Maintenance Start Age Benefit-Cost Ratio Results

Effective Age	Risk (with Maintenance)	Risk (without Maintenance)	Benefit	Annual Cost	B/C Ratio
1	$7.02	$14.54	$7.52	$900.00	0.008355
2	$31.96	$66.16	$34.21	$900.00	0.038008
3	$77.52	$160.50	$82.98	$900.00	0.092199
4	$145.36	$300.97	$155.60	$900.00	0.172894
5	$236.73	$490.14	$253.41	$900.00	0.281566
6	$352.62	$730.08	$377.46	$900.00	0.419403
7	$493.88	$1,022.55	$528.67	$900.00	0.587416
8	$661.24	$1,369.08	$707.83	$900.00	0.786481
9	$855.37	$1,771.02	$915.64	$900.00	1.01738
10	$1,076.86	$2,229.60	$1,152.74	$900.00	1.280817

As Table 2-10 indicates, the optimal maintenance start age for the most critical switch (i.e., customer count) is approximately ten years old based on this analysis. However, it is important to consider that certain sub-components of the switch, such as the lubricant that ensures smooth operation, may require servicing sooner than this ten-year period. Therefore, it is recommended that the maintenance start age aligns with the optimal maintenance frequency recommendations, as outlined in Table 2-11 below.

Table 2-11: Final Recommendations for Maintenance Start Age Analysis

Customer Count	Risk Category (for a new switch – i.e., below TUL)	Maintenance Start Age
Less than or equal to 100	Low	6 years
101 to 1000	Low	6 years
More than 1000	Medium	4 years

2.4 Proactive vs. Run to Failure

2.4.1 Overview

The purpose of this analysis is to determine whether THESL should continue completing proactive asset maintenance and replacements or switch to a run to failure strategy. This analysis involved calculating the total cost of ownership for a given switch over its lifecycle under two scenarios: with a proactive maintenance plan and without any maintenance plan. Similar to the Maintenance Start Age analysis, the risk profiles described in the risk matrix in Table 2-1 were not used as year-over-over calculations were performed. Instead, the analyst completed the total cost of ownership calculation for the three switch criticality profiles described in Section 2.3.2.1:

- Criticality 1 – Number of customers on circuit is less than or equal to 100
- Criticality 2 – Number of customers on the circuit is between 101 and 1000
- Criticality 3 – Number of customers on the circuit is more than 1000

The reasoning behind this strategy is that the effective age component of the risk matrix becomes irrelevant in a year-over-year analysis. As outlined above, the total cost of ownership is the basis of comparison for this analysis. The procedure for calculating the total cost of ownership is presented in the following subsection.

2.4.2 Total Cost of Ownership

The total cost of ownership consists of three sub-components: the asset replacement cost, the lifecycle maintenance cost, and the lifecycle risk cost. It is calculated using the equations presented below:

$$Total\ Cost\ of\ Ownership = Capital\ Cost + Lifecycle\ Maintenance\ Cost + Lifecycle\ Risk\ Cost$$

For the total cost of ownership under the with proactive maintenance plan, the capital cost consists of the cost of planned replacement. Likewise, the capital cost under the run to failure maintenance plan consists of the cost of reactive replacement. These replacement cost assumptions are listed below.

- Capital Cost (Proactive) = $18,500
- Capital Cost (Reactive) = $30,000

The lifecycle maintenance cost is calculated as the sum of the annual maintenance cost of the asset, based on the optimal maintenance frequency recommendations in Section 2.2.3. Each switch is assumed to have a lifespan of 50 years. This cost is only applicable to the total cost of ownership calculation in the with proactive maintenance scenario as it is assumed that no maintenance is completed in the run-to-failure scenarios. The lifecycle maintenance cost is calculated as follows:

$$Lifecycle\ Mainteannce\ Cost = \sum_{0}^{50} Annual\ Maintenance\ Cost$$

The lifecycle risk cost is calculated using the same methodology described in Section 2.2.2 and the results are in the same format as Table 2-10. The lifecycle risk is calculated as the sum of all yearly risk values over a 50-year lifespan, as indicated by the equation below.

$$Lifecycle\ Risk\ Cost = \sum_{0}^{50} Annual\ Risk\ Cost$$

2.4.3 Results

The total cost of ownership calculation results for the proactive maintenance and run-to-failure scenarios for the three switch criticality profiles are presented in Table 2-12 below. As expected, the results indicate that completing proactive maintenance on the cycles recommended in Section 2.2.3 results in a lower total cost of ownership than a run-to-failure strategy, regardless of the switch criticality. METSCO's final recommendation is that THESL should continue to complete proactive maintenance on the recommended cycle lengths specified in Section 2.2.3.

Table 2-12: Final Results for Proactive vs. RTF Analysis

Criticality Identifier	Total Cost of Ownership (Proactive)	Total Cost of Ownership (Run-to-Failure)
1	$84,224.47	$102,785.02
2	$216,827.42	$288,243.69
3	$651,368.69	$1,292,356.63

2.5 Key Conclusions

To establish the optimal maintenance frequency a benefit-cost ratio analysis was completed to compare several potential maintenance cycle lengths. The benefit was defined as the risk reduction between two maintenance plans and the cost was defined as the incremental maintenance cost between two maintenance plans. A benefit-cost ratio of three was used as the recommendation threshold to account for potential variability in the analysis input parameters. A recommendation was provided for each switch risk category (as defined in Table 2-1). The final results of this analysis and the optimal maintenance frequency recommendations are provided in Table 2-13 below.

Table 2-13: Summary of Final Recommendations for Optimal Maintenance Frequency Analysis

Risk Category	Optimal Frequency
Low	6 years
Medium	4 years
High	1 year

The maintenance start age analysis involved completing a benefit-cost ratio calculation for a switch over every year of its expected lifespan. The risk was calculated under two different assumptions: (1) a maintenance program exists and (2) no maintenance is completed. The benefit was calculated as the difference in risk between these two strategies and the cost was defined as the annual maintenance. The recommendations were based on the most critical switch profile to ensure that the most stringent requirements are satisfied. The age at which the benefit-cost ratio exceeded a value of one was used to provide the recommendation – for this analysis this age was ten years. However, some switch sub-components require more frequent servicing (e.g., lubricant). Therefore, it is recommended that the maintenance start age should align to the optimal maintenance frequency recommendations in Table 2-13 (e.g., the recommended maintenance start age for a Low-Risk switch is six years old).

The proactive vs. run-to-failure strategies analysis entailed the calculation of an asset's total cost of ownership over its lifespan under each of these scenarios. In other words, the total cost of ownership was calculated for a switch under the assumption that proactive maintenance is completed and under the assumption that a run-to-failure strategy is employed. This analysis was completed for three switch criticality levels, as defined by the customer counts in risk matrix (see Table 2-1). The result of this analysis indicate that a proactive maintenance strategy is the most cost-efficient option for all levels of switch criticality.

AMCL+
LEADING ASSET MANAGEMENT

TORONTO HYDRO ELECTRIC SYSTEM LIMITED (THESL)

ISO 55001 Gap Analysis & Roadmap

ISO 55001 Gap Analysis

Final Report

Date: 4th February 2021

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DOCUMENT CONTROL

APPROVAL				
FILE REF: CAN/21086				
Version	**Date**	**Compiled by**	**Reviewed by**	**Authorised by**
Final Report	4th February 2021	Imad Khan Keegan Varella	Andrew Sharp	Sarah Vine

EXECUTIVE SUMMARY

Toronto Hydro-Electric System Limited (THESL) owns and operates an electricity distribution system that delivers electricity to approximately 779,000 customers located in the city of Toronto, Ontario, Canada.

This report contains the results of an ISO 55001[1] gap analysis undertaken in July 2020. AMCL undertook the assessment in accordance with its Asset Management Assessment & Certification process, which is accredited under the Institute of Asset Management's (IAM's) Endorsed Assessor Scheme. The results of this gap analysis provide THESL with the actions required to ensure conformance with ISO 55001 which will then be developed into a Roadmap (high-level plan) for achieving compliance.

This report also contains an assessment of the maturity of THESL's Asset Management practices against the ISO 55001 clauses – possible because of the nature of the AMCL Asset Management Excellence Model™ (AMEM) assessment methodology used (see Section 3).

The main conclusion of this gap analysis is that THESL has already achieved good state of maturity and in some cases improved on the score assessed by the previous assessor. Whilst many areas of good practice exist, there are still some specific areas for improvement and some significant shortfalls that need to be addressed before many of the other improvements would become effective.

The gap analysis has concluded that there are eight (8) clauses where THESL appears to be currently compliant, fourteen (14) where compliance is potentially 'at risk' and three (3) where it appears to be non-compliant. These are summarized in Table 2.

It is our opinion that all the conformance issues identified in this gap analysis can be rectified by the end of 2023.

AMCL has recommended activities for THESL to undertake, in order of priority, to fill the gaps and conform to the ISO 55001 standard (see Section 5.2).

AMCL would like to thank all THESL staff who contributed to the successful completion of this gap analysis. The level of organization and commitment was appreciated by the AMCL team and demonstrated a clear commitment to best practices in Asset Management.

[1] *ISO 55001: 2014, Asset Management – Management System Requirements, Version 2014-07, Edition 1, Published 2014-01,*

TABLE OF CONTENTS

1. INTRODUCTION

Toronto Hydro-Electric System Limited (THESL) owns and operates an electricity distribution system that delivers electricity to approximately 779,000 customers including 42 large users i.e., hospitals, universities and essential services located in the city of Toronto, Ontario Canada.

THESL delivered 24,476 GWh of electricity as of December 31, 2019. The peak load is 4,312 MW with one control centre and four operation centres. THESL has 1,360 employees and covers around 180,000 poles, 15,480km of overhead wires and 13,407km of underground wires. Other assets include primary switches and distribution transformers.

This report contains the results of an ISO 55001 gap analysis undertaken in July 2020. AMCL undertook this in accordance with its Asset Management Assessment & Certification process, which is accredited under the Institute of Asset Management's (IAM's) Endorsed Assessor Scheme. The results of this gap analysis provide THESL with the required actions to ensure conformance with ISO 55001 which will then be converted into a Roadmap (high-level plan) for achieving compliance.

This report also contains an assessment of the maturity of THESL's Asset Management practices against the ISO 55001 clauses.

2. ACTIVITIES & SCOPE

The scope of this maturity assessment covers all distribution assets described in Section 1, including operational buildings and SCADA/Data systems. During the assessment process, it was agreed that other non-operational facilities, fleet, streetlights, and IT (e.g., Laptops/Software) would be outside of the current scope of the AM System. These assets may be incorporated into the AM System later.

The activities completed to draft this report were:

- Reviewing key Asset Management documentation in advance of and during the interview sessions.
- Interviewing the staff listed in the sessions in Appendix B.
- Assessing THESL's conformance to each of the ISO 55001 clauses (see below), through a strict interpretation of the 71 'shall' statements in Appendix C.

Preparing this report using the findings and drawing conclusions against the level of THESL's alignment with the requirements of ISO 55001.

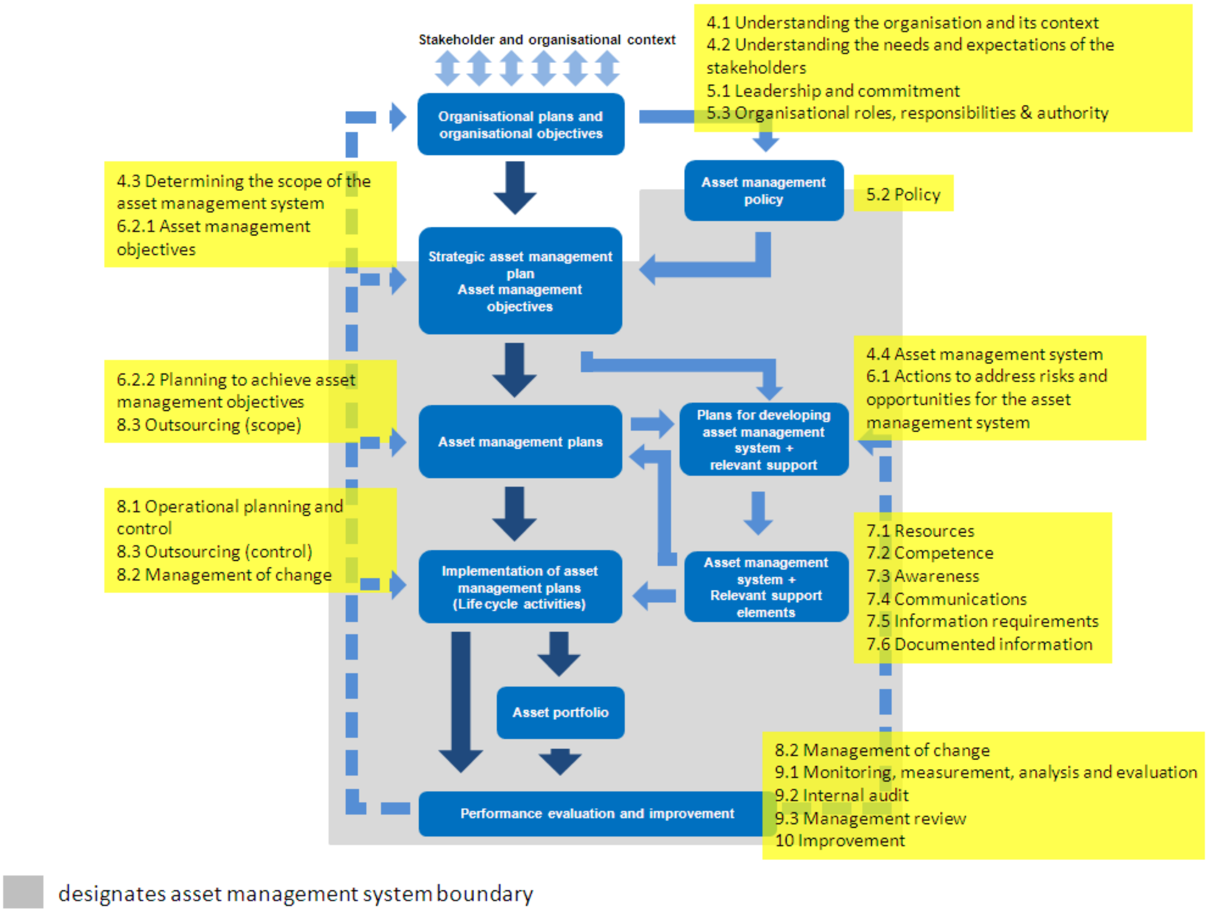


Figure 1 The ISO 55001 Clauses ©

AMCL undertook the assessment in accordance with its Asset Management Assessment & Certification process, which is accredited under the Institute of Asset Management's (IAM's) Endorsed Assessor Scheme. The assessment was based on interviews and other evidence (including documentation) and the findings, conclusions and recommendations in this report reflect AMCL's objective interpretation of the information provided against the requirements of ISO 55001.

3. THE AMCL ASSET MANAGEMENT EXCELLENCE MODEL™

3.1 OVERVIEW

The AMEM, which is shown in Figure 2, enables organizations to assess their Asset Management capability maturity and benchmark it against world best practice. It is built around the '39 Subjects' which span the range of technical, organisational and human capabilities needed to achieve world-class Asset Management. These subjects are aligned with the second edition of the 'Asset Management Landscape' agreed by the Global Forum for Maintenance & Asset Management (GFMAM). The AMEM tests the *existence*, *completeness*, *effectiveness,* and *integration* of these subjects and is applicable to any asset intensive organisation, including those in highly regulated environments.

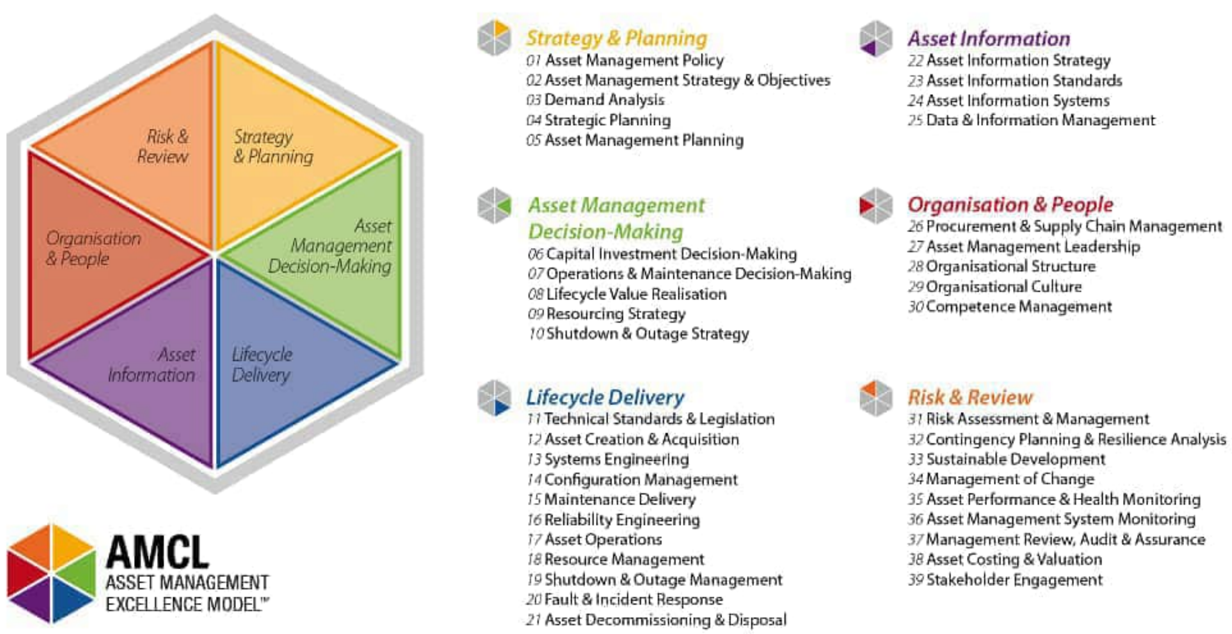


Figure 2 The AMCL Asset Management Excellence Model™ (AMEM)

Organizations are scored against each of the 39 Subjects using a range of assessment criteria and questions. The scores are presented using the maturity scale shown in Figure 3, which in turn is aligned to the Asset Management maturity scale defined by the IAM. Improvement actions are identified based on the criticality of each subject to the organisation, the current scores for the assessment criteria that make up each subject, and the targets an organization and its stakeholders wish to set themselves for each subject.

AMEM results are used to identify and prioritize improvements based on where an organization sits relative to globally recognized best practice standards, including ISO 55001.

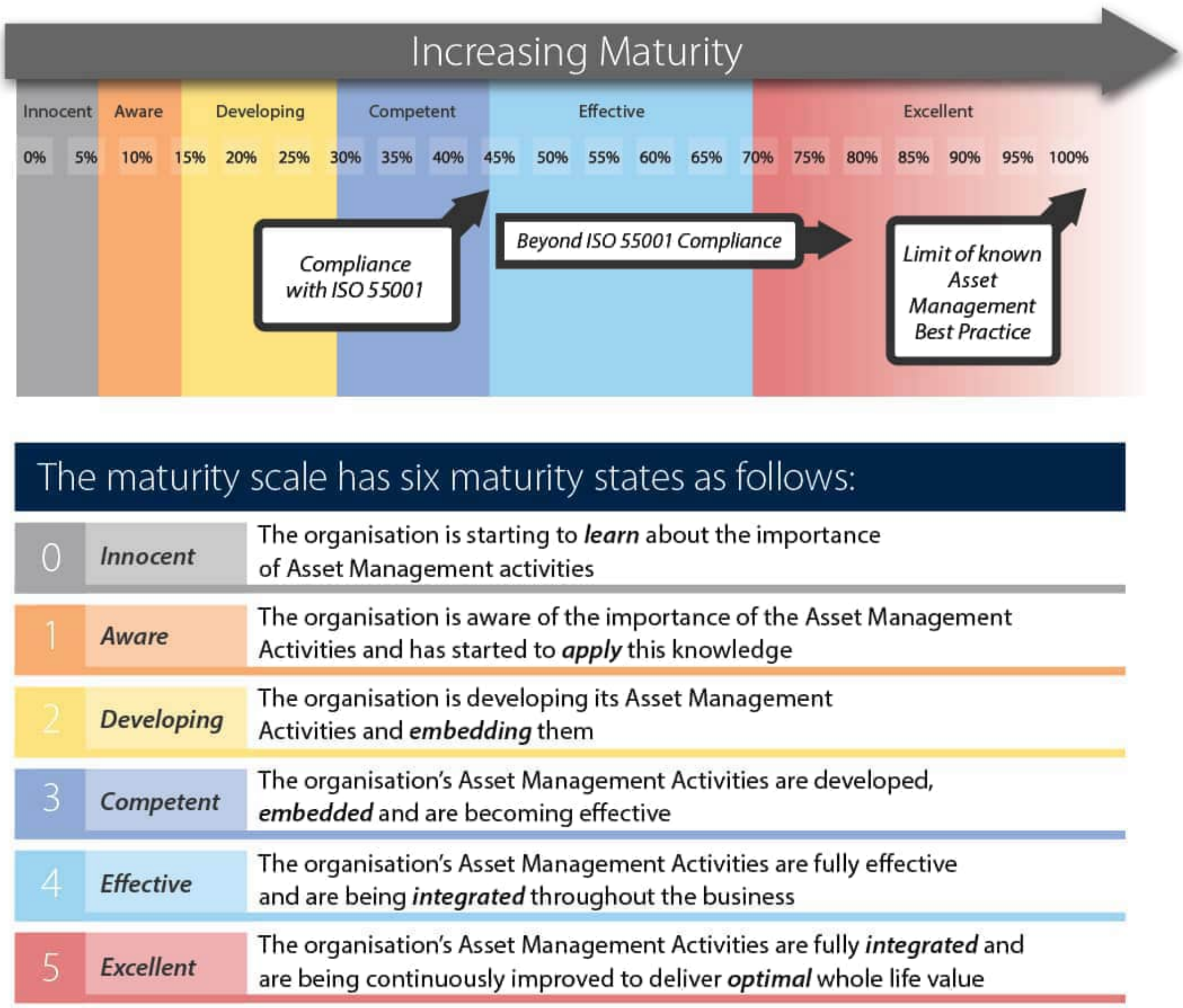


Figure 3 The AMEM Asset Management Maturity Scale

The AMEM can be used in several assessment modes. For ISO 55001 gap analysis assessments and Certification Audits the output is presented by ISO 55001 clause. The concepts of the existence, completeness, effectiveness, and integration of processes ensure the maturity assessment effectively identifies ISO 55001 conformance on the maturity scale already introduced. To be in the 'competent' band or above, an organization must have demonstrated that processes exist and are complete. This is broadly the equivalent of ISO 55001 compliance. If the organization can demonstrate its processes are effective and integrated, it will begin to demonstrate 'effective' or 'excellent' maturity.

3.2 INTERPRETING ISO 55001 GAP ANALYSIS ASSESSMENT RESULTS

When using the AMEM to assess ISO 55001 compliance during a Gap Analysis assessment, maturity scores below the 'competent' band would tend to indicate areas of systematic nonconformity against an ISO 55001 Clause, which could result in a major nonconformity during a Certification Audit. Conversely, scores above the 'competent' band would provide a high degree of confidence that ISO 55001 requirements were met, and scores within the 'competent' band would indicate some uncertainty.

In general, the following guidelines are followed to categorize findings:

1) **Current Compliance with ISO 55001**: Based on the evidence presented and assessed during the gap analysis assessment it is likely that the client would achieve compliance assuming this could be successfully demonstrated in a fully evidenced Certification Audit. This means that there is evidence that processes exist and are broadly complete which meet the requirements of the ISO 55001 Clause being assessed. Maturity scores for these Clauses are usually above 45%. It should be noted that there may be cases where the maturity score is above 45% where an organization is relatively mature against a particular clause of ISO 55001 but there is a specific nonconformity with one aspect of that clause.
2) **Compliance with ISO 55001 at Risk**: Based on the evidence presented and assessed during the gap analysis assessment it is likely that the client would not achieve compliance without instigating further work, completing existing improvement projects, or undertaking some other straightforward re-alignments of existing processes or projects. This means that there is evidence that the processes to satisfy the Clause exist but are not yet complete and there are no plans in place to complete them. Maturity scores for these Clauses are usually between 30% and 45%.

3) **Non-Compliance with ISO 55001**: Based on the evidence presented and assessed during the gap analysis assessment it is likely that the client would not achieve conformance without introducing further processes or systems. This means that there is no evidence that the processes to satisfy the Clause exist and there are no plans to put them in place. Maturity scores for these Clauses are usually below 30%.

4. ISO 55001 GAP ANALYSIS FINDINGS

4.1 OVERVIEW

Figure 4 below shows THESL's Asset Management maturity against each of the requirements of ISO 55001 as evidenced through this gap analysis assessment.

The top of the 'competent' maturity band (45% on the scale) represents the level where THESL is broadly compliant with ISO 55001. As discussed in Section 3.2, this does not mean compliance is guaranteed for these clauses as consideration needs to be given to the level of conformity with each individual requirement within the clause, but this chart provides an overview of the relative strengths and weaknesses within THESL's AM System.

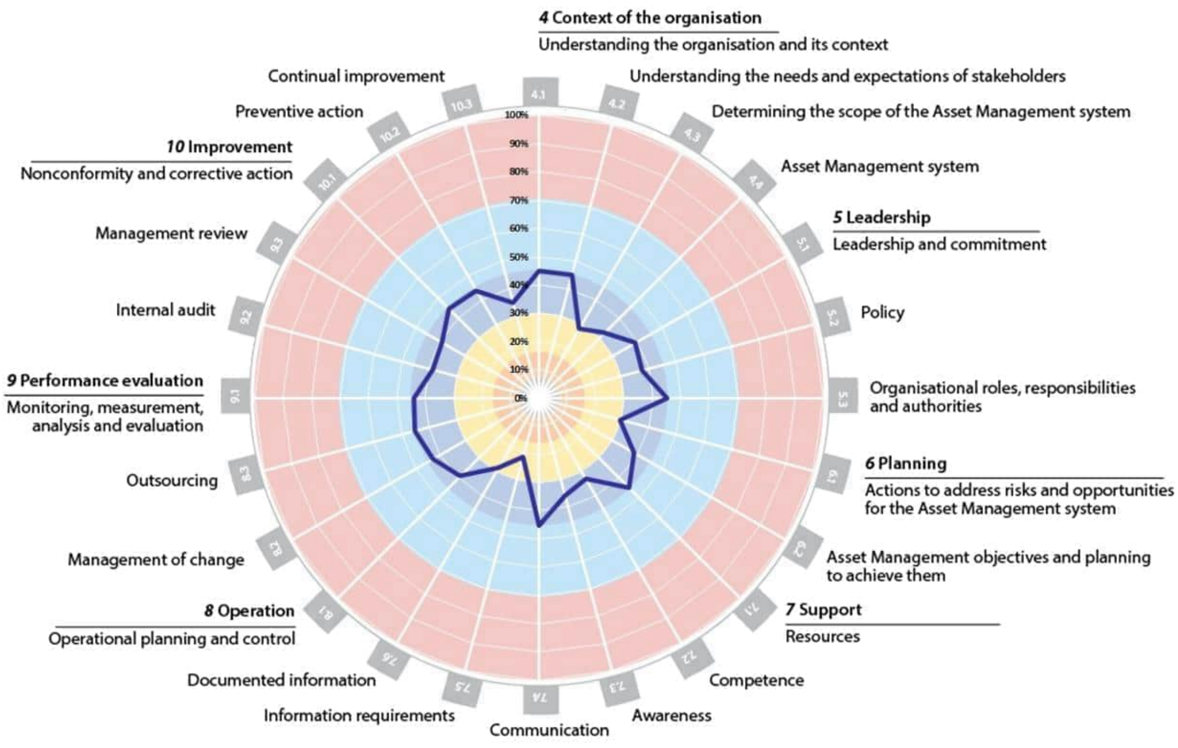


Figure 4 THESL Maturity Scores by ISO 55001 clause

Table 1 on the following page summarizes the level of conformance against each of the ISO 55001 clauses based on the findings from this gap analysis. The actions required to address the identified nonconformities are summarised in Table 2 and detailed in Table 1 of this report.

Table 1 : Overall Conformance

ISO 55001 Clause	Percentage	Current Compliance	Compliance at Risk	Non-Compliance
4.1 - Understanding the organization and its context	45%	X		
4.2 - Understanding the needs and expectations of stakeholders	45%	X		
4.3 - Determining the scope of the AM System	29%			X
4.4 - AM System	33%		X	
5.1 - Leadership and commitment	39%		X	
5.2 - Policy	38%		X	
5.3 - Organizational roles, responsibilities, and authorities	45%	X		
6.1 - Actions to address risks and opportunities for the AM System	30%		X	
6.2 - AM Objectives and planning to achieve them	39%		X	
7.1 - Resources	45%	X		
7.2 - Competence	33%		X	
7.3 - Awareness	36%		X	
7.4 - Communication	45%	X		
7.5 - Information requirements	22%			X
7.6 - Documented Information	29%			X
8.1 - Operational planning and control	41%		X	
8.2 - Management of change	43%		X	
8.3 - Outsourcing	45%	X		
9.1 - Monitoring, measurement, analysis, and evaluation	44%		X	
9.2 - Internal audit	39%		X	
9.3 - Management review	39%		X	
10.1 - Nonconformity and corrective action	45%	X		
10.2 - Preventive action	45%	X		
10.3 - Continual improvement	35%		X	
Average	38%		X	

4.2 SUMMARY OF FINDINGS & REQUIRED ACTIONS FOR CONFORMANCE

Table 2 shows a summary of the main findings from this gap analysis by ISO 55001 Clause and summarizes the minimum actions required to achieve conformance. Table 2 is used as the starting point for the ISO 55001 Compliance Roadmap which is separate to this gap analysis report. Where findings relate to observations for improvement, but do not constitute a conformance risk, these are excluded from Table 2. These improvement opportunities will be further explored and refined as part of the enhancement programme to move THESL 'beyond ISO 55001 conformance'. Details of all findings can be found in Appendix C of this report.

Table 2 Summary of Findings and Required Actions by ISO 55001 Clause

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
4.1 - Understanding the organization and its context 45%	The organization has an organizational business plan in place which implements effective Asset Management. The alignment of AM objectives with organizational objectives is also evident. THESL's corporate strategy and associated business planning processes, including the AM Process, are guided by a set of principles that align with the utility's four corporate pillars in a balanced way that promotes customer value and a sustainable business. THESL's AM objectives are driven by relevant legislative and regulatory obligations and guidance such as the OEB's Distribution System Code ("DSC") and the Electricity Act, 1998. The corporate strategy and outcome objectives determine the overall direction for decision-making throughout the AM Process.	No further action is required for this clause, however, to enhance capability above conformance, an organizational plan must acknowledge full support for the implementation, embedding and continual improvement of the AM System.
4.2 - Understanding the needs and expectations of stakeholders 45%	THESL has leveraged its Customer Engagement results to develop an enhanced Outcomes Framework for the 2020-2024 planning horizon. This translates Toronto Hydro's expenditure plan objectives into outcome categories that matter to the utility's customers. The framework is also aligned with Toronto Hydro's four corporate pillars and the OEB's Renewed Regulatory Framework ("RRF") Outcomes. All strategic stakeholders are effectively engaged throughout the planning process to understanding their requirements and have an opportunity to provide inputs and feedback. However, these existing processes require integrating with the newly defined AM System and decision-making criteria need defining.	Undertake a systematic stakeholder analysis with respect to the newly defined AM System to define an integrated set of stakeholder requirements across the asset lifecycles. Include clear criteria for THESL's corporate Asset Management decision-making to support stakeholder needs and requirements.

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
4.3 - Determining the scope of the AM System 29%	THESL has not formally defined or documented the scope and boundaries of its AM System with respect to the implementation of the ISO 55001 Asset Management standard. The boundaries also need to consider how AM System will interact with other existing management systems. The detail of the scope needs to reflect the external and internal issues identified in 4.1, the requirements identified in 4.2, alignment with newly developed Strategic Asset Management Plan (SAMP, see 4.4) and interfaces with other existing management systems.	Define the AM System scope with respect to THESL's: ▪ organization and its relationships to its stakeholders. ▪ approaches, frameworks, and processes. ▪ Scope of distribution Asset Management areas: 1) Distribution System Assets[2] 2) Operational Buildings 3) SCADA/DATA Systems Ensure the detail of the scope reflects the external and internal issues identified in 4.1, the requirements identified in 4.2, alignment with SAMP and interfaces with other management systems.
4.4 – AM System 33%	An AM System is not yet formally established and documented. A clear interface with AM System needs to be defined with respect to functions, assets, and processes. The AM System will enable THESL to deliver, review, and continually improve its activities to achieve its organizational objectives and maximize value from its assets. THESL has not defined its Strategic Asset Management Plan (SAMP) yet as required by Clause 4.4, which includes documentation of the role of the AM System in supporting achievement of AM Objectives.	Establish the AM System in accordance with Clause 4.4. It consists of a set of interacting processes, people, and information. Describe the AM System in an AM System Manual (or descriptor document). Ensure this is achieved using existing frameworks, approaches, processes, and procedures where possible, and across all elements of THESL's organization that are within the defined AM System scope. THESL is planning to define this in the Strategic Asset Management Plan (SAMP) in 2021-2023.
5.1 - Leadership and commitment 39%	Top management pro-actively manage organizational culture to support good practice Asset Management, however there is no clear framework for delineating the key Asset Management roles. Likewise, top management have established AM policy and AM objectives that are compatible with the organizational objectives, however, they have not effectively communicated the importance of Asset Management and the requirement for conformance to the AM System consistently across the company. The specific requirements for Clause 5.1 are not yet fulfilled, however these will be fulfilled once THESL's AM System is effectively defined and communicated.	Appoint a member of THESL's top management to take ownership of the AM System. Implement a cross-functional Asset Management Governance Committee (AMGC), chaired by the owner of the AM System, which will provide a focus for Asset Management governance leading up to and after certification to ISO 55001. Link Top Management competences from Clause 5.3 into this clause.

[2] *Ref: 2B_D1 – Asset Management Process Overview*

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
5.2 - Policy 38%	Asset Management Policy is in place and owned by the Executive Vice President and Chief Engineering and Construction Officer. This policy is approved by the Policy Administration Steering Committee (PASC) who is responsible for considering the impact of the proposed policy to corporate risks. The AM Policy has not been widely distributed or understood and a review of the AM Policy will be required following the rescoping of the AM System.	Communicate and implement the existing AM Policy to ensure its awareness within THESL is raised. Plan for the AMGC (see Clause 5.1) to review, update and re-communicate the policy at least once prior to an ISO Certification Audit.
5.3 - Organizational roles, responsibilities, and authorities 45%	General roles and responsibilities for the asset related activities are defined, however for the governance of the AM System there are significant differences in opinion and lack of awareness across the organization. THESL does not have a RACI chart, however, it has alternative processes and policies in place which specify Asset Management responsibilities with expected outcomes.	Compare existing THESL departmental roles and responsibilities against the AM System defined in 4.4. Reconcile in detail existing team and personal roles and responsibilities against the requirements of the newly defined AM System and fill any gaps. Define this in a RACI which is approved by the AMGC (see Clause 5.1). Define a framework that works for THESL that delineates the key Asset Management roles i.e., seven capabilities defined by the IAM Competency Framework. Incorporate this framework into the AM System definition document and ensure the roles and responsibilities defined in that document also cover all the specific requirements of 5.1.
6.1 - Actions to address risks and opportunities for the AM System 30%	THESL has systems in place to provide assurance that capital project delivery includes actions to address the risks and opportunities facing the AM System. THESL has internal metrics to track and ensure its safety and reliability outcomes required by its external stakeholders. As part of defining the scope of AM System (as discussed in 4.3 and 4.4), THESL need to complete the risk assessment of this AM System. THESL's Enterprise Risk Management (ERM) framework has been formally approved and is aligned with the ISO 31000[3] and ISO Guide 73[4], industry best practices and the direction of its regulating agencies; however, the Asset Risk Management Framework is still not formally approved. This framework is more focused toward strategic and operational risks of the distribution assets. Risk assessment sophistication varies by business unit and individual, and they are not necessarily consistent with the draft framework. Asset related risks are assessed in order of priority *(i.e., high, medium, and low*). Risks related to litigation are also assessed.	Create an Asset Risk & Opportunity Management Framework which is consistent with the existing THESL's Corporate Risk Management Framework (and ISO 31000) and approved by the AMGC (see Clause 5.1). This framework also needs to be consistent with the requirements identified in 4.2 and 4.3. Implement the new Asset Risk & Opportunity Management Framework, ensuring full support through training, briefings and the review of all documents and processes that involve the assessment of risk. Define risk assessment and management competences within role profiles where required. Development of a 'Value Framework' is in progress. This must be consistent with the Corporate Risk Management Framework and the new Asset Risk Management Framework. Both frameworks should be used to define the business rules for consistent asset decision making.

[3] *ISO 31000 is a family of standards relating to risk management codified by the International Organization for Standardization. ISO 31000:2018 provides principles and generic guidelines on managing risks faced by organizations.*

[4] *ISO Guide 73: 2009, Risk Management Vocabulary, ICS: 01.120 Standardization.*

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
6.2 - AM Objectives and planning to achieve them. 6.2.1 AM Objectives	THESL's Outcomes Framework translates expenditure plan objectives into outcome categories: *Customer Service, Reliability, Safety, Environment, Public Policy, and Financial* The alignment of AM Objectives with organizational objectives is evident. However, the AM Objectives are not consistently SMART (*Specific, Measurable, Achievable, Realistic and Time-bound*). AM Objectives should be part of the SAMP and as already discussed in 4.4 this has not yet been defined. Strategic Asset Management Plan (SAMP) is a critical requirement for this clause to enable the development of a top-down long-term work volumes and costs.	Define a set of SMART AM Objectives that are aligned to other organizational objectives and will deliver stakeholder requirements. Ensure these meet the specific requirements of 6.2.1. and are approved by the AMGC (see Clause 5.1). Incorporate the AM Objectives into the SAMP and ensure that the SAMP defines the required frameworks, approaches and processes to develop AMPs which will deliver them. Ensure that the AM Objectives and the SAMP are fully integrated into other aspects of THESL's organization and approach.
6.2 - AM Objectives and planning to achieve them. 6.2.2 – Planning to achieve AM Objectives 39%	Capital Plan: Capital investment planning (e.g., "IPPR"[5]) is defined, embedded, and followed within THESL and there are various KPIs in place to manage deliverables. Decision-making criteria have not been explicitly defined as required by Clause 4.2. Existing and emergent investment needs are reprioritized together, ensuring some consistency in decision-making and project selection is top-down constrained by budget. THESL exceeded the conformance score in one of the sub-criteria of this clause, covering budget planning and approval processes required to deliver the AMP, however this plan does not cover the entire asset lifecycle stages. AMPs should also be focused on AM Objectives and newly developed SAMP soon. Maintenance Plan: Maintenance requirements analysis (MRA) process is in place and well documented, THESL use reliability engineering tools i.e., FMECA, RCA, RCM etc. to optimize their inspection, maintenance and intervention regimes, however, THESL does not appear to have fully defined the quality requirements for these processes. This is one of the AM System requirements. Some asset plans are based on unit cost models, however it's not consistent across the asset base. Existing unit cost models need to be updated on an ongoing basis using actual cost data to ensure that up-to-date models can be developed. These plans also need to cover the entire lifecycle stages and associated risks and unit costs.	Develop AM plans which will achieve the AM objectives, in a way that is consistent with the approach set out in the SAMP. Ensure these plans detail planned activities to the assets across their lifecycles, and activities to develop the capability of the AM System. The plans should meet the requirements of Clause 6.2.2 and include work volumes, costs, resources, timescales and milestones, and the financial and non-financial implications of these activities. It is recommended to have asset class strategies for key asset types such as transformers, overhead poles, operational buildings etc. A 'Value Framework' is currently being developed which will drive improvements in organization-wide decision making. THESL's Outcomes Framework must be consistent with the 'Value Framework'. Existing Process for Data Production and Quality Assurance need to be consistent and traceable. Apply the same rigour for their data for their internal decision making.

[5] *Investment Planning and Portfolio Reporting (IPPR)*

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
6.2 - AM Objectives and planning to achieve them. 6.2.2 – Planning to achieve AM Objectives 39%	There is very limited alignment between the existing AM strategies (which are not formalized as SAMP) and lifecycle value approaches. Technology Plan: A technology plan is in development e.g., smart metering, grid modernization etc. This will enable them to leverage trends and changes in technology to improve its AM capability. Resilience Plan: There is no defined framework for the analysis of Asset Resilience. Resilience cover four 'R's. i.e., Redundancy (*e.g., system design that allows for operational flexibility*), Resistance (*e.g. the ability of the system to withstand external demands without degradation or loss of functionality*), Responsiveness (*e.g., the ability to mobilize and sustain services in emergencies*) and Recovery (*e.g., the speed with which disruption can be resolved and the site returned to normal operation*). Sustainability Plan: THESL considers the impact of Climate Change on its system as well as reducing environmental risk by eliminating PCB's by 2025.	
7.1 - Resources 45%	There is top management commitment to providing the resources required to deliver plans and a resourcing strategy is in place to defines the approach to resourcing activities. A Resource Balancing Tool is used to develop all resource plans enabling THESL to maximize utilization of its resources and to use internal staff for most of the work. Resources are planned and sufficient for the current technical delivery requirements; however, they may not be sufficient to support future AM System requirements. THESL need to identify the resources for the establishment, implementation, maintenance and continual improvement of Asset Management activities i.e., meeting the AM Objectives and implementing the AM Plan. Fixed resources are defined on an annual basis using 10+ years of historical data based on outages. Financial planning supports operational planning to balance workforce continuity with the resourcing strategy and includes an assessment of risk associated with deferring work due to resourcing constraints. Inventory and spares are managed reactively. Consumption patterns are reviewed quarterly for consumption, vendor performance on time delivery, shortage issues along with cost of holding inventory.	Include resourcing of the AM System in the scope of the Resourcing Strategy and identify resources required to establish, implement, maintain, and continually improve the AM System (including delivery of AMPs / AM Objectives). Ensure any gaps are addressed prior to the Certification Audit by the AMGC (see Clause 5.1). Define the resources required to deliver the AM Objectives as defined in the AMP, utilizing the AM competence requirements defined in 5.1, 5.3, 7.1 and 7.2 next and reconcile existing resourcing levels against this.

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
7.2 - Competence 33%	THESL have good process in place to assess technical competence. There are adequate programmes available to enable staff to develop their technical competence. THESL's talent management strategy is tied-up to the headcount data managed from HR, contract management and procurement plan. Contractors manage their own training compliance processes. THESL has technical competency Management System inhouse such as Professional Engineer (P.Eng) License, however there are no specific AM Competencies defined to meet current and future Asset Management needs. For example, competency required to develop the whole life cost models or an Information Management System.	Build on the existing approaches to develop a Competence Management System for core and functional competences, ensuring that AM Competences required to deliver the AM Objectives are included and fully integrated for the development of THESL Asset Management capabilities. Develop a list of the AM Competence required to deliver the activities within the AM System (use a good practice framework like the IAM's if needed). Align these to the RACI developed in 5.3 and define the competences for each job role. Update job descriptions to reflect the new AM competency requirements and incorporate these into the existing CMS. Build approaches to developing AM Competences (training, IAMcert, DipIAM, Expert Coaching, Mentoring, RAMP[6] etc.)
7.3 - Awareness 36%	Asset Management awareness is limited outside the core team. There is a perception that Asset Management is something that the Asset Management department does rather than an enterprise-wide management system. All staff are not aware of their specific roles in Asset Management hence there is an impact on their contribution to the effectiveness of the Asset Management activity.	Ensure that the Asset Management improvement plan is clearly communicated to all those within the scope of the AM System. Develop a training programme to increase understanding across the business of how different departments contribute to achieving the AM Objectives.
7.4 - Communication 45%	External communication channels are good and engagement with customers and regulators is well controlled. THESL internal communication relevant to Asset Management activity is limited outside the core team, impacting the awareness score as described earlier in 7.3. AM Policy is in place, but not communicated consistently outside the core team.	Develop and implement a plan for communicating relevant Asset Management information to all internal stakeholders. Communication plans are needed to increase awareness outside of the Asset Management team once the relevant documents and AM System has been developed. Ensure the AMGC takes ownership of these communication plans with respect to approval and monitoring.

[6] *Registered Asset Management Professional*

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
7.5 - Information requirements 22%	Asset Management information requirements have not been defined across all Business Units within THESL. For example, the requirements for aligning the information in the financial Fixed Asset Register and Physical Asset Register have not been defined. Asset lifecycle Information requirements and criteria are not mapped to the decision-making process e.g., renewal, maintenance strategies, disposal planning, etc. Asset Information Standards are not well defined. No logical data model exists which can be aligned with asset information needs. THESL specifies information it requires contractors to collect and audits them, however when the requirements are not specified (for example 'As-Built' data), contractors collect information based on their understanding and judgement. Inconsistent reports were noted during the assessment on the quality of the data being collected. This suggests that the information THESL specifies may be inconsistent.	Ensure the requirements for data collection and quality are defined for all assets and for all activities within the AM System in accordance with the requirements of Clause 7.5. Asset information requirements should extend to the requirements for the alignment of financial and non-financial information (specifically the financial and non-financial asset registers). Define and implement plans to rectify any gaps in these requirements. Consider using the requirements analysis and plan as the basis for an Asset Information Strategy that also consider broader asset information management needs, including requirements sufficient to guide all existing and future asset information development activities including technology and systems investments.

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
7.6 - Documented Information 29%	There are good data governance processes covering regulatory reportable data with defined owners and verification. However, non-regulatory data captured during the capital and maintenance delivery process is not as well controlled or defined. For example, for unit cost data, newly installed asset attributes and geolocations there is no defined data governance, owners, verification, and subsequent data standards. Also, no information requirements are defined (see 7.5), hence quality, consistency, and validity of data varies. A Data Population Plan does not appear to exist, so data collection and analysis is ad-hoc and not according to a consistent integrated approach. Data and information are maintained in several locations including off-line spreadsheets. It is important to understand that the relevant data should be available in timely manner should you required it to make informed decisions. Each individual area of the business has a particular asset register. Technical standards are managed in a systematic manner. However, the dependence on delivery contractors defining information for input into the Maintenance Management Systems means THESL may or may not get the information it requires. Another challenge is related to the control of asset documentation. This has a significant impact on the asset lifecycle stages handover process and risk of missing data and/or delays in updating asset and operational records. When new assets go into service, data is collected using paper-based equipment changeout forms. A pilot project has been on-going to digitize this form to capture asset and operational data and minimize errors, inconsistencies, and missing information.	Review in detail the documented information required by the following, and ensure all documented information is relevant and controlled: • ISO 55001 • THESL's legal and regulatory requirements • The AM System (*other than those identified above*) Review the specific requirements of 7.6 against THESL's current documentation control systems. These specific requirements cover general requirements, when creating and updating documented information and control of these documented information. Implement the plan to rectify any deficiencies in THESL's asset information requirements, or the full Asset Information Strategy defined in 7.5. A consolidated asset register should be established and configured to collect/manage data and information in accordance with the asset information strategy and standards.

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
8.1 - Operational planning and control 41%	Overall, THESL has developed its capital programs to maintain and improve reliability and safety, meet service and compliance obligations, address load capacity and growth needs, improve contingency constraints, or make necessary day-to-day operational investments. The choices made by the utility reflects a balance between customer preferences, affordability, and prioritized outcomes with the overriding objective of delivering value for money. An effective methodology for the management of capital program is in place including regular reports on the performance of the program. Operational planning and control of capital delivery is an example of good practice and is well embedded. Standards and procedures containing the maintenance and inspection regimes (including defect codes) for all assets are in place. Similarly, shutdown & outage planning processes are in place which enable the strategic optimization of access plans. The systems engineering approach does not enable effective alignment of business case benefits into project requirements and therefore benefits realization is not robust. Baseline configuration is established in the basic asset register; but not through a systematic commissioning and change management processes.	No actions are required for the delivery of capital plans. THESL will need to be able to demonstrate that capital delivery processes are adhered to during a certification audit. For other areas of operational planning and control (including operations, maintenance and shutdown management) it is recommended that THESL verify that for each area processes are defined and followed reliably prior to the certification audit. THESL needs to clearly identify the criteria, information and processes required to control operations, and provide sufficient assurance that they are operating the assets in accordance with these. It is suggested this be included in the asset class strategies for key asset types such as transformers, overhead poles, operational buildings etc. Design and implement annual planning requirements in accordance with the SAMP and clause 6.2; monthly reporting requirements in accordance with clause 9.1; transparent risk assessment and management in accordance with clause 6.2.2; and regular review of the achievement of AM Objectives.
8.2 - Management of change 43%	An overall organisational 'Change Management Framework' on organizational change or system change has not been defined, however, clear 'approval for modification' and project change control processes exist which could be utilised once the AM System is defined. Project requirements and benefits are not validated against original business case requirements.	Define an overall risk-based change management framework based on existing approaches and external good practice. Ensure this approach includes the identification and management of all changes within THESL in the most appropriate way, for example: • Managing day-to-day change (such as asset or project changes) through embedded processes. • Managing medium-scale changes (such as minor organizational or system implementation changes) through specific projects and good practice guidelines. • Managing major changes (such major organizational redesign) through specific programmes under the authority of the AMGC.
8.3 - Outsourcing 45%	A sourcing strategy is in place that defines THESL's approach to outsourcing its activities. Existing procurement and supply chain processes deliver products and services that effectively support delivery of the organization's AM Objectives including the ability to adapt to a changing workload. THESL validate the capabilities of their suppliers prior to any kind of engagement. Reliability growth plans are not documented where a large majority of work is outsourced.	No actions are required for the management of general outsourcing arrangements (for example contracts and suppliers), however outsourcing agreements would benefit from a review against the information requirements from the supply chain (see clauses 7.5 & 7.6).

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
9.1 - Monitoring, measurement, analysis, and evaluation 44%	In developing its approach to performance measurement, THESL considered the OEB's guidance, including the Renewed Regulatory Framework for Electricity Distributors ("RRF"). THESL is proposing 15 custom measures for the 2020-2024 plan period. These measures are incremental to the measures contained in the Electricity Distributor Scorecard ("EDS") and the Electricity Service Quality Requirements ("ESQR"), for a total of 44 measures reported to the OEB annually[7]. THESL monitor and manage the overall maintenance plan against output (lagging) KPIs but have not considered the systematic monitoring, measurement, analysis, and evaluation of leading indicators to assure achievement of KPIs. Financial outcomes are monitored and reviewed on a regular basis by analysing underlying trends. An Asset Condition Assessment model is used to derive an asset health index. The maturity of the AM system is not periodically assessed/reviewed against agreed good practice targets.	Build on the proposed measures with a focus onleading indicators (which appear to be deficient). Build capability to periodically monitor the AM System capability. Ensure monitoring, measurement, analysis, and evaluation is effectively targeted across the AM System scope and balanced to meet the requirements of the AM System and the achievement of THESL's AM objectives (see clause 7.5). Ensure the AMGC has an overview of all key performance indicators. Consider (it is not a requirement) implementation of a Performance Management Framework and stringent overview by the AMGC. Ensure these are aligned to the requirements detailed under 8.1 and 8.3.
9.2 - Internal audit 39%	Internal audit of the specific scope of the AM System is not in place. THESL's internal audit process uses known risks and ensures the use of competent auditors. Audit findings are monitored and reviewed by the internal audit team. A risk-based process for defining an audit plan is in place. The ERP group provide input to the 3-year audit plans.	Establish an overall audit plan for the scope of the AM System. Build on existing plans and resources where possible, drawing on the existing internal audit team to support this. Ensure the audit plan is reviewed and approved by the AMGC and that the outputs of audit activity are reported and actioned as required by the AMGC. Ensure that however is managing the compliance audit be it internal audit or third-party external auditors that they are trained as per best industry standards.
9.3 - Management review 39%	Formal management review and performance management framework is in place, although this is not focused on the scope of the AM System. Systematic review of performance indicators and other information is undertaken periodically; however due to the issues identified under clause 7.5 and 7.6, information inconsistencies may affect these management reviews.	Establish an overall AM System management review framework for periodic review of the overall AM System. Build on the existing review and performance management framework where possible and focus this on the scope of the AM System defined in Clause 4.3 and 4.4. Ensure the AMGC has full accountability for management review activities including input from risk assessments, audits and performance indicators and reports. Consider adopting a 'management review' calendar which defines the review and approval cycles for all key AM System artefacts (such as AM Policy, Objectives, SAMP and AMPs).

[7] *Ref: 2B_C_Performance Measurement*

AMCL

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
10.1 - Nonconformity and corrective action 45%	THESL effectively identify and prioritize reactive work. There is a process in place to identify root causes of non-conformances, faults, failures, and defects and to identify appropriate mitigations measures. Nonconformity and corrective / preventive action with respect to the AM System does not yet exist, but it is anticipated that the existing QMS capabilities and scope will provide a solid foundation for this. THESL's fault response resources are in place with defined responsibilities and effective communication. THESL review and report the lessons learned from faults and incidents. A prioritized list of preventive and corrective actions is tracked, analysed, and reported to all relevant Management Review meetings. Risks and opportunities inherent in field activities are pro-actively identified and managed.	Establish a process for recording, prioritizing, and managing nonconformities and corrective actions resulting from implementing and monitoring the AM System. Collate good practices together and put in into the AM system manual while ensuring the process is outlined in detail and systematically. Define further written processes, if required. Develop an overall framework for description in the AM Manual (see Clause 4.4)
10.2 - Preventive action 45%	Operators identify potential failures in asset performance at the monthly meetings and preventive actions are agreed there. There is evidence of a proactive risk identification culture within field/operational staff. Preventive and corrective actions are tracked in a single, accessible system for periodic reporting. Owners are allocated and regular reports from the system enable tracking of the actions to closure.	Establish a process for recording, prioritizing, and managing preventive actions resulting from implementing and monitoring the AM System. Collate good practices together and put in into the AM system manual while ensuring the process is outlined in detail and systematically. Define further written processes, if required.

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
10.3 - Continual improvement 35%	Top management encourage a culture of collaborative continual improvement and provide a clear focus on achievement of the Asset Management Strategy and Objectives. A culture of continual improvement is evident from existing and upcoming programs i.e., Enhanced Outcomes Framework for the 2020-2024 planning horizon. THESL has transitioned from the Asset Condition Assessment (ACA) methodology originally adopted in 2008 to a model that provides more accurate and comprehensive condition-based analytics, and better supports longer-term expenditure planning. THESL is currently developing a data warehouse to streamline data access and perform "big data" calculations that can support planning and system investment strategies, alongside deploying new data blending and analytics software. The existing enterprise systems are to be consolidated into one system (ERP System) so that data integrity can be improved. This will provide teams across THESL access to one system with accurate and up-to-date information. Tactical contingency plans are created, implemented, tested, and continually improved in accordance with the agreed processes and AMPs are modified accordingly. The resilience Analysis process is incomplete. It is evident from the current ISO 55000 gap analysis, development of roadmap exercise and aspiration for the certification that THESL intend to enhance their existing capabilities and mature their practices.	Establish continual improvement of the AM System and make it an integral activity defined in the AM System definition document. Implement and maintain a CI Register for the AMGC for CI opportunities identified through management review. Ensure each section of the AM System Manual include a short sentience on how the clause is continually improved and who is accountable. Ensure that a Plan-Do-Check-Act cycle is always followed and formulating an AM system manual. THESL should have the ability to demonstrate that they are doing improvements continually and in a timely manner.

5. CONCLUSIONS & RECOMMENDATIONS

5.1 OVERALL CONCLUSIONS (DISTRIBUTION ASSETS)

The overall conclusion of this gap analysis is that the fundamental requirement of ISO 55001 to ‘establish, implement, maintain and continually improve an Asset Management System, including the processes needed and the asset information requirements’ is not met.

There is currently no overall Asset Management governance structure within THESL to own, deliver and be accountable for the Asset Management System. To meet the overall requirement THESL top management will need to take a strong position on governance along with accountability for putting a clear AM structure in place and clearly defining roles and responsibilities to people managing the process. The lack of a defined AM System along with undefined roles and responsibilities with respect to Asset Management, result in significant risks to compliance with the ISO 55001, and will require some changes to THESL’s existing approach for Asset Management. This will be specified in more detail in the ISO 55001 compliance Roadmap.

The gap analysis assessment has concluded that there are eight (8) clauses where THESL appears to be currently compliant, fourteen (14) where compliance is potentially ‘at risk’, and three (3) where it appears to be non-compliant. These are summarised in Table 2.

The three (3) non-compliant clauses reflect the lack of a clearly defined AM System and its core AM documentation (e.g., Strategic Asset Management Plan (SAMP), SMART Objectives and Plans) along with explicitly defined information and documentation requirements.

The fourteen (14) clauses where compliance is potentially ‘at risk’ reflect the lack of a clear communication about the Asset Management requirements, no clear framework for delineating the key AM roles, no specific AM Competency Framework, and the analysis of asset resilience. THESL do not appear to validate project requirements and benefits against the original business case requirements. An overall change management approach has not been defined with respect to the AM System.

It is our opinion that all the compliance issues identified in this gap analysis can be rectified at the end of 2023 providing the required actions summarized in Section 4.3 and detailed in Appendix C are put into effect. Some of the existing and upcoming planned business improvement projects will develop many of the key building blocks towards compliance but THESL will need to implement these and demonstrate that the AM System is embedded before it can demonstrate compliance with the requirements of ISO 55001.

Summary of non-distribution assets is discussed in the Appendix under Additional Findings

5.2 RECOMMENDATIONS

It is recommended that THESL undertakes the following activities:

1. Implement a cross-functional Asset Management Governance Committee (AMGC) which will be chaired by an Executive Vice President accountable for the AM System and take responsibility to 'establish, implement, maintain and continually improve an AM System as required by ISO 55001.
2. Develop a clear scope and definition of its AM System that is independent of the elements of the system itself. This should define the overall framework for the AM System, and act as a 'signpost' document to existing or newly developed elements.
3. Develop a Strategic Asset Management Plan (SAMP) which includes THESL's AM Objectives and the strategic plan to deliver these over an appropriate timescale. This core documentation should demonstrate clear alignment between THESL's organizational goals from above) and the AM Plans (below).
4. Develop and establish the information requirements necessary to support the AM System and delivery of the AM Objectives.
5. Implement all other required actions summarised in Table 2 and detailed in Appendix C of this report, ensuring a focus on the newly defined AM System when implementing all recommended activities.
6. There are eight (8) clauses where THESL appears to be currently compliant. Although no further action should be required with respect to ISO 55001 compliance, it is still recommended that THESL validates this and ensures it will be able to demonstrate compliance during an ISO 55001 certification audit.

APPENDICES

Appendix A ADDITIONAL FINDINGS (NON-DISTRIBUTION ASSETS)

This section summarises high-level shortfalls related to non-core assets of distribution system:

- THESL's Asset Management policy states that it does not apply to fleet, tools, facilities, or IT assets. Develop, approve, communicate, implement, and review a revised Asset Management policy to cover all assets.
- For non-core assets, they should develop Asset Class Strategies as supplementary sections or appendices to the overall Strategic Asset Management Plan (SAMP) once it is completed.
- THESL has currently not defined or documented the scope and boundaries of AM System. They have not defined the non-core asset portfolio covered by the scope of AM System. They need to consider the external and internal issues related to these assets including their existing management systems.
- When planning for the non-distribution AM system, THESL need to determine the risks, assess their impacts, mitigation treatment approaches and opportunities that need to be addressed to give assurance that the updated AM system (for all assets) can achieve its intended outcomes to prevent, or reduce undesired effects and achieve continual improvement.
- THESL need to integrate planning activities with non-core assets and ensure consistent evaluation and prioritization of investment and funding needs.
- THESL need to consider non-core asset related risks in the organization's risk management approach.
- THESL need to determine the required current and future resources necessary to manage non-core assets performance.
- The lack of clarity around asset information requirements covers all assets. THESL need to ensure that the asset information strategy contains the requirements for all assets.

- The extent of the documented information for non-core assets can differ as compared to core assets, however THESL AM system shall include documented information required by international standard, applicable legal and regulatory requirements and as being necessary for the effectiveness of the Asset Management activities.

- THESL need to determine and document their outsourcing activities for non-core assets and monitor asset performance and processes for sharing of knowledge and information related to these assets.

- THESL shall evaluate and report on the financial and non-financial performance of these assets, and how this influences overall risk-based decision-making criteria.

Appendix B GAP ANALYSIS INTERVIEW SESSIONS

Interviewee[8]	Interview Date
General Manager, Engineering	2020-10-06 2020-10-07 2020-10-08 2020-10-15
Manager, Engineering Services	2020-09-18 2020-10-01 2020-10-05 2020-10-06
Director, Regulatory Applications and Business Support	2020-09-24 2020-09-25
Manager, Regulatory Applications	2020-09-29
General Manager, Distribution Grid Operations and Emergency Management	2020-09-21
Controller	2020-09-18
Supervisor, Capital Planning	2020-09-18
Director, IT Portfolio Management	2020-09-22
Manager, Warehouse Management & Fleet Services	2020-09-28
Manager, Facilities and Building Security Operations	2020-09-17 2020-09-23
Director, Organizational Effectiveness	2020-09-28
Director, Talent Management	2020-10-06 2020-10-08
Manager Communication, Media & Public relations	2020-09-24
Supervisor, Financial Planning	2020-09-24

[8] *Organizational structure as of September 2020*

Interviewee[8]	Interview Date
Director, Sustainability & Training	2020-09-25
Manager, Grid Systems and Analytics	2020-09-29 2020-10-16
Director, Control Center	2020-09-21
Manager, Dispatch & Grid Emergency Management	2020-09-21
General Manager, Power System Services	2020-10-23
General Manager, Customer Care	2020-10-26
Director, Streetlighting Operations & Conservation and Demand Management	2020-10-21
Manager, Enterprise Risk Management & Policy	2020-09-30
Director, Standards & Technical Studies	2020-10-16
Director, Investment Planning	2020-09-30
General Manager, Design & Construction	2020-10-09
Manager, Capital Planning & Reporting	2020-09-18
Director, Corporate Account & External Reporting	2020-10-29
Director, Internal Audit & Compliance	2020-10-07
Director, IT Infrastructure Operations	2020-10-06
Supervisor, Engineering Services (John Piroli)	2020-10-20
Director, Project Management Offices	2020-10-26
Director, Enterprise Architecture and Cyber Security	2020-10-08
Manager, Supply Chain Services	2020-10-07
Director, Distribution Stations	2020-10-28
Director, Environmental, Health & Safety	2020-10-16
Director, Enterprise Project Management & Development	2020-11-09

Appendix C DETAILED ASSESSMENT AGAINST ISO 55001 'SHALL' STATEMENTS

AMCL is assessing THESL's conformance to each of the ISO 55001 clauses through a strict interpretation of the 71 'shall' statements. ISO/IEC Directives – Part 2 – Rules for the structure and drafting of International Standards, define 'shall' as:

- [Shall] shall be used to indicate requirements strictly to be followed to conform to the document and from which no deviation is permitted.

<table>
<tr><th colspan="4">4.1 Understanding the organisation and its context</th></tr>
<tr><td>Requirement</td><td colspan="3">A) The organisation <u>shall</u> determine external and internal issues that are relevant to its purpose and that affect its ability to achieve the intended outcome(s) of its AM System.</td></tr>
<tr><td>Observations:</td><td colspan="3">THESL's corporate strategy and associated business planning processes, including the AM Process, are guided by a set of principles that align with the utility's four corporate pillars i.e., Customer, Operations, People, and Financial – in a balanced way that promotes customer value and a sustainable business. These principles are an essential element in the determination and prioritizations of outcomes.

THESL's AM objectives are to a large extent driven by relevant legislative and regulatory obligations and guidance such as the OEB's Distribution System Code ("DSC") and the Electricity Act, 1998. The corporate strategy and outcome objectives determine the overall direction for decision-making throughout the AM Process.

Investment Planning and Portfolio Reporting is their system investment planning cycle process, which includes both long-term and short-term planning horizons. It is composed of four sets of activities: Principles, Strategies and Outcomes Development, Asset Needs Assessment, Portfolio Planning and Reporting.</td></tr>
<tr><td>Conclusion:</td><td>☒ Compliant</td><td>☐ At risk</td><td>☐ Non-compliant</td></tr>
<tr><td>Action status:</td><td colspan="3">☒ No action required.

☐ Action required:</td></tr>
</table>

4.1 Understanding the organisation and its context			
Requirement	**B) AM Objectives, included in the strategic Asset Management plan (SAMP), *shall* be aligned to, and consistent with, the organizational objectives.**		
Observations:	The organization has an organizational business plan in place which implements effective Asset Management. The alignment of AM objectives with organizational objectives is also evident.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☒ Recommendation for further improvement: ☐ Action required: No further action is required for this clause, however, to enhance THESL's capability above conformance, THESL's organisational plan must acknowledge full support for the implementation, embedding and continual improvement of the AM System.		

4.2 Understanding the needs and expectations of stakeholders			
Requirement	**The organization *shall* determine:** • the stakeholders that are relevant to the AM System; • …		
Observations:	THESL has roles and responsibilities defined and effectively implemented for external stakeholder engagement. Customer Engagement results were used to develop an enhanced Outcomes Framework for the 2020-2024 planning horizon which translates THESL's expenditure plan objectives into outcome categories that matter to the utility's customers. The framework is also aligned with the four corporate pillars and the OEB's Renewed Regulatory Framework ("RRF") Outcomes; structured around the following six outcome categories: Customer Service, Reliability, Safety, Environment, Public Policy, and Financial. Beyond its mandated service and conformance obligations, the broader objective of their AM process is to realize sustainable value from their assets for the benefit of customers and stakeholders. This requires continuously balancing near-term customer preferences with the need to ensure predictable performance and costs over the long-term for both current and future customers. THESL's regulatory team engage with regulatory bodies on technical standards. THESL's proactive public communications include incentivizing customers to move to a paperless billing. Their customer operations communications team deal with planned supply interruptions. A digital comms team manages the social media accounts e.g., Twitter being the main channel with around 150k followers. All customer contacts are classified for reporting purposes (complaints, billing enquiries, etc.). Also, the outage map is published on the company website and a subscribed email notification service is also available.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☒ Recommendation for further improvement: ☐ Action required: Undertake a systematic stakeholder analysis with respect to the newly defined AM System to define an integrated set of stakeholder requirements across the asset lifecycles. Include in these clear criteria of THESL's corporate Asset Management decision-making to review stakeholder needs and requirements.		

4.3 Determining the scope of the AM System			
Requirement	**The organization *shall* determine the boundaries and applicability of the AM System to establish its scope. The scope *shall* be aligned with the SAMP and the Asset Management policy. When determining this scope, the organization *shall* consider:** **— the external and internal issues referred to in 4.1;** **— …**		
Observations:	All strategic stakeholders are effectively engaged throughout the planning process to understanding their requirements and have an opportunity to provide inputs and feedback. THESL has not formally defined or documented the scope and boundaries of its AM System with respect to the implementation of the ISO 55001 Asset Management standard. The boundaries also need to consider how AM System will interact with other existing management systems. The detail of the scope needs to reflect the external and internal issues identified in 4.1, the requirements identified in 4.2, alignment with newly developed Strategic Asset Management Plan (SAMP, see 4.4) and interfaces with other existing management systems.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Define the AM System scope with respect to THESL's organisation and its relationships to its stakeholders. Ensure the details of the scope reflects the external and internal issues identified in 4.1 and the requirements identified in 4.2.		

4.3 Determining the scope of the AM System

Requirement	**The organization *shall* define the asset portfolio covered by the scope of the AM System. The scope *shall* be available as documented information.**		
Observations:	The boundaries need to be defined with respect to organization, geography, and technical (scope of physical assets). The detail of the scope needs to reflect the alignment with SAMP and interfaces with other management systems.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Define the AM System scope with respect to THESL's: • organization and its relationships to its stakeholders. • approaches, frameworks, and processes. • Scope of distribution Asset Management areas: 1) Distribution System Assets 2) Operational Buildings 3) SCADA/DATA Systems Ensure the detail of the scope reflects the external and internal issues identified in 4.1, the requirements identified in 4.2, alignment with SAMP and interfaces with other management systems.		

4.4 AM System			
Requirement	**The organization *shall* establish, implement, maintain and continually improve an AM System, including the processes needed and their interactions, in accordance with the requirements of this International Standard.**		
Observations:	An AM System is not yet formally established and documented. A clear interface with AM System needs to be defined with respect to functions, assets, and processes. The AM System will enable THESL to deliver, review, and continually improve its activities to achieve its organizational objectives and maximize value from its assets. Although THESL has set of interactive processes in place e.g., Investment Planning & Portfolio Reporting process (IPPR), ERP, Enterprise risk management framework, however they are not integrated and/or aligned with the AM policy e.g., system and capacity planning are not streamlined into a single processes and practice etc. THESL has not currently defined clear interfaces for AM system with respect to functions, assets, and processes.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Establish the AM System in accordance with Clause 4.4. It consists of a set of interacting processes, people, and information. Describe the AM System in an AM System Manual (or descriptor document). Ensure this is achieved using existing frameworks, approaches, processes, and procedures where possible, and across all elements of THESL's organization that are within the defined AM System scope.		

4.4 AM System			
Requirement	**The organization *shall* develop a SAMP which includes documentation of the role of the AM System in supporting achievement of the AM Objectives.**		
Observations:	THESL has not defined its Strategic Asset Management Plan (SAMP) yet as required by Clause 4.4, which includes documentation of the role of the AM System in supporting achievement of AM Objectives.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: THESL is planning to define its Strategic Asset Management Plan (SAMP) between 2021-2023.		

<table>
<tr><th colspan="4">5.1 Leadership and commitment</th></tr>
<tr><td>Requirement</td><td colspan="3">Top management <u>shall</u> demonstrate leadership and commitment with respect to the AM System by:
• ensuring that the Asset Management policy, the SAMP and AM Objectives are established and are compatible with the organizational objectives;
…</td></tr>
<tr><td>Observations:</td><td colspan="3">Top management pro-actively manage organizational culture to support good practice Asset Management, however there is no clear framework for delineating the key Asset Management roles.
Likewise, top management have established AM policy and AM objectives that are compatible with the organizational objectives, however, they have not effectively communicated the importance of Asset Management and the requirement for conformance to the AM System consistently across the company.
The specific requirements for Clause 5.1 are not yet fulfilled, however these will be fulfilled once THESL's AM System is effectively defined and communicated.</td></tr>
<tr><td>Conclusion:</td><td>☐ Compliant</td><td>☒ At risk</td><td>☐ Non-Compliant</td></tr>
<tr><td>Action status:</td><td colspan="3">☐ No action required.
☒ Action required:
Appoint a member of THESL's top management to take ownership of the AM System.
Implement a cross-functional Asset Management Governance Committee (AMGC), chaired by the owner of the AM System, which will provide a focus for Asset Management governance leading up to and after certification to ISO 55001.
Link Top Management competences from Clause 5.3 into this clause.
Define a framework that works for THESL that delineates the key Asset Management roles i.e., seven capabilities defined by the IAM Competency Framework.
Incorporate this framework into the AM System definition document and ensure the roles and responsibilities defined in that document also cover all the specific requirements of 5.1.</td></tr>
</table>

5.2 Policy			
Requirement	**Top management *shall* establish an Asset Management policy that:** **— is appropriate to the purpose of the organization;** **— …**		
Observations:	Asset Management policy is in place and owned by the Executive Vice President and Chief Engineering and Construction Officer.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☐ Action required:		

5.2 Policy			
Requirement	**The Asset Management policy *shall*:** **— be consistent with the organizational plan;** **— …**		
Observations:	This policy is approved by the Policy Administration Steering Committee (PASC) who is responsible for considering the impact of the proposed policy to corporate risks. The AM Policy has not been widely distributed or understood and a review of the AM Policy will be required following the rescoping of the AM System.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Communicate and implement the existing AM Policy to ensure its awareness within THESL is raised. Plan for the AMGC (see Clause 5.1) to review, update and re-communicate the policy at least once prior to an ISO Certification Audit.		

5.3 Organizational roles, responsibilities and authorities

Requirement	**Top management *shall* ensure that the responsibilities and authorities for relevant roles are assigned and communicated within the organization.**		
Observations:	General roles and responsibilities for the asset related activities are defined, however for the governance of the AM System there are significant differences in opinion and lack of awareness across the organization.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☒ Recommendation for further improvement: ☐ Action required: Compare existing THESL departmental roles and responsibilities against the AM System defined in 4.4. Define a framework that works for THESL that delineates the key Asset Management roles i.e., seven capabilities defined by the IAM Competency Framework. Incorporate this framework into the AM System definition document and ensure the roles and responsibilities defined in that document also cover all the specific requirements of 5.1.		

5.3 Organizational roles, responsibilities and authorities			
Requirement	**Top management *shall* assign the responsibility and authority for:** **— establishing and updating the SAMP, including AM Objectives;** **— …**		
Observations:	THESL does not have a RACI chart, however, it has alternative processes and policies in place which specify Asset Management responsibilities with expected outcomes.		
Conclusion:	☒ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☒ No action required. ☒ Recommendation for further improvement: ☐ Action required: Reconcile in detail existing team and personal roles and responsibilities against the requirements of the newly defined AM System and fill any gaps. Define this in a RACI which is approved by the AMGC (see Clause 5.1). Refer to the 'IAM Competences Framework' for seven key roles for guidance. Also use this as basis for recruitment, selection, professional development, and training.		

6.1 Actions to address risks and opportunities for the AM System			
Requirement	**When planning for the AM System, the organization *shall* consider the issues referred to in 4.1 and the requirements referred to in 4.2 and determine the risks and opportunities that need to be addressed to:** **— give assurance that the AM System can achieve its intended outcome(s);** **— …**		
Observations:	In general, THESL has good approaches in place to provide assurance that the delivery of capital projects includes actions to address the risks and opportunities facing the AM System. THESL has internal metrics to track and ensure its safety and reliability outcomes required by its external stakeholders. As part of defining the scope of AM System (as discussed in 4.3 and 4.4), THESL need to complete the risk assessment of this AM System. Asset related risks are weighted in order of priority (i.e., high, medium, and low). For example, public safety is the highest risk category and hence a top priority.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Create an Asset Risk & Opportunity Management Framework which is consistent with the existing THESL's Corporate Risk Management Framework (and ISO 31000) and approved by the AMGC (see Clause 5.1). This framework also needs to be consistent with the requirements identified in 4.2 and 4.3. Development of 'Value Framework' is in progress which will enable investment to be prioritized to deliver highest value and prevent or reduce undesired effects and achieve continual improvement. This Value Framework must be consistent with the Risk Management Framework.		

6.1 Actions to address risks and opportunities for the AM System			
Requirement	**The organization *shall* plan:** **— actions to address these risks and opportunities, taking into account how these risks and opportunities can change with time;** **— …**		
Observations:	The Enterprise Risk Management (ERM) framework has been formally approved and is aligned with the ISO 31000 and ISO Guide 73. Risk assessment sophistication varies by business unit and individual and they are not necessarily its alignment with the framework. In fact, this framework is more focused toward strategic and operational risks of the distribution assets.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Implement the new asset risk management framework, ensuring full support through training, briefings and the review of all documents and processes that involve the assessment of risk. Define risk assessment and management competences within role profiles where required. In conjunction with key stakeholders define how the risk management framework will support the creation of risk-based plans for all stages of the asset lifecycle. Ensure this is incorporated into the SAMP.		

6.2.1 AM Objectives			
Requirement	**The organization *shall* establish AM Objectives at relevant functions and levels. When establishing its AM Objectives, the organization *shall* consider the requirements of relevant stakeholders and of other financial, technical, legal, regulatory and organizational requirements in the Asset Management planning process.**		
Observations:	THESL's Outcomes Framework translates expenditure plan objectives into outcome categories: Customer Service, Reliability, Safety, Environment, Public Policy, and Financial. These objectives are not consistently SMART. The alignment of AM Objective with organizational objectives is evident from their regular collaboration.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: Ensure all objectives are written in the SMART format and clarify where these are not. Formally issue and brief out the AM Objectives (as part of the SAMP). Ensure these AM Objectives are aligned to other organizational objectives and will deliver stakeholder requirements. Ensure these meet the specific requirements of 6.2.1.		

6.2.1 AM Objectives			
Requirement	**The AM Objectives *shall*:** **— be consistent and aligned with the organizational objectives;** **— …**		
Observations:	THESL uses the output from the 1) Principles, Strategies and Outcomes Development, 2) Asset Needs Assessment and 3) Portfolio Reporting to develop capital and maintenance investment plans. Decision-making criteria are not defined in alignment with AM objectives. Unprioritized asset needs identification processes are insufficient to justify steady state renewal and disposal requirements of assets. More discrete list of unprioritized list is planned for 2021. Strategic Asset Management planning (SAMP) is a critical requirement for this clause to enable the development of a top-down long-term work volumes and costs.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Incorporate the AM Objectives into the SAMP and ensure that the SAMP defines the required frameworks, approaches and processes to develop Asset Management plans which will deliver them. Ensure that the AM Objectives and the SAMP are fully integrated into other aspects of THESL's organisation and approach.		

6.2.1 AM Objectives			
Requirement	**The organization *shall* retain documented information on the AM Objectives.**		
Observations:	THESL has Asset Management Process overview where they have put together Asset Management principles, strategies, and outcomes. These objectives are not contained in the SAMP and have not yet communicated widely.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure all AM Objectives are contained in the SAMP.		

6.2.2 Planning to achieve AM Objectives			
Requirement	**The organization *shall* integrate the planning to achieve AM Objectives with other organizational planning activities, including financial, human resources and other support functions.**		
Observations:	Capital investment planning is an example of good practice which is defined and THESL follow it. It is a process where stakeholders and other requirements are well understood, and this process is well embedded. THESL's capital programs are grouped into the following four categories. Each program is assigned with one or more trigger drivers of work: 1) System Access Investments 2) System Renewal Investments 3) System Service Investments 4) General Plant Investments Operational and maintenance planning processes are in place and documented. These planning processes are not incorporated into the overall AM System.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure that the AM Objectives and the SAMP are fully integrated into other aspects of the organisation and approach. Develop Asset Management plans which will achieve the SMART objectives, in a way that is consistent with the approach set out in the newly developed SAMP. Ensure these plans detail planned activities to the assets across their lifecycles, and activities to develop the capability of the AM System.		

6.2.2 Planning to achieve AM Objectives

Requirement	**The organization *shall* establish, document and maintain Asset Management plan(s) to achieve the AM Objectives. These Asset Management plan(s) *shall* be aligned with the Asset Management policy and the SAMP.**		
Observations:	THESL uses the output from the 1) Principles, Strategies and Outcomes Development, 2) Asset Needs Assessment and 3) Portfolio Reporting to develop capital and maintenance investment plans. Capital investment planning (e.g., "IPPR") is defined, embedded, and followed within THESL and there are various KPIs in place to manage deliverables. Decision-making criteria have not been explicitly defined as required by Clause 4.2. There is currently no integrated plan covering overall work volumes and costs – e.g., an integrated plan that justifies work volumes and costs across all stages of the assets' lifecycles. The long-term (i.e., 20+years) work volumes and costs do not align with agreed maintenance and renewal work volumes and costs. For example, capital work volumes and costs are largely driven by budget availability which varies from year to year. The modelling of lifecycle value utilizes optimized capital renewal requirements and maintenance costs e.g., CMMS is used to create metrics and reporting systems to ensure all assets are functioning as intended and minimize total lifecycle cost. THESL has plans for 2020-2024 period, however forward plans for new works go out as far as 50 years and moved through several planned stages before implementation.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Develop Asset Management plans which will achieve the AM Objectives, in a way that is consistent with the approach set out in the SAMP.		

6.2.2 Planning to achieve AM Objectives			
Requirement	**The organization *shall* ensure that the Asset Management plan(s) take(s) into account relevant requirements coming from outside the AM System.**		
Observations:	The AM System has not been explicitly defined; therefore, capital planning process cannot be incorporated into an overall AM System.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure these plans detail planned activities to the assets across their lifecycles, and activities to develop the capability of the AM System.		

6.2.2 Planning to achieve AM Objectives

Requirement	**When planning how to achieve its AM Objectives, the organization *shall* determine and document:** **— the method and criteria for decision making and prioritizing of the activities and resources to achieve its Asset Management plan(s) and AM Objectives;** **— …**		
Observations:	THESL is above conformance in budget planning and approval process which is required to deliver the AMP. Reprioritization of existing and emergent needs together and project selection is top-down constrained by budget. Financial planning support operational planning to balance workforce continuity with the resourcing strategy and risk associated with deferring work due to resourcing constraints. Their Asset Management planning does not utilize agreed unit costs to create the constrained AMP. Maintenance Plan: Maintenance requirements analysis (MRA) process is in place and well documented, THESL use reliability engineering tools i.e., FMECA, RCA, RCM etc. to optimize their inspection, maintenance and intervention regimes, however, THESL does not appear to have fully defined the quality requirements for these processes. This is one of the AM System requirements. Some asset plans are based on unit cost models, however it's not consistent across the asset base. Existing unit cost models need to be updated on an ongoing basis using actual cost data to ensure that up-to-date models can be developed. These plans also need to cover the entire lifecycle stages and associated risks and unit costs. There is very limited alignment between the existing AM strategies (which are not formalized as SAMP) and lifecycle value approaches.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: Build on the existing Asset Management Plans to develop plans for all stages of the assets' lifecycles, which should be developed in accordance with the integrated approach to be defined in the SAMP, and demonstrate the AM Objectives will be achieved. Review Asset Management plans against all the criteria listed above in 6.2.2.		

6.2.2 Planning to achieve AM Objectives			
Requirement	**The organization *shall* ensure that its Asset Management related risks are considered in the organization's risk management approach including contingency planning.**		
Observations:	THESL has considered Asset Management related risks in their corporate risk management policy and using probability of failure and consequence of failure in their Asset Condition Assessment model. Existing and emergent investment needs are reprioritized together, ensuring some consistency in decision-making and project selection is top-down constrained by budget. THESL exceeded the conformance score in one of the sub-criteria of this clause, covering budget planning and approval processes required to deliver the AMP, however this plan does not cover the entire asset lifecycle stages. AMPs should also be focused on AM Objectives and newly developed SAMP soon. Contingency plans i.e., Emergency and Disaster Recovery Plan are in place that provide clear guidance on how THESL should respond to such situations. Technology plan is in development e.g., Smart Metering, Grid Modernization etc. This will enable them to leverage trends and changes in technology to improve its AM capability. There is no defined framework for the analysis of Asset Resilience. Resilience cover four 'R's. i.e., Redundancy (e.g., system design that allows for operational flexibility), Resistance (e.g., the ability of the system to withstand external demands without degradation or loss of functionality), Responsiveness (e.g., the ability to mobilize and sustain services in emergencies) and Recovery (e.g., the speed with which disruption can be resolved and the site returned to normal operation). THESL use FMECA, RCA, RCM etc. tools to optimize their maintenance and inspection regimes, a maintenance requirement analysis process is in place and well documented. A sustainable development strategy is in place and THESL considers the impact of climate change on its system as well as reducing environmental risk by eliminating PCBs by 2025. Another example is their 4kV conversion project which will reduce line losses, improving system efficiency and contribute to sustainability measures; however, the evaluation of sustainability benefits was undertaken retrospectively rather than being an investment driver.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: Ensure alignment with the Corporate Risk Management Framework (see the recommendation to implement an Asset Risk Assessment and Opportunity Framework under Clause 6.1.) Ensure that alignment is demonstrably embedded.		

7.1 Resources			
Requirement	**The organization *shall* determine and provide the resources needed for the establishment, implementation, maintenance and continual improvement of the AM System.**		
Observations:	There is top management commitment to providing the resources required to deliver plans and a resourcing strategy is in place to defines the approach to resourcing activities. Resource balancing is used to develop all resource plans enabling THESL to maximize utilization of its resources and to use internal staff for most of the work. Resources are planned and sufficient for the current technical delivery requirements; however, they may not be sufficient to support future AM System requirements. THESL need to identify the resources for the establishment, implementation, maintenance and continual improvement of Asset Management activities i.e., meeting the AM Objectives and implementing the AM Plan.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☒ Recommendation for further improvement: ☐ Action required: Define the resources required to deliver the AM Objectives as defined in the AMP, utilizing the AM competence requirements defined in 5.1, 5.3, 7.1 and 7.2 next and reconcile existing resourcing levels against this.		

7.1 Resources			
Requirement	**The organization *shall* provide the resources required for meeting the AM Objectives and for implementing the activities specified in the Asset Management plan(s).**		
Observations:	Fixed resources are defined on an annual basis using 10+ years of historical data based on outages. Financial planning supports operational planning to balance workforce continuity with the resourcing strategy and includes an assessment of risk associated with deferring work due to resourcing constraints. Inventory and spares are managed reactively. Consumption patterns are reviewed quarterly for consumption, vendor performance on time delivery, shortage issues along with cost of holding inventory. THESL achieve all resource plans including utilizing the opportunity to mix the activities with other groups to accelerate the work i.e., planned outage and/or to cover the resource shortage for program delivery projects. THESL maximize the utilization of their resources and use internal staff for majority of the work.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☒ Recommendation for further improvement: ☐ Action required: Develop and implement a plan for the Asset Management recruitment and training required to fulfil the resource requirements defined.		

7.2 Competence			
Requirement	**The organization *shall*:** **— determine the necessary competence of person(s) doing work under its control that affects its asset performance, Asset Management performance and AM System performance;** **— …**		
Observations:	THESL have good process in place to assess technical competence. There are adequate programmes available to enable staff to develop their technical competence. THESL's talent management strategy is tied-up to the headcount data managed from HR, contract management and procurement plan. Contractors manage their own training compliance processes. THESL has technical competency Management System inhouse such as Professional Engineer (P.Eng) License, however there are no specific AM Competencies defined to meet current and future Asset Management needs. For example, competency required to develop the whole life cost models or an Information Management System.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Build on the existing approaches to develop a Competence Management System for core and functional competences, ensuring that AM Competences required to deliver the AM Objectives are included and fully integrated for the development of THESL Asset Management capabilities. Develop a list of the AM Competence required to deliver the activities within the AM System (use a good practice framework like the IAM's if needed). Align these to the RACI developed in 5.3 and define the competences for each job role. Update job descriptions to reflect the new AM competency requirements and incorporate these into the existing CMS. Build approaches to developing AM Competences (training, IAMcert, DipIAM, Expert Coaching, Mentoring, RAMP etc.)		

7.3 Awareness			
Requirement	**Persons doing work under the organization's control, who can have an impact on the achievement of the AM Objectives, *shall* be aware of:** **— the Asset Management policy;** **— …**		
Observations:	Asset Management awareness is limited outside the core team. There is a perception that Asset Management is something that the Asset Management department does rather than an enterprise-wide management system. All staff are not aware of their specific roles in Asset Management hence there is an impact on their contribution to the effectiveness of the Asset Management activity.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure that the Asset Management improvement plan is clearly communicated to all those within the scope of the AM System. Develop a training programme to increase understanding across the business of how different departments contribute to achieving the AM Objectives.		

7.4 Communication			
Requirement	**The organization *shall* determine the need for internal and external communications relevant to assets, Asset Management and the AM System including:** **— on what it will communicate;** **— …**		
Observations:	External communication channels are good and engagement with customers and regulators is well controlled. THESL internal communication relevant to Asset Management activity is limited outside the core team, impacting the awareness score as described earlier in 7.3. AM Policy is in place, but not communicated consistently outside the core team.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☒ Recommendation for further improvement: ☐ Action required: Develop and implement a plan for communicating relevant Asset Management information to all internal stakeholders. Communication plans are needed to increase awareness outside of the Asset Management team once the relevant documents and AM System has been developed. Ensure the AMGC takes ownership of these communication plans with respect to approval and monitoring.		

<table>
<tr><th colspan="4">7.5 Information requirements - General</th></tr>
<tr><td>Requirement</td><td colspan="3">The organization <u>shall</u> determine its information requirements to support its assets, Asset Management, AM System and the achievement of its organizational objectives.</td></tr>
<tr><td>Observations:</td><td colspan="3">Asset Management information requirements have not been defined across all Business Units within THESL. For example, the requirements for aligning the information in the financial Fixed Asset Register and Physical Asset Register have not been defined.

Asset lifecycle Information requirements and criteria are not mapped to the decision-making process e.g., renewal, maintenance strategies, disposal planning, etc.</td></tr>
<tr><td>Conclusion:</td><td>☐ Compliant</td><td>☐ At risk</td><td>☒ Non-Compliant</td></tr>
<tr><td>Action status:</td><td colspan="3">☐ No action required.

☐ Recommendation for further improvement:

☒ Action required:

Implementation of the Asset Information Strategy should ensure that clarity on information requirements is sufficient to guide all existing and future asset information development activities.

Document the current structure of asset information systems including all links and dependencies between systems. Identify where systems and data currently support the AM System and its processes, and where it does not.

Define the data requirements needed for each process. This should include current data use and potential new use of existing data, and the likely future information requirements based on the SAMP and the Asset Management plans.</td></tr>
</table>

7.5 Information requirements – Implementation factors			
Requirement	**In determine its information requirements:** **a) the organization *shall* include consideration of:** **— the significance of the identified risks;** **— …**		
Observations:	Risk and criticality are not currently used in the determination of information requirements and there does not appear to be a clear definition of the roles and responsibilities for information and data.		
Conclusion:	☐ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: Develop an Asset Information Strategy as a stand-alone document or as part of the SAMP which defines the overall approach to defining asset information requirements to deliver the AM Objectives, and specifies the required attribute, quality and implementation standards. Ensure this contains the requirements for the alignment of financial and non-financial information. Consider using the requirements analysis and plan as the basis for an Asset Information Strategy that also consider broader asset information management needs, including requirements sufficient to guide all existing and future asset information development activities including technology and systems investments.		

7.5 Information requirements – Attributes			
Requirement	**In determine its information requirements:** **b) the organization *shall* determine:** **— the attribute requirements of identified information;** **— …**		
Observations:	Asset Information Standards are not well defined. No logical data model exists which can be aligned with asset information needs.		
Conclusion:	☐ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: Create a structured information methodology which defined all the required attributes. Define and implement plans to rectify any gaps in these requirements.		

7.5 Information requirements – Processes			
Requirement	**In determine its information requirements:** **c) the organization *shall* specify, implement and maintain processes for managing its information;**		
Observations:	THESL specifies information it requires contractors to collect and audits them, however when the requirements are not specified (for example 'As-Built' data), contractors collect information based on their understanding and judgement. Inconsistent reports were noted during the assessment on the quality of the data being collected. This suggests that the information THESL specifies may be inconsistent.		
Conclusion:	☐ Compliant Notes:	☐ At risk Notes:	☒ Non-Compliant Notes:
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: Document the current structure of asset information systems including all links and dependencies between systems. Identify where systems and data currently support the AM System and its processes, and where it does not.		

7.5 Information requirements – Alignment with other Systems			
Requirement	**In determine its information requirements:** **d) the organization *shall* determine the requirements for alignment of financial and non-financial terminology relevant to Asset Management throughout the organization;**		
Observations:	The requirements for aligning the information in the financial Fixed Asset Register and Physical Asset Register have not been defined.		
Conclusion:	☐ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: Asset information requirements should extend to the requirements for the alignment of financial and non-financial information (specifically the financial and non-financial asset registers).		

7.5 Information requirements – Consistency across Interfaces			
Requirement	**In determine its information requirements:** **e) the organization *shall* ensure that there is consistency and traceability between the financial and technical data and other relevant non-financial data, to the extent required to meet its legal and regulatory requirements while considering its stakeholders' requirements and organizational objectives.**		
Observations:	THESL is currently developing an engineering data warehouse to streamline data access and perform "big data" calculations that can support planning and system investment strategies. In parallel, the utility has been deploying new data blending and analytics software and has integrated software into business processes to improve productivity and drive new insights.		
Conclusion:	☐ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: Ensure the requirements for data collection and quality are defined for all assets and for all activities within the AM System in accordance with the requirements of Clause 7.5.		

7.6.1 Documented Information – General

Requirement	**The organization's AM System *shall* include:** **— documented information as required by this International Standard;** **— …**		
Observations:	There are good data governance processes covering regulatory reportable data with defined owners and verification. However, non-regulatory data captured during the capital and maintenance delivery process is not as well controlled or defined. For example, for unit cost data, newly installed asset attributes and geolocations there is no defined data governance, owners, verification, and subsequent data standards. Also, no information requirements are defined (see 7.5), hence quality, consistency, and validity of data varies. A Data Population Plan does not appear to exist, so data collection and analysis is ad-hoc and not according to a consistent integrated approach.		
Conclusion:	☐ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: Review in detail the documented information required by the following, and ensure all documented information is relevant and controlled: • ISO 55001 • THESL's legal and regulatory requirements • The AM System (*other than those identified above*)		

7.6.2 Documented Information – Creating and Updating

Requirement	**When creating and updating documented information the organization *shall* ensure appropriate:** **— identification and description (e.g. a title, date, author, or reference number);** **— …**		
Observations:	Data and information are maintained in several locations including off-line spreadsheets. It is important to understand that the relevant data should be available in timely manner should you required it to make informed decisions. Each individual area of the business has a particular asset register.		
Conclusion:	☐ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: The Asset information system shall be in place and configure to collect/manage data and information in accordance with the asset information strategy and standards. Review the specific requirements of 7.6 against THESL's current documentation control systems. These specific requirements cover general requirements, when creating and updating documented information and control of these documented information.		

7.6.3 Documented Information – Control of Documented Information

Requirement	**Documented information required by the AM System and by this International Standard *shall* be controlled to ensure:** **a) it is available and suitable for use, where and when it is needed;** **b) …**		
Observations:	Control of documented information appears to be through the Intranet which allows access to employees to the last versions of documentation. Where access should not be available to all then restrictions could be put in place. Technical standards are managed in a systematic manner. However, the dependence on delivery contractors defining information for input into the Maintenance Management Systems means THESL may or may not get the information it requires. Another challenge is related to the control of asset documentation. This has a significant impact on the asset lifecycle stages handover process and risk of missing data and/or delays in updating asset and operational records.		
Conclusion:	☐ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: A consolidated asset register should be established and configured to collect/manage data and information in accordance with the asset information strategy and standards.		

7.6.3 Documented Information – Control of Documented Information

Requirement	**For the control of documented information, the organization *shall* address the following activities, as applicable:** **— distribution, access, retrieval and use;** **— …**		
Observations:	Control of documented information appears to be through the Intranet which allows access by employees to the last versions of documentation. There are good data governance processes covering regulatory reportable data with defined owners and verification. However, non-regulatory data captured during the capital and maintenance delivery process is not as well controlled or defined. For example, for unit cost data, newly installed asset attributes and geolocations there is no defined data governance, owners, verification, and subsequent data standards. Also, no information requirements are defined (see 7.5), hence quality, consistency, and validity of data varies.		
Conclusion:	☐ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☐ No action required. ☒ Recommendation for further improvement: ☒ Action required: Update existing documentation with latest version and/or create new version to make it suitable for use and make them available to all relevant internal stakeholders. It is also important to protect them by putting adequate restrictions in place.		

7.6.3 Documented Information – Control of Documented Information

Requirement	**Documented information of external origin determined by the organization to be necessary for the planning and operation of the AM System *shall* be identified, as appropriate, and controlled.**		
Observations:	When new assets go into service, data is collected using paper-based equipment changeout forms. A pilot project has been on-going to digitize this form to capture asset and operational data and minimize errors, inconsistencies, and missing information.		
Conclusion:	☐ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: The Asset information system shall be in place and configure to collect/manage data and information in accordance with the asset information strategy and standards. Review document request requirements against the requirements of the new AM system.		

8.1 Operational planning and control			
Requirement	**The organization *shall* plan, implement and control the processes needed to meet requirements, and to implement the actions determined in 6.1, the Asset Management plan(s) determined in 6.2, and the corrective and preventive actions determined in 10.1 and 10.2 by:** **— establishing criteria for the required processes;** **— …**		
Observations:	Overall, THESL has developed its capital programs to maintain and improve reliability and safety, meet service and compliance obligations, address load capacity and growth needs, improve contingency constraints, or make necessary day-to-day operational investments. The choices made by the utility reflects a balance between customer preferences, affordability, and prioritized outcomes with the overriding objective of delivering value for money. An effective methodology for the management of capital program is in place including regular reports on the performance of the program. Operational planning and control of capital delivery is an example of good practice and is well embedded. Standards and procedures containing the maintenance and inspection regimes (including defect codes) for all assets are in place. Similarly, shutdown & outage planning processes are in place which enable the strategic optimization of access plans. The systems engineering approach does not enable effective alignment of business case benefits into project requirements and therefore benefits realization is not robust. Baseline configuration is established in the basic asset register; but not through a systematic commissioning and change management processes.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: No actions are required for the delivery of capital plans. THESL will need to be able to demonstrate that capital delivery processes are adhered to during a certification audit. For other areas of operational planning and control (including operations, maintenance and shutdown management) it is recommended that THESL verify that for each area processes are defined and followed reliably prior to the certification audit. THESL needs to clearly identify the criteria, information and processes required to control operations, and provide sufficient assurance that they are operating the assets in accordance with these. It is suggested this be included in the asset class strategies for key asset types such as transformers, overhead poles, operational buildings etc. Design and implement annual planning requirements in accordance with the SAMP and clause 6.2; monthly reporting requirements in accordance with clause 9.1; transparent risk assessment and management in accordance with clause 6.2.2; and regular review of the achievement of AM Objectives.		

8.2 Management of change

Requirement	**Risks associated with any planned change, permanent or temporary that can have an impact on achieving the AM Objectives, *shall* be assessed before the change is implemented.**		
Observations:	An overall organisational 'Change Management Framework' on organizational change or system change has not been defined, however, clear 'approval for modification' and project change control processes exist which could be utilised once the AM System is defined.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Define an overall risk-based change management framework based on existing approaches and external good practice. Ensure this approach includes the identification and management of all changes within THESL in the most appropriate way, for example: • Managing day-to-day change (such as asset or project changes) through embedded processes. • Managing medium-scale changes (such as minor organizational or system implementation changes) through specific projects and good practice guidelines. • Managing major changes (such major organizational redesign) through specific programmes under the authority of the AMGC.		

8.2 Management of change

Requirement	**The organization *shall* ensure that such risks are managed in accordance with 6.1 and 6.2.2.**		
Observations:	Asset changes are not completed in accordance with the organisational Change Management Framework which is not established yet. The Corporate Risk Management Framework appears to be good practice, but is not fully integrated into Asset Management, or the specific requirement to risk assess changes that may affect the achievement of AM Objectives.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Define an overall risk-based change management process based on existing approaches and external good practice. Ensure the new overall risk-based change management process is effectively aligned to the Corporate Risk Management Framework.		

8.2 Management of change

Requirement	**The organization *shall* control planned changes and review the unintended consequences of changes, taking action to mitigate any adverse effects, as necessary.**		
Observations:	No processes are in place to control the planned changes and review unintended consequences of changes.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Define an overall risk-based change management process based on existing approaches and external good practice. Ensure the new overall risk-based change management process is effectively implemented and embedded.		

8.3 Outsourcing			
Requirement	**When the organization outsources any activities that can have an impact on the achievement of its AM Objectives, it *shall* assess the associated risks. The organization *shall* ensure that outsourced processes and activities are controlled.**		
Observations:	A sourcing strategy is in place that defines THESL's approach to outsourcing its activities. Existing procurement and supply chain processes deliver products and services that effectively support delivery of the organization's AM Objectives including the ability to adapt to a changing workload. THESL validate the capabilities of their suppliers prior to any kind of engagement. Reliability growth plans are not documented where a large majority of work is outsourced.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☒ Recommendation for further improvement: ☐ Action required: No actions are required for the management of general outsourcing arrangements (for example contracts and suppliers), however outsourcing agreements would benefit from a review against the information requirements from the supply chain (see clauses 7.5 & 7.6).		

8.3 Outsourcing			
Requirement	**The organization *shall* determine and document how these activities will be controlled and integrated into the organization's AM System. The organization *shall* determine:** **a) the processes and activities that are to be outsourced (including the scope and boundaries of the outsourced processes and activities and their interfaces with the organization's own processes and activities);** **b) …**		
Observations:	Existing procurement and supply chain processes do deliver products and services that effectively support delivery of the organisation's AM Objectives. Supply chain is limited by resources available to perform key functions. Supply chain lacks a coherent resourcing strategy and hence the value from supply chain is not leveraged.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☐ Recommendation for further improvement: ☐ Action required:		

8.3 Outsourcing

Requirement	**When outsourcing any activities, the organization *shall* ensure that:** **— the outsourced resources meet the requirements of 7.2, 7.3 and 7.6;** **— the performance of the outsourced activities is monitored in accordance with 9.1.**		
Observations:	THESL validate the capabilities of their suppliers prior to any kind of engagement. A sourcing strategy is in place that defines THESL's approach to outsourcing its activities. Several performance measures have been developed from KPI list of measures.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☐ Recommendation for further improvement: ☐ Action required:		

9.1 Monitoring, measurement, analysis and evaluation – Setting Requirements			
Requirement	**The organization *shall* determine:** **a) what needs to be monitored and measured;** **b) …**		
Observations:	In developing its approach to performance measurement, THESL considered the OEB's guidance, including the Renewed Regulatory Framework for Electricity Distributors ("RRF").		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure monitoring, measurement, analysis, and evaluation is effectively targeted across the AM System scope and balanced to meet the requirements of the AM System and the achievement of THESL's AM objectives (see clause 7.5).		

9.1 Monitoring, measurement, analysis and evaluation – Setting Requirements			
Requirement	**The organization *shall* determine:** **c) when the monitoring and measuring *shall* be performed;** **d) …**		
Observations:	THESL is proposing 15 custom measures for the 2020-2024 plan period. These measures are incremental to the measures contained in the Electricity Distributor Scorecard (“EDS”) and the Electricity Service Quality Requirements (“ESQR”), for a total of 44 measures reported to the OEB annually.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Build on the proposed measures with a focus onleading indicators (which appear to be deficient).		

9.1 Monitoring, measurement, analysis and evaluation - Reporting			
Requirement	**The organization *shall* evaluate and report on** **— the asset performance;** **— …**		
Observations:	THESL monitor and manage the overall maintenance plan against output (lagging) KPIs but have not considered the systematic monitoring, measurement, analysis, and evaluation of leading indicators to assure achievement of KPIs. Financial outcomes are monitored and reviewed on a regular basis by analysing underlying trends.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure monitoring, measurement, analysis, and evaluation is effectively targeted across the AM System scope and balanced to meet the requirements of the AM System and the achievement of THESL's AM objectives (see clause 7.5).		

9.1 Monitoring, measurement, analysis and evaluation

Requirement	**The organization *shall* evaluate and report on the effectiveness of the processes for managing risks and opportunities.**		
Observations:	THESL uses known risks to focus on the asset health performance and performance monitoring. They use Asset Condition Assessment model to calculate the health index, probability of failure and consequence of failure. An Asset Condition Assessment model is used to derive an asset health index. The maturity of the AM system is not periodically assessed/reviewed against agreed good practice targets.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure these are aligned to the requirements detailed under 8.1 and 8.3.		

9.1 Monitoring, measurement, analysis and evaluation

Requirement	**The organization *shall* retain appropriate documented information as evidence of the results of monitoring, measurement, analysis and evaluation.**		
Observations:	The maturity of the AM system is not periodically assessed/reviewed against agreed good practice targets. Financial outcomes are monitored and reviewed on a regular basis by analysing underlying trends.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Set out how these high-level measures will be reviewed and analysed through the process of management review defined under 9.3. Ensure the AMGC has an overview of all key performance indicators.		

9.1 Monitoring, measurement, analysis and evaluation

Requirement	**The organization *shall* ensure that its monitoring and measurement enables it to meet the requirements of 4.2.**		
Observations:	Visualization/performance hubs is utilized within THESL but is not fully embedded or integrated into the system.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure these are aligned to the requirements detailed under 4.2. Consider (it is not a requirement) implementation of a Performance Management Framework and stringent overview by the AMGC. Ensure these are aligned to the requirements detailed under 8.1 and 8.3.		

9.2 Internal audit – Conducting			
Requirement	**"The organization *shall* conduct internal audits at planned intervals to provide information to assist in the determination on whether the AM System:"** **a) conforms to:** **— the organization's own requirements for its AM System;** **— …**		
Observations:	Internal audit of the specific scope of the AM System is not in place. THESL's internal audit process uses known risks and ensures the use of competent auditors. Audit findings are monitored and reviewed by the internal audit team.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Establish an overall audit plan for the scope of the AM System. Build on existing plans and resources where possible, drawing on the existing internal audit team to support this. Ensure the audit plan is reviewed and approved by the AMGC and that the outputs of audit activity are reported and actioned as required by the AMGC.		

9.2 Internal audit – audit programme(s)

Requirement	**The organization *shall*:** **a) plan, establish, implement and maintain an audit programme(s), including the frequency, methods, responsibilities, planning requirements and reporting. The audit programme(s) *shall* take into consideration the importance of the processes concerned and the results of previous audits;** **b) …**		
Observations:	A risk-based process for defining an audit plan is in place. The ERP group provide input to the 3-year audit plans. THESL's audit process use knows risks and ensure the use of competent auditors. For example, they use KPMG as their 3rd party auditor. Additional audit support is bought in as required.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure that however is managing the compliance audit be it internal audit or third-party external auditors that they are trained as per best industry standards.		

9.3 Management review			
Requirement	**Top management *shall* review the organization's AM System, at planned intervals, to ensure its continuing suitability, adequacy and effectiveness.**		
Observations:	Formal management review and performance management framework is in place, although this is not focused on the scope of the AM System.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Establish an overall AM System management review framework for periodic review of the overall AM System. Build on the existing review and performance management framework where possible and focus this on the scope of the AM System defined in Clause 4.3 and 4.4.		

9.3 Management review			
Requirement	**The management review *shall* include consideration of:** **a) the status of actions from previous management reviews;** **b) The outputs of the management review shall include decisions related to continual improvement opportunities and any need for changes (see 8.2) to the AM System.**		
Observations:	Systematic review of performance indicators and other information is undertaken periodically; however due to the issues identified under clause 7.5 and 7.6, information inconsistencies may affect these management reviews.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure the AMGC has full accountability for management review activities including input from risk assessments, audits and performance indicators and reports. Consider adopting a 'management review' calendar which defines the review and approval cycles for all key AM System artefacts (such as AM Policy, Objectives, SAMP and AMPs).		

AMCL

9.3 Management review			
Requirement	**The organization *shall* retain documented information as evidence of the results of management reviews.**		
Observations:	Performance Status Report (PSR) for Power System Analytics, Power System Operational technology and Grid System and Analytics are prepared.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Define the requirements for retaining documented information within the Asset Management System definition.		

10.1 Nonconformity and corrective action			
Requirement	**When a nonconformity or incident occurs in its assets, Asset Management or AM System the organization *shall*:** **a) react to the nonconformity or incident, and, as applicable:** **— …**		
Observations:	THESL effectively identify and prioritize reactive work. There is a process in place to identify root causes of non-conformances, faults, failures, and defects and to identify appropriate mitigations measures. Nonconformity and corrective / preventive action with respect to the AM System does not yet exist, but it is anticipated that the existing QMS capabilities and scope will provide a solid foundation for this.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☒ Recommendation for further improvement: ☐ Action required: Establish a process for recording, prioritizing, and managing nonconformities and corrective actions resulting from implementing and monitoring the AM System.		

10.1 Nonconformity and corrective action – Appropriateness			
Requirement	**Corrective actions *shall* be appropriate to the effects of the nonconformities or incident encountered.**		
Observations:	Nonconformity and corrective / preventive action with respect to the AM System does not yet exist, but it is anticipated that the existing QMS capabilities and scope will provide a solid foundation for this. THESL's fault response resources are in place with defined responsibilities and effective communication. THESL review and report the lessons learned from faults and incidents		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☐ Action required:		

10.1 Nonconformity and corrective action – Documentation			
Requirement	**The organization *shall* retain documented information as evidence of:** **— the nature of the nonconformities or incident and any subsequent actions taken;** **— …**		
Observations:	THESL review and report the lessons learned from faults and incidents. A prioritized list of preventive and corrective actions is tracked, analysed, and reported to all relevant Management Review meetings. Risks and opportunities inherent in field activities are pro-actively identified and managed.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☐ Action required: Collate good practices together and put in into the AM system manual while ensuring the process is outlined in detail and systematically. Define further written processes, if required. Develop an overall framework for description in the AM Manual (see Clause 4.4)		

<table>
<tr><th colspan="4">10.2 Preventive action</th></tr>
<tr><td>Requirement</td><td colspan="3">The organization <u>shall</u> establish processes to proactively identify potential failures in asset performance and evaluate the need for preventive action.
When a potential failure is identified the organization <u>shall</u> apply the requirements of 10.1.</td></tr>
<tr><td>Observations:</td><td colspan="3">Operators identify potential failures in asset performance at the monthly meetings and preventive actions are agreed there. There is evidence of a proactive risk identification culture within field/operational staff.
Preventive and corrective actions are tracked in a single, accessible system for periodic reporting. Owners are allocated and regular reports from the system enable tracking of the actions to closure.</td></tr>
<tr><td>Conclusion:</td><td>☒ Compliant</td><td>☐ At risk</td><td>☐ Non-Compliant</td></tr>
<tr><td>Action status:</td><td colspan="3">☒ No action required.
☐ Action required:
Establish a process for recording, prioritizing, and managing preventive actions resulting from implementing and monitoring the AM System.
Collate good practices together and put in into the AM system manual while ensuring the process is outlined in detail and systematically.
Define further written processes, if required.</td></tr>
</table>

10.3 Continual improvement

Requirement	**The organization *shall* continually improve the suitability, adequacy and effectiveness of its Asset Management and the AM System.**
Observations:	Top management encourage a culture of collaborative continual improvement and provide a clear focus on achievement of the Asset Management Strategy and Objectives. A culture of continual improvement is evident from existing and upcoming programs i.e., Enhanced Outcomes Framework for the 2020-2024 planning horizon. THESL has transitioned from the Asset Condition Assessment (ACA) methodology originally adopted in 2008 to a model that provides more accurate and comprehensive condition-based analytics, and better supports longer-term expenditure planning. THESL is currently developing a data warehouse to streamline data access and perform "big data" calculations that can support planning and system investment strategies, alongside deploying new data blending and analytics software. The existing enterprise systems are to be consolidated into one system (ERP System) so that data integrity can be improved. This will provide teams across THESL access to one system with accurate and up-to-date information. Tactical contingency plans are created, implemented, tested, and continually improved in accordance with the agreed processes and AMPs are modified accordingly. The resilience Analysis process is incomplete. It is evident from the current ISO 55000 gap analysis, development of roadmap exercise and aspiration for the certification that THESL intend to enhance their existing capabilities and mature their practices.
Conclusion:	☐ Compliant ☒ At risk ☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Establish continual improvement of the AM System and make it an integral activity defined in the AM System definition document. Implement and maintain a CI Register for the AMGC for CI opportunities identified through management review. Ensure each section of the AM System Manual include a short sentience on how the clause is continually improved and who is accountable. Ensure that a Plan-Do-Check-Act cycle is always followed and formulating an AM system manual. THESL should have the ability to demonstrate that they are doing improvements continually and in a timely manner.

NBM ENGINEERING

DAILY ACTIVITY REPORT

Date: 2024-03-02

Weather: 4 °C Drizzle

Project	141 Bay ELEC Private Work
TH Project #	C-200002-X19001-HS001
TH Scope #	
NBM Project #	H1-TH23-0730
Type of Work	Electrical
TH Contact	Kris Velss
Address	141 Bay St. (CC9439)
Inspector	Rod Finlay
Role	Compliance Inspector
Scope of Work	Critical Task - Cable Spike

DAILY SITE ROSTER

Contractor	Powerline Plus
Foreperson	Joe Shawihat
Approx. # of Crew Members	7
Others On Site	TPS PDO

YES = Item is required for scope and *was followed*
NO = Item is required for scope but *was not followed* (Potential NCR)
N/A = Not required for the current scope inspected

GENERAL — SAFETY

YES	NO	N/A	
X			Work completed in accordance with Toronto Hydro Rule Book & EUSR.
X			Work completed in accordance with Toronto Hydro Standards & Procedures.
X			Contractor set-up adheres to MTO Book 7.
X			Site Supervisor on site.
X			Pay duty officer on site & appropriately stationed.
		X	Pedestrian traffic safely re-routed.
		X	Appropriate hold-offs have been documented. Hold off number (if applicable): ____________
		X	Appropriate locates are on site.
X			First-aid kits present on site.
X			Work Protection complies with Utility Work Protection Code (UWPC).

GENERAL — QUALITY

YES	NO	N/A	
X			Notice of Project (NOP) is displayed on site.
X			Contractor installations are completed as per design.
X			Contractor installations are completed as per standards.
		X	Cut permits approved & on site.
		X	Correct processes followed (e.g. Change Orders).
X			Critical tasks completed correctly.
		X	Materials installed as per Bill of Materials.
X			Photos taken where necessary.
		X	Installation & removal of equipment documented as required (equipment change-out forms).
X			Site & adjacent sidewalks / roadways are kept clean & organized.

DAILY ACTIVITY REPORT

NOTES

Topics of Discussion

Switching Delay, adjacent cable chambers, scope of work, drawings, CC 9439, circuit being worked on, cable ID, confined space entry, cable ID labels,

Outstanding Items (Toronto Hydro)

N/A

Outstanding Items (NBM Engineering)

N/A

Outstanding Items (Contractor)

N/A

Comments

On site 7:30am for 8am cable spike, informed of delay, paper and verbal tailboard (recorded) completed - auditor signed on, performed work site inspection - CC 9439 while waiting, left site and returned to witness spike in the afternoon, appropriate traffic control in place - TPS PDO on site, all required PPE in use, confined space entry form completed and updated as required, UWPC incomplete as switching not completed, inspected vehicle and personal safety equipment and tools - Tr.# 1024.

PHOTOS

Traffic looking south to work site at Front St. & Bay St.

Traffic looking south to work site from SW corner of Front St. & Bay St.

PHOTOS

Work Location CC 9439

Work Site/PPE

Fire Ext. Checked Fully Charged

First Aid Kit

Inspector Signature: Rod Finlay
Digitally signed by Rod Finlay
DN: cn=Rod Finlay, ou=Users, email=rodf@nbmengineering.com
Date: 2024.03.04 11:32:33 -05'00'

ADDITIONAL PHOTOS (OPTIONAL)

Burn Kit

Eye Wash

LLT's

SRL's x 2 checked in date and good working order

NBM
ENGINEERING

CABLE IDENTIFICATION RECORD

Date: 2024-03-02

Project: 141 Bay ELEC Private Work
TH Contact: Kris Velss
Address: 141 Bay St.
NBM Project #: H1-TH23-0730
Inspector: Rod Finlay
TH Project #: C-200002-X19001-HS001

DAILY SITE ROSTER

Contractor: PLP
Approx. # of Crew Members: 7
Foreperson: Joe Showihat
Other Companies On Site: TPS PDO

PART 1: CABLE IDENTIFICATION

YES = Required for scope and *was followed*
NO = Required for scope but *was not followed* (Potential NCR)
N/A = Not required for the current scope inspected

YES	NO	N/A	Item
■	☐	☐	Confirm prints, drawings, data records, work protection documents, nomenclature, and location.
■	☐	☐	Gas Detection test completed.
■	☐	☐	Hold off: Confined Space
■	☐	☐	Contractor supervisor/manager on site.
■	☐	☐	Connect cable ID equipment and conduct test (complete minimum 1 of the below methods and check upon successful completion).

- [x] VCI
- [ ] EZ-Cable ID
- [ ] Hiptronic
- [ ] Fault Locator
- [ ] Continuity Tester

YES	NO	N/A	Item
■	☐	☐	Install Cable Label(s) (ensure cable label has ALL the following information and check to confirm).

- [x] Date cable identified
- [x] Method used to identify cable
- [x] Name of workers identifying and checking cable
- [ ] Location of cable fault (if applicable)
- [x] Feeder number (if applicable)

YES	NO	N/A	Item
■	☐	☐	Additional Cable Verification Methods (complete minimum 2 of the below methods and check upon successful completion).

- [x] Verify by counting duct numbers in at least (1) adjacent chamber
- [x] Verify applicable nomenclature (e.g., location, cable tag, feeder#) and ensure similar to drawings/records
- [x] Eliminate all other cables in location with cable ID equipment, ensuring transmitted signal is only reviewed on one feeder/cable.
- [ ] Identify/trace contents (cable type) of adjacent ducts in relation to the cable being identified
- [ ] Tug, move, tap on cables at both ends
- [ ] Fish ducts
- [ ] Shine flashlight beams through duct
- [ ] Ammeter load test
- [ ] Visually locate fault on cable

Additional Information / Comments:

PART 2: SPEARING / SPIKING RECORD

YES	NO	N/A	Item
☐	☐	■	Trace cable if not spearing/ spiking at exact work location and place a coloured tape marker for reference (check once completed). ☐ Trace Cable ☑ Not required
■	☐	☐	Spear/ spike cable to be performed by competent worker (EUSR 119-9, EUSR 141-10).
■	☐	☐	Confirm spearing/ spiking was effective.

Inspector Name, Signature & Date: Rod Finlay
Digitally signed by Rod Finlay
DN: cn=Rod Finlay, ou=Users, email=rodf@nbmengineering.com
Date: 2024.03.04 11:55:49 -05'00'

Certified Crew Leader Name, Signature & Date:

PHOTOS

Work Location (CC9439)

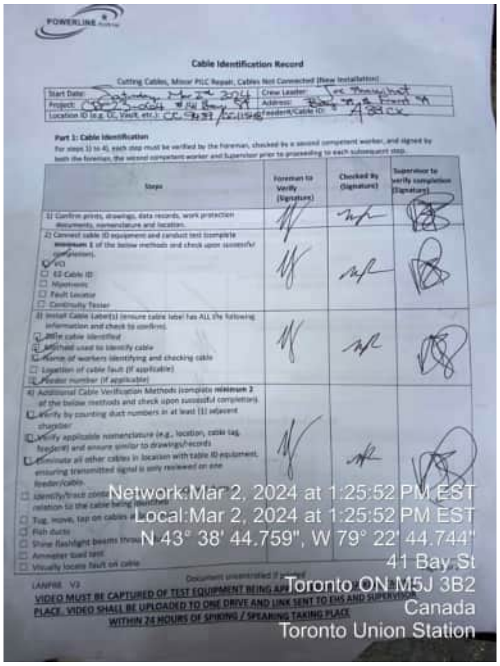
Cable ID

Cable ID Successful

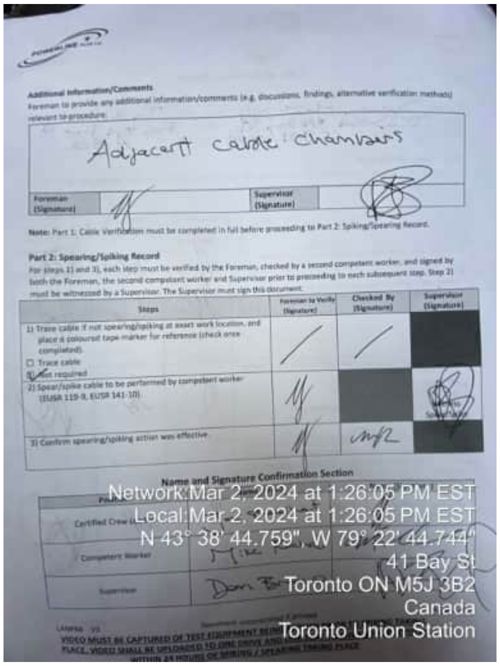
Cable Labelled

PHOTOS

Cable Spike Successful



PLP Cable ID Record Form (PG.1)



PLP Cable ID Record Form (PG.2)

Spike Tool Installed

Wade Avenue 77 – Temp Cap

C-230038-W10502-HT003

TABLE OF CONTENTS

TABLE OF FIGURES

PROJECT INFORMATION

PROJECT LOCATION(S):	77 Wade Avenue, Toronto, Ontario
PROJECT TYPE:	Overhead Services, Transformers, and Poles Installation
WBS ELEMENT NUMBER:	C-230038-W10502-HT003
PM ORDER NUMBER:	1000572973 and 1000572976
TORONTO HYDRO CONTACT:	Akiff Maredia
PROJECT START DATE:	November 7, 2023
PROJECT END DATE:	February 14, 2024
CONTRACTOR:	Powerline Plus Ltd.
CONTRACTOR'S FOREMAN:	Cody Anderson
INSPECTOR(S):	Cornel Pascal (ELI)

PROJECT SUMMARY

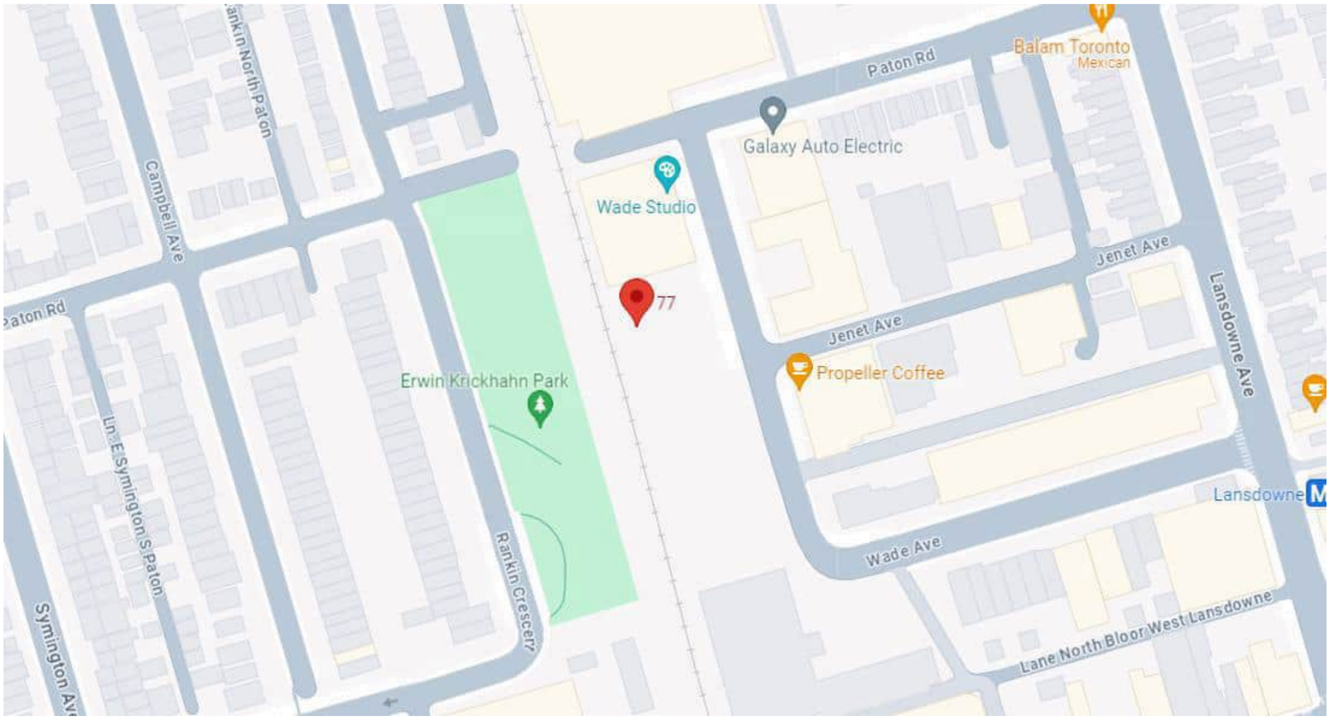


Figure 1 – Project Location

On February 14, 2024, Powerline Plus Ltd. (PLP) completed the project, which involved the installation of a 3-phase transformer at existing pole P27, as well as the installation of various poles and overhead primary and secondary conductors at new locations along 77 Wade Avenue, Toronto, Ontario.

PROJECT TIMELINES AND MILESTONES

Figure 2 - Project Timeline

AUDITOR SITE VISITS

Month of Visit: November, 2023

Inspector: Cornel Pascal (ELI)

Notes:

- On November 7, 2023, the crew worked on installing a bank of 3-phase transformers (OT24584) on pole P27 and installed the cutout switch. However, the transformers were of the wrong voltage and need to come back again.
- The contractor continued the work the next day and installed a new bank of 3-phase transformers.
- They connected secondary to the new transformer and framed new poles P20 and P50.
- Transferred service wires and streetlight to pole P20.
- Contractor energized OT24584 on pole P27 and connection had ESA approval.
- Contractor set-up adheres to MTO Book 7.
- All work was completed in accordance with Toronto Hydro standards and procedures.

FINAL INSPECTION NOTES AND DEFICIENCIES

On February 14, 2024, the auditor, Cornel Pascal, verified the project. NBM was not notified during the installation of poles P20 and P50, however, these were inspected post-construction. Several deficiencies were identified, including the installation of the wrong class of pole in the field where class 2 was required per design, but class 3 was installed instead, which is weaker. Additionally, there was missing stenciling on new poles P50 and P20, and asphalt restoration issues on various poles, which will be completed in spring. A quality NCR has been issued to the contractor. The contractor needs to provide designer confirmation and approval from TH on the changes to the original design relating to the class of pole used.

NON-COMPLIANCE REPORTS

The below NCR was issued during the duration and completion of the project:

NCR Type	NCR Number	Date Issued	Date Closed	Details
Quality	QUA-5608	February 15, 2024	Open	- Drawing states that existing 600/347V secondary needs to be transferred to new P20, but conductor has not been transferred. - Missing pole nomenclature on P20 and P50. - P50 needs asphalt restoration for: pole base, anchor and additional hole made for pole. - P11 needs asphalt restoration at anchor. - P58 needs asphalt restoration at ground rod. - Drawing calls for P20 to be installed as a class 2 wood pole, but class 3 has been installed.

INCOMPLETE TICKETS

There were no INC's issued during the duration and completion of the project:

INC Type	INC Number	Date Issued	Date Closed	Details
N/A	N/A	N/A	N/A	N/A

CHANGE ORDERS

The below change orders were issued during the duration and completion of the project:

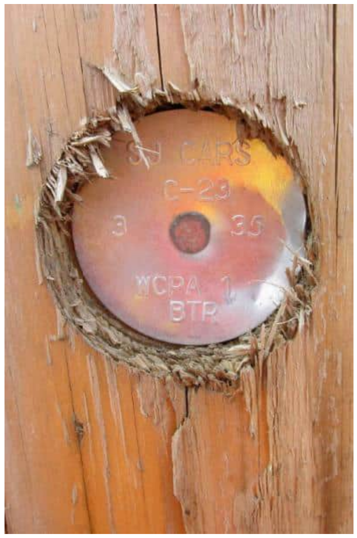
CO#	Date Requested	Date Approved	Details
Change Order # 1	January 11, 2024	January 19, 2024 (Rejected)	Captured unit for Premium Rates – incremental rates - work rescheduled from December 6, 2023 to December 13, 2023.
Change Order # 2	January 19, 2024	January 19, 2024 (Rejected)	Resubmission of Change Order # 1.
Change Order # 3	January 19, 2024	January 31, 2024	Resubmission of Change Order # 2.

AS-CONSTRUCTED VERIFICATION

After examining the as-constructed drawings and photos submitted by PLP, the on-site inspector, Cornel Pascal, has verified that all the mark-ups on the as-built drawings are accurate. The contractor has redlined the drawing approved by Toronto Hydro, confirming the changes in the class of pole installed; class 3 was used, as supported by the analysis report.

PHOTOS

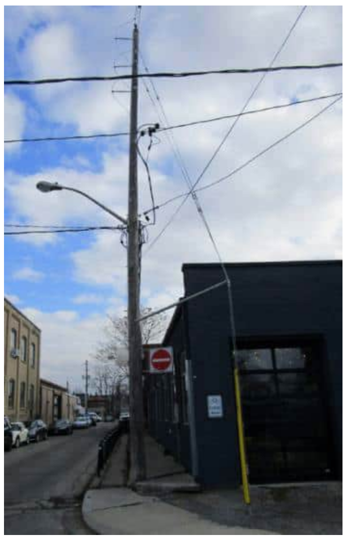
P20 – Pole Installation (Secondary Conductor and Stenciling Issues Fixed)



P20 – Pole Tag

P50 – Pole Installation (Stenciling Issue Fixed)

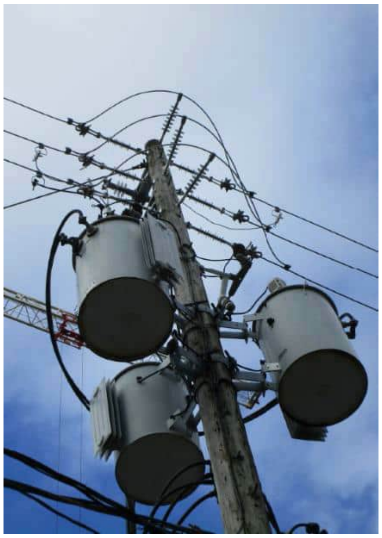
P50 – Pole Tag



P11 (Existing Pole) – Guying Installation

P11 (Existing Pole) – Overhead Conductors

P58 OT400445 (Existing) – 3-PH Double Dead-End Configuration



P58 OT400445 – Overhead Conductors Installation

P77 – Temporary Service for Construction Site

P27 OT24584 – 3-PH Transformer Installation

P27 OT24584 – 3-PH Transformer Installation

P27 – Guying Installation

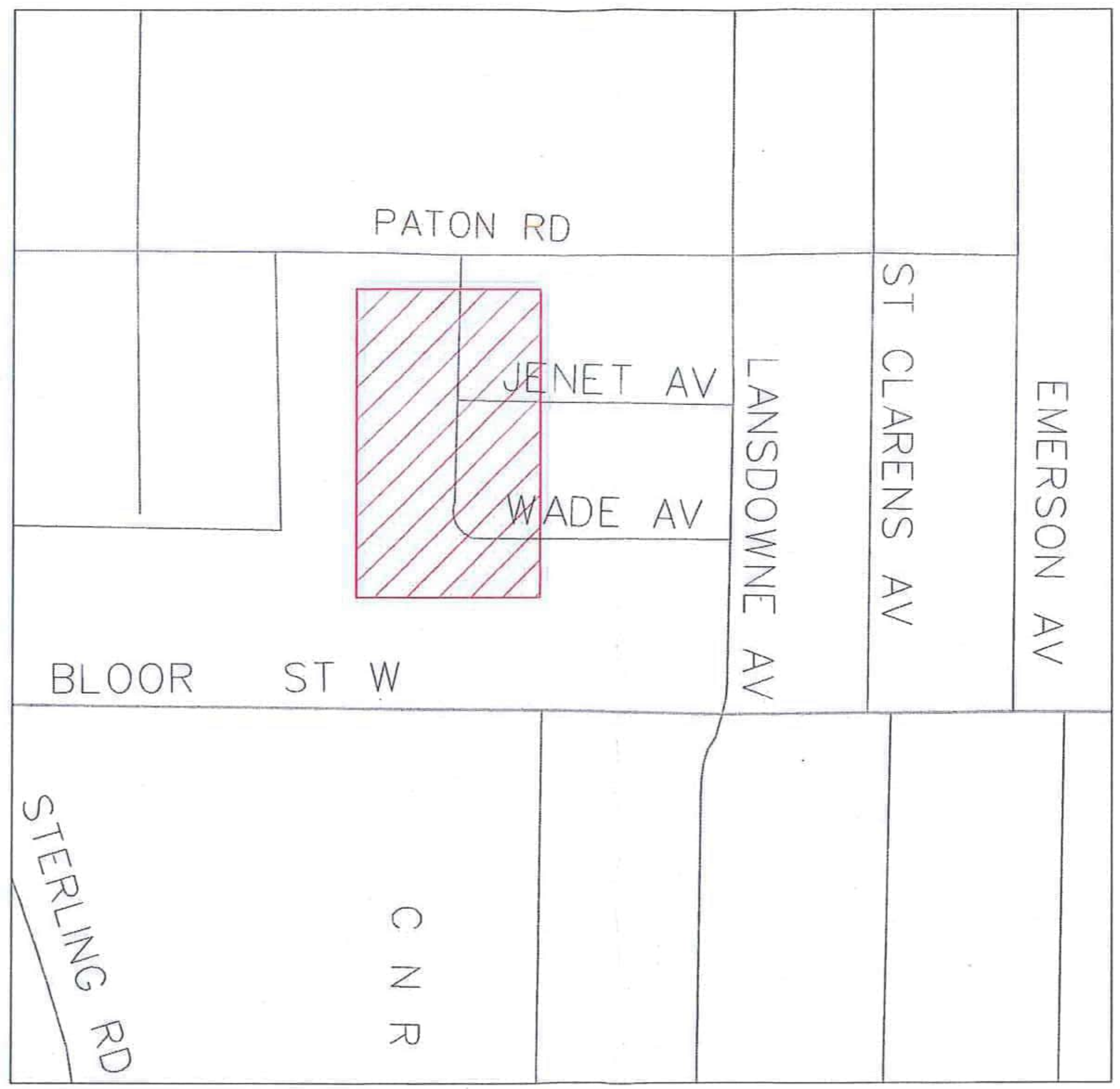
APPENDIX A – AS-BUILT DRAWINGS

TORONTO HYDRO
LOAD CONNECTIONS
C-230038-W10502-HT003
77 WADE TEMP
WADE AVE

THIS DRAWING SET REFLECTS THE LATEST CUSTOMER NOTIFICATION LIST DATE:________ (MM/DD/YYYY)
DRAWINGS REV#:________
APPROVED BY:________

GENERAL NOTES

1. PLUMB POLES AS REQUIRED.
2. TRIM TREES ALONG ROUTE AS REQUIRED.
3. AS PER THE REQUIREMENTS OF BILL 208. THE FOLLOWING "DESIGNATED SUBSTANCES" MAY BE ENCOUNTERED ON THE PROJECT:
MERCURY - MERCURY VAPOR LAMPS AND STREET LIGHT RELAYS
ETHYLENE OXIDE - POLYETHYLENE INSULATED CABLES
SILICA - CURRENT LIMITED FUSES AND LIGHTNING ARRESTERS(4kV).
4. IN INSTANCES WHERE AN ISOLATED AND UNDERGROUND LINE IS IN CLOSE PROXIMITY OF, AND FOLLOWS THE SAME GENERAL ROUTE OF AN ENERGIZED OVERHEAD LINE. IT IS POSSIBLE FOR THE ISOLATED LINE TO BE CHARGED BY INDUCTION. EXERCISE DUE CAUTION.
5. NEW POLES AND EQUIPMENT ARE TO BE NUMBERED AS PER CONSTRUCTION STANDARD SECTION 21. EXISTING POLE AND EQUIPMENT LOCATIONS ARE TO BE RELABLED AS INDICATED. BOTH THE NEW LOCATION NUMBER AND FORMER (IN BRACKETS) ARE SHOWN AT EACH POLE/EQUIPMENT LOCATION. (i.e. P1234(123)).
6. CONTRACTOR TO PERFORM ALL NECESSARY SWITCHING AND FINAL ENERGIZATION.
7. JOINT-USE ARRANGEMENTS WITH BELL CANADA, ROGERS CABLE AND ENBRIDGE MUST BE COORDINATED BY THE CONTRACTOR.
8. STREET LIGHTING INSTALLATION SHALL BE INSPECTED AND APPROVED BY THE ELECTRICAL SAFETY AUTHORITY (ESA)
9. MINIMUM HORIZONTAL CLEARANCE FROM FOREIGN UTILITIES SHALL BE MAINTAINED IN ACCORDANCE WITH APPENDIX 'O' AND TREE PROTECTION ZONE CLEARANCES SHALL BE ADHERED TO AS PER APPENDIX 'F' OF THE CITY OF TORONTO'S MUNICIPAL CONSENT REQUIREMENTS.
10. CONTRACTOR RESPONSIBLE FOR OBTAINING HOLD-OFFS WHEN NECESSARY
11. ASSUME THAT ALL CABLES ARE ENERGIZED AND OPERATING AT A NORMAL VOLTAGE OF 750 VOLTS OR MORE UNLESS OTHERWISE STATED.
12. ALL WORK ON THIS DRAWING SHALL BE PERFORMED BY THE CONTRACTOR UNLESS OTHERWISE STATED.
13. COMPLETE ALL PRELIMINARY WORK TO MINIMIZE POWER INTERRUPTION TO CUSTOMER.
14. IF NOT DIMENSIONED. POLE TO BE MOVED 0.5m OF EXISTING LOCATION, IN LINE WITH EXISTING POLE LINE.
15. ANY DAMAGE TO THE EXISTING UTILITIES IS TO BE DOCUMENTED AND WILL REQUIRE IMMEDIATE REPAIR. THE COST OF THE REPAIR IS THE RESPONSIBILITY OF THE CONTRACTOR.
16. CONTRACTOR TO OBTAIN AND RECORD THE HORIZONTAL AND VERTICAL LOCATION OF PROPOSED AND EXISTING INFRASTRUCTURE AS PER STD 31-0800.
17. RETURN RECOVERED CABLE, EQUIPMENT AND ASSOCIATED HARDWARE TO THESL STORE.



AS BUILT

AS CONSTRUCTED ROAD CUT

PERMIT #:	STREET #:		TO #:		FROM #:	
	RATED DEPTH [RD] (mm)	DEPTH [D] (mm)	WIDTH [D] (mm)	LENGTH [D] (mm)	FACTOR	TOTAL (sq.m)
ASPHALT						
BOULEVARD (DRIVEWAY)						
LOCAL ROAD						
ARTERIAL AND COLLECTOR ROADS						
GRIND AND PAVE						
CONCRETE						
SIDEWALK	85	100	300	300	1.17	0.2 sq.m
MONOLITHIC CURB AND S/W						
ROAD BASE						

CUT PERMIT INFORMATION

THESL APPLICATION #	PERMIT #	FROM	TO	STREET
THA-F-2023-XXXXX	XXXXXXXX			

DRAWING INDEX

SHEET	DRAWING #	REV #	DRAWING TYPE
1	2023-1007806	0	TITLE SHEET
2	2023-1007807	0	PRIMARY SCHEMATIC
3	2023-1007808	0	ELECTRICAL PLAN

AS CONSTRUCTED
☑ ELECTRICAL ☐ CIVIL
WITH CHANGES AS SHOWN ON THIS DRAWING.
Municipality: ☐ ET ☐ EY ☐ NY ☐ YK ☑ TO ☐ SC
Marked By: [illegible] — Date: 1/10/24, 1/10/24, 1/10/24
Approved by Toronto Hydro: Cornel Pascal, NBM, Inspector
Digitally signed by Cornel Pascal
DN: cn=Cornel Pascal, ou=Users, email=cornelp@nbmengineering.com
Date: 2024.03.05 09:18:48 -05'00'
CONTRACTOR COMPANY NAME: PLP — [illegible] — 1/10/24, 1/10/24
☑ This is to certify that the construction as recorded in this drawing is consistent with the approved plan, Standard Designs, or work instruction and that approved equipment has been used

CERTIFICATE OF APPROVAL

THIS WORK INSTRUCTION HAS BEEN ASSEMBLED UTILIZING ONLY CERTIFIED CONSTRUCTION STANDARDS, SPECIFICATIONS, APPROVED EQUIPMENT AND MEETS SAFETY REQUIREMENTS OF SECTION 4 OF THE ONTARIO REGULATION 22/04.

JOHN HECIMOVIC — NAME OF ENGINEER — DATE
SIGNATURE OF P.ENG. — ELECTRICAL DESIGN SUPERVISOR — POSITION

POWERLINE PLUS Ltd.
CPC23-036

ODAN·DETECH CONSULTING ENGINEERS
The Odan/Detech Group Inc. 5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

rev.	date	description of revision	by	design approval	construction approval
0	2023/09/28	ISSUED FOR CONSTRUCTION	L.H	J.H.	S.R.

TORONTO HYDRO

TORONTO HYDRO REVIEWED BY
Department: CPE
Contract Administrator: ARIFF MAREDIA
Signature:
Date: Oct 02, 2023

project reference #: C-230038-W10502-HT003		civil design (print name & signature)	date (yy/mm/dd)
drawn by: L. HOANG		civil design approval (print name & signature)	date (yy/mm/dd)
department/division: CPE		electrical design: L. HOANG, ODAN DETECH	date: 2023/07/13
district: TORONTO		electrical design approval: J. HECIMOVIC, ODAN DETECH	date: 2023/07/13
scale: N.T.S	sheet size: D	construction approval: S. RUSCETTI, PLP	date: 2023/07/13

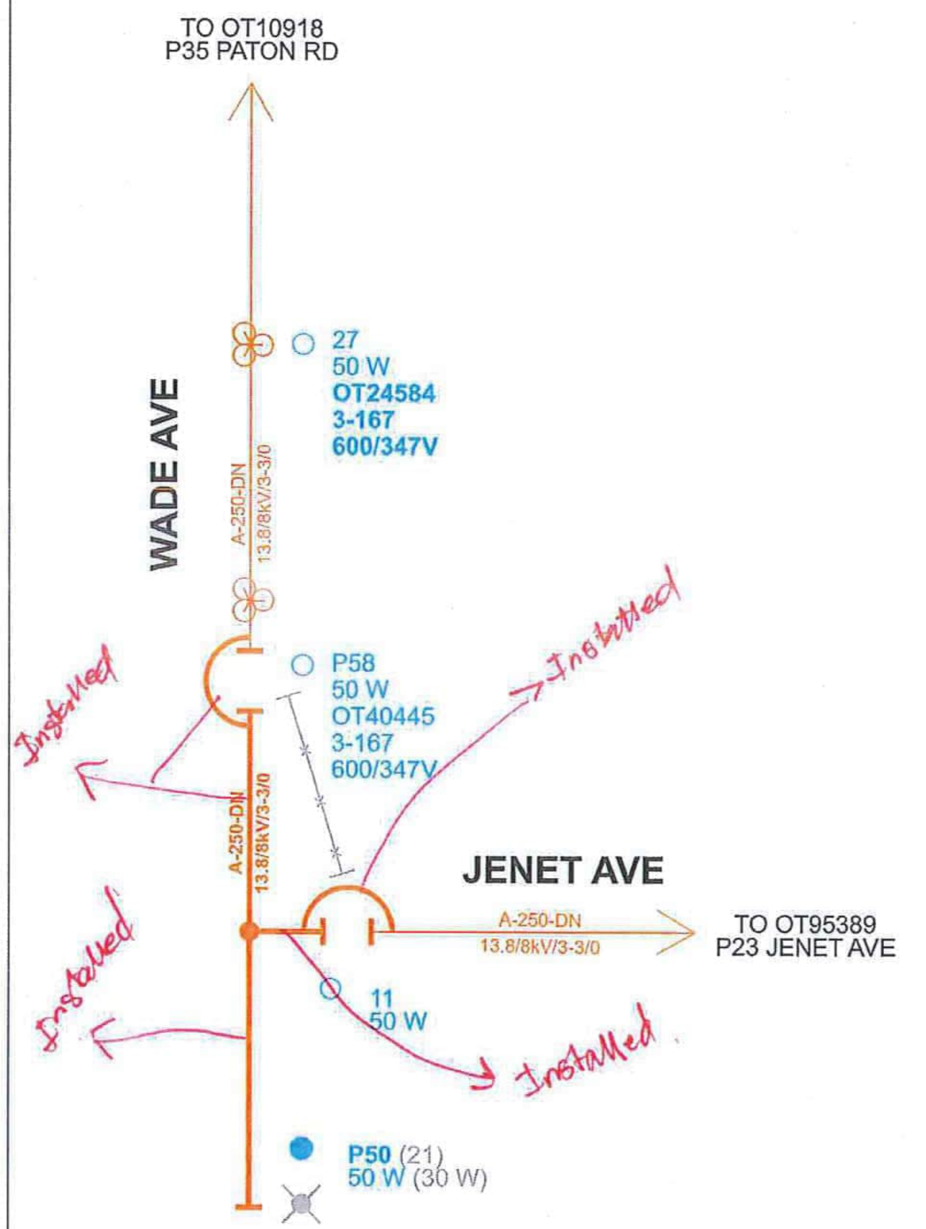
location: WADE AVE
project title: 77 WADE TEMP
dwg. type: TITLE PAGE

dwg. no.	sheet no.	rev. no.
2023–1007806	1 Of 3	0

$$date$$

REFER TO TITLE SHEET DRAWING #2023-1007806 FOR ACCOMPANYING PROJECT DRAWINGS

SITE: 77 WADE AVE



FEEDER A-250-DN

PRIMARY SCHEMATIC LEGEND	
SYMBOL	DESCRIPTION
PROPOSED	
	OVERHEAD 3-PHASE PRIMARY CABLE (SIZE AS INDICATED)
	POLE (TORONTO HYDRO OWNED) (UNSCALED)
	THREE 1-PHASE WYE POLE-MOUNTED TRANSFORMER
	CONNECTION NODE OR TAP
EXISTING	
	OVERHEAD 3-PHASE PRIMARY CABLE (SIZE AS INDICATED)
	POLE (TORONTO HYDRO OWNED) (UNSCALED)
	THREE 1-PHASE WYE POLE-MOUNTED TRANSFORMER
REMOVED	
	OVERHEAD 3-PHASE PRIMARY CABLE (SIZE AS INDICATED)
	POLE (TORONTO HYDRO OWNED) (UNSCALED)

DISCONNECTION OF UNUSED LINE WORK INSTRUCTIONS:

THE FOLLOWING PROCEDURES ARE MANDATORY IN ORDER TO COMPLY WITH THE REQUIREMENTS OF SECTION 11 "DISCONNECTION OF UNUSED LINES" OF ONTARIO REGULATION 22/04. NO EXCEPTIONS ARE THEREFORE PERMITTED. IF REMOVING AND/OR ABANDONING DISTRIBUTION LINES OF 750 VOLTS OR MORE, EITHER DIRECT BURIED OR IN UNDERGROUND DUCTS, THE FOLLOWING PROCEDURES ARE TO BE OBSERVED IN ORDER:

- REMOVE THE LINES COMPLETELY. MARK THE LINES AS "REMOVED" ON AS-BUILT DRAWING(S). SEND THE AS-BUILT DRAWING(S) TO THE CONTRACT ADMINISTRATOR AT TORONTO HYDRO.
- IF NOT REMOVED, DISCONNECT AND GROUND THE LINES AS PER TORONTO HYDRO STANDARD #16-0020. MARK THE LINES AS "GROUNDED" ON THE AS-BUILT DRAWING(S). SEND THE AS-BUILT DRAWING(S) TO THE CONTRACT ADMINISTRATOR AT TORONTO HYDRO.
- IF REMOVAL OR GROUNDING OF SUCH LINES IS NOT PRACTICAL, MARK THE LINES AS "UNGROUNDED" ON AS-BUILT DRAWING(S). SEND THE AS-BUILT DRAWING(S) TO THE CONTRACT ADMINISTRATOR AT TORONTO HYDRO. IN ADDITION, CONTACT THE SUPERVISOR, STANDARDS & MATERIALS SECTION AT TORONTO HYDRO WITH THE INFORMATION SUCH AS VOLTAGE, FEEDER DESIGNATION, AND LOCATION OF SUCH LINES.

AS BUILT

FIELD VALIDATION

☐Conceptual Primary Schematic
☐Preliminary Primary Schematic

SIGN-OFF

J. HECIMOVIC
Supervisor (Print Name & Signature)
J. HECIMOVIC
Planner/Designer (Print Name & Signature)

AS CONSTRUCTED
☐ ELECTRICAL ☐ CIVIL
WITH CHANGES AS SHOWN ON THIS DRAWING.
Marked By
Approved by Toronto Hydro
Cornel Pascal
CONTRACTOR
COMPANY NAME
Municipality: ☐ET ☐EY ☐NY ☐YK ☐TO ☐SC
Date
1/10/24
1/10/24
1/10/24
This is to certify that the construction as recorded in this drawing is consistent with the approved plan, Standard Designs, work instruction and that approved equipment has been used

Digitally signed by Cornel Pascal, cn=Cornel Pascal, ou=Users, email=cornelp@nbmengineering.com 2024.03.05 09:19:32 -05'00'

KEY MAP
N.T.S.

CERTIFICATE OF APPROVAL

THIS WORK INSTRUCTION HAS BEEN ASSEMBLED UTILIZING ONLY CERTIFIED CONSTRUCTION STANDARDS, SPECIFICATIONS, APPROVED EQUIPMENT AND MEETS SAFETY REQUIREMENTS OF SECTION 4 OF THE ONTARIO REGULATION 22/04.

JOHN HECIMOVIC
NAME OF ENGINEER

DATE

SIGNATURE OF P.ENG.

ELECTRICAL DESIGN SUPERVISOR
POSITION

CPC23-036

POWERLINE PLUS Ltd.

ODAN·DETECH CONSULTING ENGINEERS
The Odan/Detech Group Inc. 8230 South Service Road, Burlington, Ontario, L7L 5K2

rev.	date	description of revision	by	design approval	construction approval
0	2023/09/28	ISSUED FOR CONSTRUCTION	LH	J.H.	S.R.

TORONTO HYDRO

TORONTO HYDRO REVIEWED BY
Department: CPE
Contract Administrator: AKIFF MAREDIA
Signature:
Date: Oct 02, 2023

project reference # C-230038-W10502-HT003		civil design	date
drawn by L. HOANG		civil design approval	date
department/division CPE		electrical design L. HOANG, ODAN DETECH	date 2023/07/13
district TORONTO		electrical design approval J. HECIMOVIC, ODAN DETECH	date 2023/07/13
scale N.T.S	sheet size D	construction approval S. RUSCETTI, PLP	date 2023/07/13

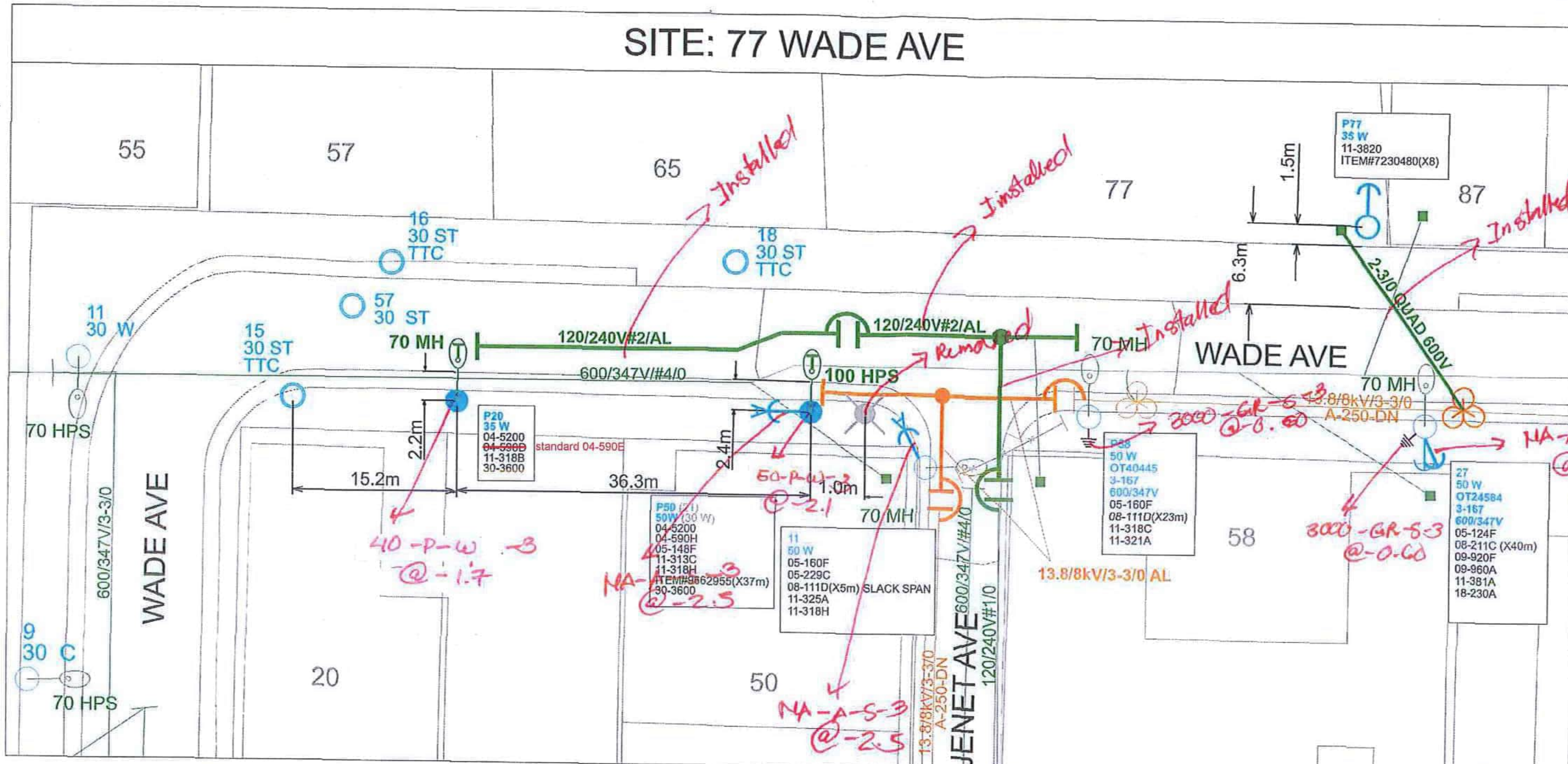
location: WADE AVE

project title: 77 WADE TEMP

dwg. type: PRIMARY SCHEMATIC

dwg. no.	sheet no.	rev. no.
2023–1007807	2 of 3	0

$Sdate$S



REFER TO TITLE SHEET DRAWING •2023-1007806 FOR ACCOMPANYING PROJECT DRAWINGS

KEY MAP
N.T.S.

CERTIFICATE OF APPROVAL

THIS WORK INSTRUCTION HAS BEEN ASSEMBLED UTILIZING ONLY CERTIFIED CONSTRUCTION STANDARDS, SPECIFICATIONS, APPROVED EQUIPMENT AND MEETS SAFETY REQUIREMENTS OF SECTION 4 OF THE ONTARIO REGULATION 22/04.

JOHN HECIMOVIC
NAME OF ENGINEER

DATE

SIGNATURE OF P.ENG.

ELECTRICAL DESIGN SUPERVISOR
POSITION

POWERLINE PLUS Ltd.

CPC23-036

ODAN·DETECH CONSULTING ENGINEERS

ELECTRICAL LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	PROPOSED		EXISTING
	OVERHEAD 3-PHASE PRIMARY CABLE (SIZE AS INDICATED)		OVERHEAD 3-PHASE PRIMARY CABLE (SIZE AS INDICATED)
	OVERHEAD SECONDARY CABLE (SIZE AS INDICATED)		OVERHEAD SECONDARY CABLE (SIZE AS INDICATED)
	PRIMARY DEAD-END 3-PHASE OR 1-PHASE		PRIMARY DEAD-END 3-PHASE OR 1-PHASE
	SECONDARY DEAD-END 1-PHASE		SECONDARY DEAD-END 1-PHASE
	HOME SUPPLY POINT		POLE (TORONTO HYDRO OWNED) (UNSCALED)
	STREET LIGHT WITH PHOTOCELL		POLE (FOREIGN) (UNSCALED)
	POLE (TORONTO HYDRO OWNED) (UNSCALED)		STREET LIGHT WITH PHOTOCELL
	POLE (FOREIGN) (UNSCALED)		TRANSFER
	THREE 1-PHASE WYE POLE-MOUNTED TRANSFORMER		STREET LIGHT WITH PHOTOCELL
	DOWN GUY WITH ANCHOR		GROUND POINT
	STRUT GUY		
	GROUND POINT		
	REMOVED		
	OVERHEAD 3-PHASE PRIMARY CABLE (SIZE AS INDICATED)		
	POLE (TORONTO HYDRO OWNED) (UNSCALED)		
	POLE (FOREIGN) (UNSCALED)		

GUYING AND ANCHORING SCHEDULE

POLE DETAILS		GUYING DETAILS				ANCHOR DETAILS		
POLE NUMBER	STREET NAME	GUYING TYPE	ATTACHMENT HEIGHT (m)	STRUT BAR HEIGHT (m)	GUYING STANDARD	LEAD LENGTH (m)	ORIENTATION	ANCHORING STANDARD
27	WADE	DOWN	7.25m, 7.55m	-	07-510GX2	3.0m	NE	07-210D
11	JENET	STRUT	11.2, 12.3m	3.5m	07-522G	3.0m	W	07-210D
P50	WADE	STRUT	11.15m, 12.4m	3.5m	07-522G	3.0m	S	07-210D

WORK BY TORONTO HYDRO:

1. SUPPLY AND INSTALL PROPOSED 3-PHASE TRANSFORMER BANK AT EXISTING POLE 27 AS PER STD. 11-381A AND 11-3820.
2. SUPPLY AND INSTALL 2-3/0 QUADPLEX SECONDARY CONDUCTOR FROM EXISTING POLE 27 TO CUSTOMER POLE AS PER STD. 11-381A AND 11-3820.
3. INSTALL PROPOSED GUYING AND ANCHOR AT EXISTING POLE 27 AS PER STD. 07-210D AND 07-510G AS SHOWN.
4. SUPPLY AND INSTALL PROPOSED 35' WOOD POLE P20 AS PER STD. 04-5200 AND 04-590D. FRAME POLE P20 AS PER STD. 11-318B. TRANSFER SECONDARY TO PROPOSED POLE 20 AND TRANSFER STREETLIGHT FROM EXISTING POLE 57 TO PROPOSED POLE 20 AS PER STD. 30-3600. DISCONNECT AND REMOVE STREETLIGHT FEED TO EXISTING POLE 57.
5. SUPPLY AND INSTALL PROPOSED 50' WOOD POLE 50 AS PER STD. 04-5200 AND 04-590H. FRAME NEW POLE AS PER STD. 05-148F, 11-313C AND 11-318H. INSTALL #2 AL TRIPLEX CONDUCTOR FROM POLE P58 TO PROPOSED POLE P20 (ITEM# 9662925 X50m) AS SHOWN.TRANSFER EXISTING STREETLIGHT TO PROPOSED P50 AS PER 30-3600. TRANSFER SECONDARY LATERALS TO PROPOSED POLE P50 FROM EXISTING POLE 21. REMOVE EXISTING 30' WOOD POLE 21.
6. INSTALL PROPOSED GUYING AND ANCHOR AT PROPOSED POLE P50 AS PER STD. 07-210D AND 07-522G.
7. RE-FRAME EXISTING PRIMARY CONDUCTOR AT EXISTING POLE P58 AS PER STD. 05-160F.
8. INSTALL NEW PRIMARY CONDUCTOR FROM EXISTING POLE P58 TO PROPOSED POLE P50 AS PER STD. 08-111D.
9. RE-FRAME EXISTING POLE 11 AS PER STD. 05-160F. SLACK SPAN PROPOSED 5m OF 3/0 ACSR CONDUCTOR TO MID-SPAN TAP AS PER STD. 05-229C.
10. *INSTALL PROPOSED GUYING AND ANCHOR AT EXISTING POLE 11 AS PER STD. 07-210D AND 07-522G.*
11. INSTALL 120.240V SECONDARY MID-SPAN TAP FROM EXISTING POLE 11 AS PER 11-325A TO PROPOSED SECONDARY CONDUCTOR.

WORK BY CUSTOMER:

1. SUPPLY AND INSTALL PROPOSED 35' CUSTOMER-OWNED POLE P77 AS PER TORONTO HYDRO STANDARDS.
2. SUPPLY AND INSTALL DOWNGUY AND ANCHOR (3.0m LEAD LENGTH) AS PER TORONTO HYDRO STANDARDS.
3. CUSTOMER TO SUPPLY AND INSTALL WEATHERHEAD, SERVICE MAST AND CLEVIS AS PER STD. 11-3820.
4. OBTAIN ESA AUTHORIZATION PRIOR TO ENERGIZATION.

DISCONNECTION OF UNUSED LINE WORK INSTRUCTIONS:

THE FOLLOWING PROCEDURES ARE MANDATORY IN ORDER TO COMPLY WITH THE REQUIREMENTS OF SECTION 11 "DISCONNECTION OF UNUSED LINES" OF ONTARIO REGULATION 22/04. NO EXCEPTIONS ARE THEREFORE PERMITTED. IF REMOVING AND/OR ABANDONING DISTRIBUTION LINES OF 750 VOLTS OR MORE, EITHER DIRECT BURIED OR IN UNDERGROUND DUCTS, THE FOLLOWING PROCEDURES ARE TO BE OBSERVED IN ORDER:

- REMOVE THE LINES COMPLETELY. MARK THE LINES AS "REMOVED" ON AS-BUILT DRAWING(S). SEND THE AS-BUILT DRAWING(S) TO THE CONTRACT ADMINISTRATOR AT TORONTO HYDRO.
- IF NOT REMOVED, DISCONNECT AND GROUND THE LINES AS PER *TORONTO HYDRO STANDARD #16-0020*. MARK THE LINES AS "GROUNDED" ON THE AS-BUILT DRAWING(S). SEND THE AS-BUILT DRAWING(S) TO THE CONTRACT ADMINISTRATOR AT TORONTO HYDRO.
- IF REMOVAL OR GROUNDING OF SUCH LINES IS NOT PRACTICAL, MARK THE LINES AS "UNGROUNDED" ON AS-BUILT DRAWING(S). SEND THE AS-BUILT DRAWING(S) TO THE CONTRACT ADMINISTRATOR AT TORONTO HYDRO. IN ADDITION, CONTACT THE SUPERVISOR, STANDARDS & MATERIALS SECTION AT TORONTO HYDRO WITH THE INFORMATION SUCH AS VOLTAGE, FEEDER DESIGNATION, AND LOCATION OF SUCH LINES.

FIELD VALIDATION
☐Conceptual Primary Schematic
☐Preliminary Primary Schematic
SIGN-OFF
J. HECIMOVIC
Supervisor (Print Name & Signature)
J. HECIMOVIC
Planner/Designer (Print Name & Signature)

AS CONSTRUCTED
☑ ELECTRICAL ☐ CIVIL
WITH CHANGES AS SHOWN ON THIS DRAWING
Municipality ☐ET ☐EY ☐NY ☐YK ☑TO ☐SC
Marked By
Date
1/10/24
Approved by Toronto Hydro
NBM
Cornel Pascal
Digitally signed by Cornel Pascal
CONTRACTOR
COMPANY NAME
1/10/24
This is to certify that the construction as recorded on this drawing is consistent with the approved plan, Standard Designs, or work instruction and that approved equipment has been used

rev.	date	description of revision	by	design approval	construction approval
0	2023/09/08	ISSUED FOR CONSTRUCTION	L.H.	J.H.	S.R.

TORONTO HYDRO

TORONTO HYDRO REVIEWED BY
Department: CPE
Contract Administrator: AKIFF MAREDIA
Signature:
Date: Oct 02, 2023

project reference # C-230038-W10502-HT003	civil design		date yyy/mm/dd
drawn by L. HOANG	civil design approval		date yyy/mm/dd
department/division CPE	electrical design L. HOANG, ODAN DETECH		date 2023/07/13
district TORONTO	electrical design approval J. HECIMOVIC, ODAN DETECH		date 2023/07/13
scale N.T.S	sheet size D	construction approval S. RUSCETTI, PLP	date 2023/07/13

location: WADE AVE

project title: 77 WADE TEMP

dwg. type: ELECTRICAL PLAN

dwg. no.	sheet no.	rev. no.
2023-1007808	3 of 3	0

$Sdate$$

TORONTO HYDRO - ELECTRIC SYSTEM LIMITED

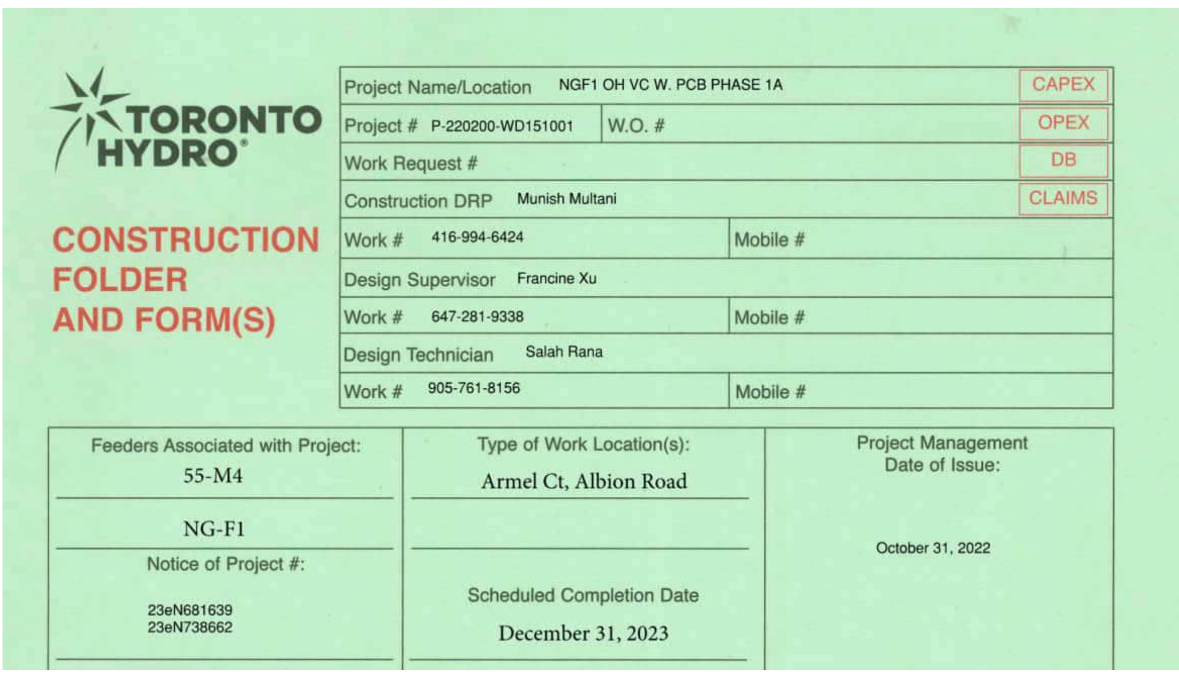
PROJECT NUMBER: 231-60000-11

THESL PROJECT NUMBER: P-220200-WD151001

NGF1 OH VC W. PCB PHASE 1A
PROJECT FINALIZATION REPORT

FEBRUARY 21, 2024

CONFIDENTIAL



TORONTO HYDRO

CONSTRUCTION FOLDER AND FORM(S)

Project Name/Location	NGF1 OH VC W. PCB PHASE 1A		CAPEX
Project # P-220200-WD151001	W.O. #		OPEX
Work Request #			DB
Construction DRP	Munish Multani		CLAIMS
Work # 416-994-6424		Mobile #	
Design Supervisor	Francine Xu		
Work # 647-281-9338		Mobile #	
Design Technician	Salah Rana		
Work # 905-761-8156		Mobile #	

Feeders Associated with Project:	Type of Work Location(s):	Project Management Date of Issue:
55-M4	Armel Ct, Albion Road	October 31, 2022
NG-F1		
Notice of Project #: 23eN681639 23eN738662	Scheduled Completion Date December 31, 2023	

REPORT NUMBER: 231-60000-11_REPT-0001_R.0

NGF1 OH VC W. PCB PHASE 1A

PROJECT FINALIZATION REPORT

THESL

PROJECT FINALIZATION REPORT (REV. 0)
CONFIDENTIAL

PROJECT NO.: 231-60000-11
THESL PROJECT NUMBER: P-220200-WD151001
DATE: FEBRUARY 21, 2024

WSP
100 COMMERCE VALLEY DRIVE WEST
THORNHILL, ONTARIO, L3T 0A1 CANADA
T: +1 905-882-1100

WSP.COM

CONTRIBUTORS

Owner: Toronto Hydro - Electric System Limited			
Contractor: Valard Construction LP			
Auditor: WSP Canada		**Signature**	**Date**
Site Auditor(s):	Doug Jamieson Electrical Auditor		Feb 21 2024
Prepared by:	Diya George PCO		Feb 21 2024
Approved by:	Kamran Fallahi WSP DRP for A&V Program	Kamran Fallahi	Feb 21 2024

Notes:

Contractor to confirm on Civil GCF
Contractor to provide revised ECF Summary Sheet

TABLE OF CONTENTS

For remaining Appendices, please check zipped folder with title "Appendices.zip".

1 PROJECT BACKGROUND

1.1 GENERAL INFORMATION

THESL Project #	P-220200-WD151001
Project Name	NGF1 OH VC W. PCB PHASE 1A
Department	CPW
Pre-Job Meeting Date	Feb 9 2023
THESL Contract Administrator (CA)	Francine Xu
Contractor	Valard
Construction Period	MAY 2023 -JAN 2024
WSP Field Auditor(s)	Doug Jamieson
WSP Certified Engineer	Kamran Fallahi
Audit Period	MAY 2023 -JAN 2024
Attainment Date	DEC 22 2023
# of NCRs	N/A
GCF Score	94.4%

Project Location

TORONTO HYDRO

NGF1 OH VC W. PCB PHASE 1A

P-220200-WD151001

KEY MAP

Project Drawings

DRAWING INDEX			
SHEET	**DRAWING #**	**REV #**	**DRAWING TYPE**
1	2022-018815	3	TITLE SHEET
2	2023-1008621	0	DETAILS
3	2022-018816	1	PRIMARY SCHEMATIC
4	2022-018817	3	OH & ELECTRICAL PLAN
5	2022-018818	3	CIVIL PLAN 1of 2
6	2022-018819	3	CIVIL PLAN 2 of 2

1.2 SCOPE BRIEF DESCRIPTION

High Level Description of Work

The scope of work included to rebuild the existing aged and unreliable overhead infrastructure on feeder NGF1 including poles with non-standard insulators and extension brackets , conductors , overhead transformers and vault transformers

1.3 ASSETS INSTALLATION AND REMOVAL

- 1 Transformer install and removal.
- 1 Pole install and removal.

2 PROJECT AUDIT SERVICE DESCRIPTION

The scope of work for the Project audit services involved evaluating the Project Execution with attending in the Pre-job meeting, site inspection during execution and finally close out the Project. It also involved QA functions and high-level oversight of QC of construction activities have been performed by Contractor as listed below:

- Attending in Pre-Con meeting.
- Performed audit of all the Project activities and compared them with the required standard and best practice.
- Verified material/equipment acquired by contractor (delivered by THESL to the Contractor) is in accordance with the Bill of Material (Prelim BOM attached) and is in accordance with THESL standard specifications.
- Verified contractors' adherence to Applicable Laws & Guidelines and Safety.
- Conducted QA and workmanship verification/reporting to confirm construction work conforms to construction drawings approved by THESL, THESL standards and specifications and Canadian regulation.
- Conducted site inspection and provided Audit field support and audit daily report and prepared report on deficiencies.
- Validated and documented all the required construction changes from original design using Change Order process. Validate completion of all changes.
- Prepared all of document/report safety infractions and reflecting site safety and field safety awareness in site daily report.
- Observed project execution and reviewed contractor performance in order to check for any non-comply situation and in case of any issue, to raise a Quality, Safety or Admin Non-Compliance Reports to contractor.
- Validated all required forms, permits and approvals before any execution on job site.
- Verified Contractor UPCMS Billing sheets.
- Verified Contractor Change Orders. (Not applicable for this project)
- Verified markup drawings and As-Built drawings that have been prepared by Contractor.

3 APPENDICES SUMMARY

ITEM	STATUS / COMMENT	APPENDIX REF.
Certificate of Substantial Completion	Completed	Appendix A
Final Quality Assurance Checklist	Completed	Appendix B
Final Walkdown Checklist	Completed	Appendix C
Non-Compliance Reports	N/A	N/A
Prelim BOM Verification Report	Completed	Appendix E
Critical Task Checklist	Completed	Appendix F
Pre-Job Meeting Memo and EHS Form	Completed	Appendix G
Completed Contractor UPCMS Billing Sheets and Supporting Documentation	Completed	Refer to folder “Appendices.zip”
Contractor Close-Out GCF Verification Checklist	Completed	Refer to folder “Appendices.zip”
THESL Department Requisition (Electrical)	Completed	Refer to folder “Appendices.zip”
Asset Installation Checklist	Completed	Refer to folder “Appendices.zip”
Change Orders and Change Order Log	Completed	Refer to folder “Appendices.zip”
Equipment Change out Record	Completed	Refer to folder “Appendices.zip”
Nomenclature Labelling Report	Completed	Refer to folder “Appendices.zip”
ECF Summary Sheet	Completed	Refer to folder “Appendices.zip”
Investment Recovery Forms	Completed	Refer to folder “Appendices.zip”
As Built Drawings Signed	Completed	Refer to folder “Appendices.zip”
GCF Back Signed	Completed	Refer to folder “Appendices.zip”
Street Light Change Forms	N/A	N/A
Material Return Forms	Completed	Refer to folder “Appendices.zip”
TPTF Forms	Completed	Refer to folder “Appendices.zip”

APPENDIX

A

CERTIFICATE OF SUBSTANTIAL COMPLETION

FORM 6
CERTIFICATE OF SUBSTANTIAL PERFORMANCE OF THE CONTRACT UNDER SECTION 32 OF THE ACT

Construction Lien Act

Ontario / Toronto ,
(County/District/Regional Municipality/Town/City in which premises are situated)

Armel Court and Albion Road, Toronto, ON M9W 3P1, Canada ,
(street address and city, town, etc., or, if there is no street address, the location of the premises)

This is to certify that the contract for the following improvement:

P-220200-WD151001 - NGF1 OH VC W. PCB PHASE 1A
(short description of the improvement)

LICENSED PROFESSIONAL ENGINEER
Kamran Fallahi
K. FALLAHI
100196231
2024-2-21
PROVINCE OF ONTARIO

to the above premises was substantially performed on December 22, 2023 .
(date substantially performed)

Date certificate signed: February 21 2024 .

WSP Canada - Kamran Fallahi
(payment certifier where there is one)

Toronto Hydro Electric System Limited
(owner and contractor, where there is no payment certifier)

Name of owner: Toronto Hydro Electric System Limited

Address for service: 14 Carlton Street, Toronto, ON, M5B 1K5

Name of contractor: Valard Construction LP

Address for service: 4209 99 Street, Edmonton Alberta T6E 5V7, Canada

Name of payment certifier (where applicable): WSP Canada

Address: 100 Commerce Valley Drive East, Thornhill, Ontario, L3T 0A1

(Use A or B, whichever is appropriate)

☐ A. Identification of premises for preservation of liens:

NA
(where liens attach to premises, reference to lot and plan number or instrument registration number)

☑ B. Office to which claim for lien must be given to preserve lien:

Toronto Hydro Electric System - LTD (14 Carlton Street, Toronto, ON, M5B 1K5)
(where liens do not attach to premises)

APPENDIX

B FINAL QUALITY ASSURANCE CHECKLIST

Final Quality Assurance Checklist

Electrical Inspector: Doug Jamieson	Civil Inspector:	Audit Date: Feb. 6, 2024
Project Number: P-220200-WD151001	**Project Name:** NGF1 OH VC W. PCB PHASE 1A	

No.	Project Deficiency List Sign Off (Safety, Quality) Status	Yes	No	N/A	Comments
1	Safety NCRs	☐	☒	☐	
2	Quality and Administrative NCRs	☐	☒	☐	
3	Incomplete Work Ticket	☐	☒	☐	
4	All Safety, Quality and Administrative NCRs have been resolved and closed	☐	☒	☐	
5	All Incomplete Work Ticket NCRs have been submitted for follow-up	☐	☒	☐	
6	All deficiencies (including ESA identified deficiencies) have been rectified by the Contractor	☐	☒	☐	
No.	**As-Built Drawings Status**	**Yes**	**No**	**N/A**	**Comments**
7	All as-built drawings have been submitted and verified by auditor	☒	☐	☐	
8	All as-built drawings have been stamped and signed	☒	☐	☐	
9	Any CVP or 34-1000 Deviation from the approved drawings	☒	☐	☐	
10	All changes and deviations from design are marked-up on the As-Built drawings	☒	☐	☐	
11	As-built drawings match with the Nomenclature and ECF forms	☒	☐	☐	
12	Drawings are complying with CSA-S250 & 31-0800 and are all clear/readable	☐	☐	☐	
No.	**Safety**	**Yes**	**No**	**N/A**	**Comments**
13	All of the activities performed in safety manner	☒	☐	☐	
14	Traffic Paid Duty	☒	☐	☐	
15	Is the site left safe and ready to operate	☒	☐	☐	
16	Is there any hazards left on site after day-work is finished	☐	☒	☐	

No.	Adherence to Critical Task Checklist (Civil)	Yes	No	N/A	Comments
17	Vaults/Chamber Build	☐	☐	☒	
18	Remove/Lift Slab test at vault	☐	☐	☒	
19	Breaking into ducts or ductbanks containing energized cable	☐	☐	☒	
20	Duct radius installation	☒	☐	☐	
21	Mandrelling of ducts	☒	☐	☐	
22	Pumping of water from structures	☐	☒	☐	
23	Cutting of Asphalt on City roads	☒	☐	☐	
24	Tunneling & boring	☐	☒	☐	
25	Directional drilling	☐	☒	☐	
26	Core Drilling into Energized Vaults/Chambers	☐	☒	☐	
27	Drain connection to City sewer	☐	☒	☐	
28	Customer communication	☐	☒	☐	
29	Multiple contractor on Site	☒	☐	☐	
30	Site Restoration for City Road, Sidewalk and customer driveway have been completed as per standard and there was no outstanding restoration	☒	☐	☐	
No.	**Adherence to Critical Task Checklist (Electrical)**	**Yes**	**No**	**N/A**	**Comments**
31	Power Interruptions have been audited by site inspector	☒	☐	☐	
32	Life support	☐	☒	☐	
33	Working at a Hydro One Transformer Station Facility	☐	☒	☐	
34	Cable Identification/ Spearing	☐	☒	☐	
35	Transportation of Dangerous Goods or working in vicinity of hazardous materials	☐	☒	☐	
36	Inter-utility coordination	☐	☒	☐	
37	Delta to Wye Conversion	☐	☒	☐	
38	Padmounted Tx, Submersible Tx, Vault Tx, and Padmounted Switchgear final installation photographs prior to energization	☒	☐	☐	
No.	**Design Change / Change Order**	**Yes**	**No**	**N/A**	**Comments**
39	Any Design Change	☒	☐	☐	
40	Any Field Change	☐	☒	☐	
41	Any Change Order	☒	☐	☐	Still waiting for THESL
No.	**Professional Conduct**	**Yes**	**No**	**N/A**	**Comments**

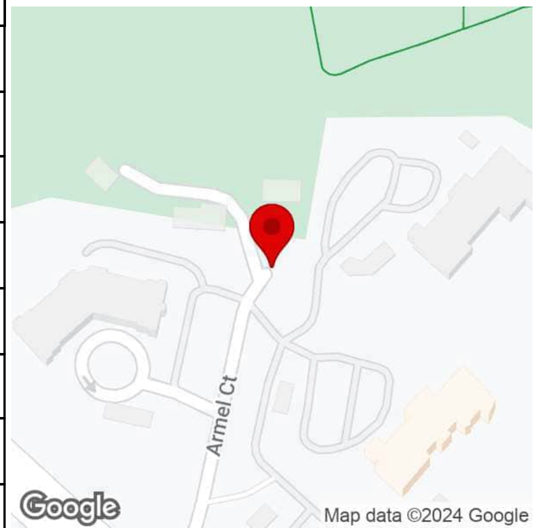
42	Outage letters were issued on a timely basis	☒	☐	☐	
43	Customer requests & issues were dealt with & resolved in a Professional manner	☒	☐	☐	
44	Contractor dealt with public in a courteous and cooperative manner	☒	☐	☐	
45	Proper signage posted on construction site as per THESL and MCR requirements	☒	☐	☐	
46	Cut Permits are valid during cutting of City Road/Side walks	☒	☐	☐	

No.	Lessons Learned & Areas for Improvement	Comments
47	**For Contractor**	
48	**For Auditor**	none

APPENDIX

C FINAL WALKDOWN CHECKLIST

THESL - Final Walkdown Checklist (Regular)	
WSP Inspector Representative:	Doug.jamieson@wsp.com
Contractor Representative:	No
Date:	2024-01-17
THESL Department:	CPW
Project Number:	231-60000-11
Project Location:	Armed crt
THESL CA:	Francine
THESL Project Number:	
Project Name:	Ngf1



1- SITE OBSERVATION/VERIFICATION					
No.	**Finding**	**YES**	**NO**	**N/A**	**Comments**
1-1	Project scope of work has been completed as defined in IFC drawings	☑	☐	☐	
	All equipment been installed and energized as per final primary schematic	☑	☐	☐	
	All assets requiring P&C have been commissioned (if applicable)	☐	☐	☑	
1-2	All electrical work removal (including OH, UG and street lighting) has been completed	☑	☐	☐	
	All civil work removal has been completed	☑	☐	☐	
	All cables are either: - Properly terminated at both ends, or	☑	☐	☐	
	- Not terminated, and capped at both ends following THESL standard	☑	☐	☐	
1-3	All site area has been cleaned up and comply with City standard and MCR requirements	☑	☐	☐	Spring clean up required
	Site has been left safe with no undue hazards as per Ontario Reg 22/04	☑	☐	☐	
1-4	All temporary restorations have been completed as per MCR	☑	☐	☐	
	All customer restorations are completed, and debris removed	☑	☐	☐	
1-5	Is there any pole with 3rd party attachments has been remained on site	☑	☐	☐	At albion
	Has TPTF form been submitted by contractor	☐	☑	☐	
1-6	Nomenclature, phase markings etc. are installed as per standard	☑	☐	☐	
1-7	Field drawings have been checked for partial energization stamp, date and signed	☑	☐	☐	
1-8	All Site modification/changes captured either as As-Built or Red-Line Drawings	☐	☑	☐	Not yet
1-9	All deficiencies found have been sent to the Contractor for follow-up (Refer to Section-2)	☐	☐	☑	None found

1-10	Others	☐	☑	☐	

Inspector sign off:

WSP Inspector Representative: Doug.jamieson@wsp.com

(First name, Last name)

Date of the Final Walkdown 2024-01-17

(Year, Month, Day)

Inspector Signature: 

APPENDIX

D

NON-COMPLIANCE REPORTS

(Not applicable)

APPENDIX

E

BOM VERIFICATION REPORT

															WSP Verification					
Order	Activity	Reservation	Item number of reservation	Requirements date	Material	Material Description	Requirement Quantity	Base Unit of Measure	Removed quantity	Difference Quantity	Quantities as per original Estimate	Issued (Delivered) Quantities	Used Quantities	Differences Quantities (Issued - Used on site)	WSP Comments	Record of Returned items	Material Returned	$/unit	$ Need Return	$ Returned
1000465854	0020	529901	1	1/16/2023	1400019	POLE 55' WESTERN RED CEDAR CLASS 2 AS	1	EA	1	0	1	1	1	0	1 installed			$ 1,778.69	$ -	
1000465858	0020	529904	2	2/21/2023	2500023	ANCHOR EXPANSION 12" DIAMETER ANCHOR	1	EA	1	0	1	1	1	0				$ 112.69	$ -	
1000465859	0020	529906	5	1/16/2023	6380011	INDICATOR FAULT UG 1PH INTEGRAL DISPLAY	3	EA	3	0	3	3	3	0				$ 235.74	$ -	
1000465859	0020	529906	1	1/16/2023	6663301	TRANSFORMER PADMOUNTED 3PH 150KVA	1	EA	1	0	1	1	1	0	1 installed			$22,784.12	$ -	
1000465856	0110	529902	53	1/16/2023	7105045	WIRE #2 19 STR CU SD AS PER ASTM B8	1	M	1	0	21	221	21	200	Material returned	MR 71355	180	$ 8.35	$ 1,669.94	$ 1,502.95
1000465856	0120	529902	83	1/16/2023	7105045	WIRE #2 19 STR CU SD AS PER ASTM B8	1	M	1	0										
1000465858	0050	529904	26	2/21/2023	7105045	WIRE #2 19 STR CU SD AS PER ASTM B8	15	M	15	0										
1000465858	0060	529904	33	2/21/2023	7105045	WIRE #2 19 STR CU SD AS PER ASTM B8	1	M	1	0										
1000465882	0030	529908	5	1/16/2023	7105045	WIRE #2 19 STR CU SD AS PER ASTM B8	3	M	3	0										
1000465881	0030	529907	6	1/16/2023	7150236	CABLE QUAD 3 500 KCMIL CU XLPE/PVCJ	20	M	20	0	20	20	36	-16	Material returned	MR 71356	12	$ 132.05	-$ 2,112.74	$ 1,584.55
1000465882	0080	529908	27	1/16/2023	7180050	RMO CABLE 1C 1/0 CU 28KV AS PER LATEST	300	M	616	-316	300	616	579	37	Material returned	MR 71354	40	$ 23.42	$ 866.43	$ 936.68
1000465858	0030	529904	6	2/21/2023	7190130	<<< WIRE STEEL GUY 3/8" GRADE 180 (75M	30	M	75	-45	70	150	70	80	Item negligible. No need to return.			$ 2.45	$ 196.00	
1000465858	0040	529904	22	2/21/2023	7190130	<<< WIRE STEEL GUY 3/8" GRADE 180 (75M	40	M	75	-35										
1000465882	0080	529908	30	1/16/2023	9656456	CABLE TRIPLEX 1/0 AL USEI 90 BLACK/	10	M	290	-280	10	290	10	280	Material returned	MR 71354	280	$ 4.94	$ 1,382.88	$ 1,382.88
1000465856	0120	529902	70	1/16/2023	9664048	SWITCH 200A 25KV SMD20 POWER FUSE FOR PO	3	EA	3	0	3	3	3	0	3 installed			$ 523.25	$ -	
1000465856	0090	529902	47	1/16/2023	9664153	PIPE, RISER, GALV 4" X 8', SCHEDULE 40	1	EA	1	0	1	1	0	1	0 as per JIS, No response, item assumed scrapped			$ 254.24		
1000465882	0020	529908	3	1/16/2023	100000025	KIT SPLICE COLD SHRINK 28KV FOR SPLICING	3	EA	3	0	3	3	0	3	Material returned	MR 71354	3	$ 363.77	$ 1,091.32	$ 1,091.32
1000465856	0080	529902	42	1/16/2023	100001623	8' NON-FLANGED PVC U GUARD, SIZE 4"	2	EA	2	0	8	8	8	0				$ 176.88	$ -	
1000465856	0120	529902	67	1/16/2023	100001623	8' NON-FLANGED PVC U GUARD, SIZE 4"	6	EA	6	0										
1000465881	0020	529907	2	1/16/2023	7223032	CONNECTOR AL TERMINAL BUS "E"TYPE 6 - 2	3	EA	3	0	3	3	3	0				$ 97.58	$ -	
1000465856	0120	529902	87	1/16/2023	7700014	ARRESTER SURGE 21KV CLASS FOR 28KV GRDY	3	EA	3	0	3	3	3	0				$ 99.59	$ -	
1000465882	0030	529908	13	1/16/2023	7810040	TERMINATION KIT COLD SHRINK 28 KV 1/0 AL	3	EA	3	0	3	3	3	0				$ 127.14	$ -	
1000465856	0120	529902	68	1/16/2023	8220072	<<< BANDING STAINLESS STEEL, 3/4" X	3	FT	100	-97	3	100	3	97	Item negligible. No need to return.			$ 1.11		
1000465856	0080	529902	43	1/16/2023	9656533	GUARD CABLE 3 1/4" X 9' GALV	1	EA	1	0	1	1	1	0				$ 90.20	$ -	
1000465856	0120	529902	72	1/16/2023	9656698	BRACKET ARRESTER CUTOUT 3 PH DOUBLE	1	EA	1	0	1	1	1	0				$ 297.21	$ -	
1000465856	0120	529902	65	1/16/2023	9656892	STIRRUP EQUIPMENT GROUNDING FOR OPEN	3	EA	3	0	3	3	3	0				$ 112.20	$ -	
1000465856	0030	529902	20	1/16/2023	9663940	CROSSARM FIBREGLASS 7' 6" FOR DEADEND	1	EA	1	0	1	1	1	0				$ 408.56	$ -	
1000465858	0050	529904	24	2/21/2023	2470102	ROD 3/4" X 10' GRD STEEL GALV	1	EA	1	0	1	1	1	0				$ 27.71		
1000465858	0060	529904	31	2/21/2023	2470102	ROD 3/4" X 10' GRD STEEL GALV	1	EA	1	0	1	1	0	1	only 1 installed, remaining to be returned. No response, item assumed scrapped			$ 27.71		
1000465858	0070	529904	34	2/21/2023	2470102	ROD 3/4" X 10' GRD STEEL GALV	4	EA	4	0	4	4	0	4	only 1 installed, remaining to be returned. No response, item assumed scrapped			$ 27.71		
1000465882	0030	529908	8	1/16/2023	2200011	CLOTH SANDING GRIT P120 J WEIGHT	0.100	EA	0	0.100	0	0	0	0	Nothing to return					
1000465882	0020	529908	1	1/16/2023	9664193	<<< DUSTER SHEETING MILL ENDS WHITE	1	EA	1	0	1	1	1	0	Nothing to return					
1000465882	0030	529908	10	1/16/2023	9664193	<<< DUSTER SHEETING MILL ENDS WHITE	0.040	EA	0	0.040	0	0	0	0	Nothing to return					
1000465882	0060	529908	26	1/16/2023	9664193	<<< DUSTER SHEETING MILL ENDS WHITE	0.080	EA	0	0.080	0	0	0	0	Nothing to return					
1000465856	0090	529902	45	1/16/2023	2310024	STRAP PIPE 4" GALV STEEL 2 HOLE NO	6	EA	6	0	6	6	6	0	Nothing to return					
1000465856	0070	529902	36	1/16/2023	2320012	TIE CABLE TY-RAP NATURAL 8" LENGTH	1	EA	1	0	1	1	1	0	Nothing to return					
1000465856	0120	529902	84	1/16/2023	2320046	TIE CABLE TY-RAP BLACK 7.8" LENGTH	3	EA	3	0	3	3	3	0	Nothing to return					
1000465882	0050	529908	21	1/16/2023	2320047	TIE CABLE TY-RAP BLACK 14.6" LENGTH	3	EA	3	0	3	3	3	0	Nothing to return					
1000465858	0020	529904	1	2/21/2023	2400022	ANCHOR ROD 1" X 8' TRIPLE EYE AS PER	1	EA	1	0	1	1	1	0	Nothing to return					
1000465856	0020	529902	5	1/16/2023	2420202	BRACKET 9" POST TYPE STAND OFF	2	EA	2	0	2	2	2	0	Nothing to return					
1000465856	0020	529902	1	1/16/2023	2420238	BRACKET 15" POLE TOP ARMLESS 1 PIECE	1	EA	1	0	1	1	1	0	Nothing to return					
1000465858	0050	529904	29	2/21/2023	2430010	GUARD CABLE 3/4" X 8' GALV U TYPE	1	EA	1	0	1	1	1	0	Nothing to return					
1000465858	0050	529904	23	2/21/2023	2430025	GUARD CABLE 1/2" X 8' U TYPE B.	2	EA	2	0	2	2	2	0	Nothing to return					
1000465856	0080	529902	40	1/16/2023	2430041	GUARD STRAP 3 1/4" AS PER SPEC C83.55	6	EA	6	0	6	6	6	0	Nothing to return					
1000465882	0080	529908	31	1/16/2023	2430041	GUARD STRAP 3 1/4" AS PER SPEC C83.55	24	EA	24	0	24	24	24	0	Nothing to return					
1000465858	0030	529904	11	2/21/2023	2450001	CLAMP 3 BOLT FOR GUYING AS PER CSA	4	EA	4	0	4	4	4	0	Nothing to return					
1000465858	0040	529904	16	2/21/2023	2450001	CLAMP 3 BOLT FOR GUYING AS PER CSA	4	EA	4	0	4	4	4	0	Nothing to return					
1000465858	0030	529904	12	2/21/2023	2450007	GRIP PREFORMED FOR 3/8" GUY WIRE AS PER	6	EA	6	0	6	6	6	0	Nothing to return					
1000465858	0040	529904	13	2/21/2023	2450007	GRIP PREFORMED FOR 3/8" GUY WIRE AS PER	10	EA	10	0	10	10	10	0	Nothing to return					
1000465858	0030	529904	9	2/21/2023	2450011	GUY GUARD 2 1/4" ROUND X 7' POLYETHYLENE	2	EA	2	0	2	2	2	0	Nothing to return					
1000465882	0080	529908	37	1/16/2023	2450011	GUY GUARD 2 1/4" ROUND X 7' POLYETHYLENE	5	EA	5	0	5	5	5	0	Nothing to return					
1000465858	0030	529904	10	2/21/2023	2450013	GUY HOOK COMBINATION TYPE FOR 5/8" DIA	2	EA	2	0	2	2	2	0	Nothing to return					
1000465858	0030	529904	7	2/21/2023	2450018	INSULATOR 11" GUY STRAIN ROD	2	EA	2	0	2	2	2	0	Nothing to return					
1000465858	0040	529904	14	2/21/2023	2450018	INSULATOR 11" GUY STRAIN ROD	4	EA	4	0	4	4	4	0	Nothing to return					
1000465858	0040	529904	15	2/21/2023	2450026	GUY THIMBLE GALVANIZED 5/8" CLEVIS PIN	2	EA	2	0	2	2	2	0	Nothing to return					
1000465858	0030	529904	3	2/21/2023	2450039	SLEEVE SERVI FOR 3/8" GUY WIRE	2	EA	2	0	2	2	2	0	Nothing to return					
1000465858	0040	529904	17	2/21/2023	2450039	SLEEVE SERVI FOR 3/8" GUY WIRE	2	EA	2	0	2	2	2	0	Nothing to return					
1000465856	0020	529902	2	1/16/2023	2460028	STUD INSULATOR 3/4" X 1 7/8" AS PER CSA	3	EA	3	0	3	3	3	0	Nothing to return					
1000465856	0030	529902	14	1/16/2023	2510022	BOLT OVAL EYE 5/8" X 6" AS PER CSA	2	EA	2	0	2	2	2	0	Nothing to return					
1000465856	0050	529902	23	1/16/2023	2510027	BOLT OVAL EYE 5/8" X 16"- 11 UNC CW	1	EA	1	0	1	1	1	0	Nothing to return					
1000465856	0060	529902	31	1/16/2023	2510027	BOLT OVAL EYE 5/8" X 16"- 11 UNC CW	1	EA	1	0	1	1	1	0	Nothing to return					
1000465856	0120	529902	75	1/16/2023	2510120	BOLT MACHINE 3/8" X 1" GALV HEX HEAD	3	EA	3	0	3	3	3	0	Nothing to return					
1000465856	0020	529902	3	1/16/2023	2510188	BOLT MACHINE 5/8" X 10"- 11 UNC SQUARE	3	EA	3	0	3	3	3	0	Nothing to return					
1000465856	0040	529902	21	1/16/2023	2510188	BOLT MACHINE 5/8" X 10"- 11 UNC SQUARE	1	EA	1	0	1	1	1	0	Nothing to return					
1000465856	0020	529902	4	1/16/2023	2510190	BOLT MACHINE 5/8" X 12" 11 UNC SQUARE	2	EA	2	0	2	2	2	0	Nothing to return					
1000465856	0030	529902	9	1/16/2023	2510190	BOLT MACHINE 5/8" X 12" 11 UNC SQUARE	2	EA	2	0	2	2	2	0	Nothing to return					
1000465856	0110	529902	56	1/16/2023	2510190	BOLT MACHINE 5/8" X 12" 11 UNC SQUARE	2	EA	2	0	2	2	2	0	Nothing to return					
1000465856	0120	529902	78	1/16/2023	2510190	BOLT MACHINE 5/8" X 12" 11 UNC SQUARE	2	EA	2	0	2	2	2	0	Nothing to return					
1000465856	0120	529902	86	1/16/2023	2510202	BOLT MACHINE 5/8" X 14"- 11 UNC SQUARE	2	EA	2	0	2	2	2	0	Nothing to return					
1000465858	0040	529904	19	2/21/2023	2510222	BOLT MACHINE 3/4" X 12"- 10 UNC SQUARE	4	EA	4	0	4	4	4	0	Nothing to return					
1000465858	0030	529904	5	2/21/2023	2510223	BOLT MACHINE 3/4" X 14"- 10 UNC SQUARE	2	EA	2	0	2	2	2	0	Nothing to return					

											WSP Verification									
Order	Activity	Reservation	Item number of reservation	Requirements date	Material	Material Description	Requirement Quantity	Base Unit of Measure	Removed quantity	Difference Quantity	Quantities as per original Estimate	Issued (Delivered) Quantities	Used Quantities	Differences Quantities (Issued - Used on site)	WSP Comments	Record of Returned items	Material Returned	$/unit	$ Need Return	$ Returned
1000465856	0120	529902	62	1/16/2023	2510414	BOLT-ASSEMBLY EVERDUR HEX HEAD	6	EA	6	0	6	6	6	0	Nothing to return					
1000465859	0020	529906	14	1/16/2023	2510414	BOLT-ASSEMBLY EVERDUR HEX HEAD	5	EA	5	0	5	5	5	0	Nothing to return					
1000465881	0040	529907	8	1/16/2023	2510414	BOLT-ASSEMBLY EVERDUR HEX HEAD	16	EA	16	0	16	16	16	0	Nothing to return					
1000465856	0030	529902	10	1/16/2023	2520024	NUT OVAL EYE 5/8" AS PER CSA C83.84	1	EA	1	0	1	1	1	0	Nothing to return					
1000465856	0050	529902	24	1/16/2023	2520024	NUT OVAL EYE 5/8" AS PER CSA C83.84	1	EA	1	0	1	1	1	0	Nothing to return					
1000465858	0040	529904	20	2/21/2023	2520026	NUT EYE 3/4" GALV AS PER THES	4	EA	4	0	4	4	4	0	Nothing to return					
1000465856	0050	529902	26	1/16/2023	2520042	NUT SQUARE 5/8" GALV BOLT	1	EA	1	0	1	1	1	0	Nothing to return					
1000465856	0120	529902	88	1/16/2023	2520055	NUT HEX 3/8"- 16 STEEL GALV AS PER	3	EA	3	0	3	3	3	0	Nothing to return					
1000465856	0020	529902	6	1/16/2023	2530003	WASHER GALV SQUARE 2" X 2" X 11/16"	6	EA	6	0	6	6	6	0	Nothing to return					
1000465856	0020	529902	8	1/16/2023	2530020	WASHER CURVED SQUARE GALV 2" X 2"	4	EA	4	0	4	4	4	0	Nothing to return					
1000465856	0030	529902	11	1/16/2023	2530020	WASHER CURVED SQUARE GALV 2" X 2"	2	EA	2	0	2	2	2	0	Nothing to return					
1000465856	0040	529902	22	1/16/2023	2530020	WASHER CURVED SQUARE GALV 2" X 2"	2	EA	2	0	2	2	2	0	Nothing to return					
1000465856	0050	529902	27	1/16/2023	2530020	WASHER CURVED SQUARE GALV 2" X 2"	2	EA	2	0	2	2	2	0	Nothing to return					
1000465856	0110	529902	52	1/16/2023	2530020	WASHER CURVED SQUARE GALV 2" X 2"	4	EA	4	0	4	4	4	0	Nothing to return					
1000465856	0120	529902	63	1/16/2023	2530020	WASHER CURVED SQUARE GALV 2" X 2"	3	EA	3	0	3	3	3	0	Nothing to return					
1000465856	0060	529902	30	1/16/2023	2530024	WASHER CURVED SQUARE GALV 3" X 3"	2	EA	2	0	2	2	2	0	Nothing to return					
1000465858	0030	529904	8	2/21/2023	2530025	WASHER CURVED SQUARE GALV 3" X 3"	2	EA	2	0	2	2	2	0	Nothing to return					
1000465858	0040	529904	21	2/21/2023	2530025	WASHER CURVED SQUARE GALV 3" X 3"	8	EA	8	0	8	8	8	0	Nothing to return					
1000465856	0120	529902	79	1/16/2023	2530081	WASHER GALV STEEL 3/8" AS PER CSA	3	EA	3	0	3	3	3	0	Nothing to return					
1000465856	0030	529902	12	1/16/2023	2530084	WASHER GALV STEEL 5/8" AS PER CSA	2	EA	2	0	2	2	2	0	Nothing to return					
1000465856	0120	529902	77	1/16/2023	2530084	WASHER GALV STEEL 5/8" AS PER CSA	5	EA	5	0	5	5	5	0	Nothing to return					
1000465859	0020	529906	15	1/16/2023	2530100	WASHER BELLEVILLE 1/2" STEEL AS PER	10	EA	10	0	10	10	10	0	Nothing to return					
1000465856	0120	529902	80	1/16/2023	2540031	STAPLE STEEL GALV 1-1/2" X 3/8"	3	EA	3	0	3	3	3	0	Nothing to return					
1000465858	0050	529904	25	2/21/2023	2540031	STAPLE STEEL GALV 1-1/2" X 3/8"	20	EA	20	0	20	20	20	0	Nothing to return					
1000465856	0080	529902	41	1/16/2023	2550002	LAG SCREW 1/4" X 4" GALV GIMLET POINT	12	EA	12	0	12	12	12	0	Nothing to return					
1000465856	0090	529902	44	1/16/2023	2550002	LAG SCREW 1/4" X 4" GALV GIMLET POINT	12	EA	12	0	12	12	12	0	Nothing to return					
1000465882	0080	529908	32	1/16/2023	2550002	LAG SCREW 1/4" X 4" GALV GIMLET POINT	50	EA	50	0	50	50	50	0	Nothing to return					
1000465856	0120	529902	71	1/16/2023	2550023	LAG SCREW 1/2" X 4" GALV FETTER	3	EA	3	0	3	3	3	0	Nothing to return					
1000465858	0030	529904	4	2/21/2023	2550023	LAG SCREW 1/2" X 4" GALV FETTER	2	EA	2	0	2	2	2	0	Nothing to return					
1000465856	0090	529902	46	1/16/2023	5230009	CONDUIT PVC RIGID 4" IN 10' LENGTHS	2	EA	2	0	2	2	2	0	Nothing to return					
1000465882	0050	529908	22	1/16/2023	5240030	TUBING POLYETHYLENE 2" INSIDE DIAMETER	2	EA	2	0	2	2	2	0	Nothing to return					
1000465885	0020	529911	2	1/16/2023	7020006	FUSE 600V 10A 100KA I.R. FAST-ACTING	1	EA	1	0	1	1	1	0	Nothing to return					
1000465885	0020	529911	1	1/16/2023	7030139	FUSEHOLDER WATERTIGHT 600V 30A FOR	1	EA	1	0	1	1	1	0	Nothing to return					
1000465858	0070	529904	35	2/21/2023	7105160	WIRE 2/0 19 STR CU SD AS PER ASTM B8	24	M	24	0	24	24	24	0	Nothing to return					
1000465856	0120	529902	74	1/16/2023	7110010	CABLE #2 19STR CU SD PE BLACK TX DROP	5	M	5	0	5	5	5	0	Nothing to return					
1000465882	0040	529908	17	1/16/2023	7150162	CABLE #2 7STR CU 600V TW75 BLACK AS PER	3	M	3	0	3	3	3	0	Nothing to return					
1000465885	0020	529911	3	1/16/2023	7155155	CABLE 2C #12 SOL CU WITH #14 SOL CU	3	M	3	0	3	3	3	0	Nothing to return					
1000465856	0060	529902	32	1/16/2023	7210028	DEAD END CLAMP SPRING LOADED FOR #4-	1	EA	1	0	1	1	1	0	Nothing to return					
1000465856	0030	529902	13	1/16/2023	7210029	DEAD END CLAMP SPRING LOADED FOR 3/0	3	EA	3	0	3	3	3	0	Nothing to return					
1000465856	0110	529902	54	1/16/2023	7210047	CLAMP HOT LINE GENERAL PURPOSE AL CU	1	EA	1	0	1	1	1	0	Nothing to return					
1000465856	0120	529902	73	1/16/2023	7210047	CLAMP HOT LINE GENERAL PURPOSE AL CU	1	EA	1	0	1	1	1	0	Nothing to return					
1000465856	0070	529902	35	1/16/2023	7210050	GRIP WEDGE FOR #4 - 1/0 ACSR WITH	1	EA	1	0	1	1	1	0	Nothing to return					
1000465856	0120	529902	85	1/16/2023	7210054	GRIP CABLE SINGLE OFFSET EYE FOR 1	3	EA	3	0	3	3	3	0	Nothing to return					
1000465882	0080	529908	34	1/16/2023	7210070	CHAIN LINK DOUBLE EYE STRAIGHT 9/16" X	6	EA	6	0	6	6	6	0	Nothing to return					
1000465856	0050	529902	28	1/16/2023	7210135	CLAMP FOR LASHING WIRE CSA G164	2	EA	2	0	2	2	2	0	Nothing to return					
1000465856	0060	529902	34	1/16/2023	7210135	CLAMP FOR LASHING WIRE CSA G164	1	EA	1	0	1	1	1	0	Nothing to return					
1000465856	0070	529902	37	1/16/2023	7210135	CLAMP FOR LASHING WIRE CSA G164	2	EA	2	0	2	2	2	0	Nothing to return					
1000465856	0050	529902	29	1/16/2023	7210137	CLAMP MESSENGER STRAIGHT EN# 13E SP* CSA	1	EA	1	0	1	1	1	0	Nothing to return					
1000465859	0020	529906	10	1/16/2023	7211040	CONNECTOR AL TERMINAL LUG TINNED 2/0 STR	2	EA	2	0	2	2	2	0	Nothing to return					
1000465882	0080	529908	28	1/16/2023	7211044	CONNECTOR CU TERMINAL LUG, 3/0 STD OR	3	EA	3	0	3	3	3	0	Nothing to return					
1000465881	0020	529907	3	1/16/2023	7211078	CONNECTOR AL TERMINAL LUG TINNED 4/0	6	EA	6	0	6	6	6	0	Nothing to return					
1000465881	0020	529907	1	1/16/2023	7211088	CONNECTOR AL TERMINAL LUG 500KCMIL 2	3	EA	3	0	3	3	3	0	Nothing to return					
1000465859	0020	529906	9	1/16/2023	7211142	CONNECTOR AL TERMINAL LUG TINNED 1/0 STR	3	EA	3	0	3	3	3	0	Nothing to return					
1000465881	0040	529907	9	1/16/2023	7211444	CONNECTOR CU TERMINAL LUG TINNED 300 STR	2	EA	2	0	2	2	2	0	Nothing to return					
1000465881	0040	529907	7	1/16/2023	7211484	CONNECTOR CU TERMINAL LUG TINNED 500 STR	6	EA	6	0	6	6	6	0	Nothing to return					
1000465882	0080	529908	29	1/16/2023	7211484	CONNECTOR CU TERMINAL LUG TINNED 500 STR	3	EA	3	0	3	3	3	0	Nothing to return					
1000465882	0060	529908	24	1/16/2023	7212172	SLEEVE AL NON TENSION REDUCING 1/0	2	EA	2	0	2	2	2	0	Nothing to return					
1000465882	0020	529908	4	1/16/2023	7212616	SLEEVE CU NON TENSION TINNED 2/0 STR	3	EA	3	0	3	3	3	0	Nothing to return					
1000465882	0030	529908	6	1/16/2023	7213014	CONNECTOR CU SPLIT BOLT TINNED CW	3	EA	3	0	3	3	3	0	Nothing to return					
1000465882	0040	529908	16	1/16/2023	7213038	CONNECTOR CU SPLIT BOLT 2/0 STR - #6 STR	1	EA	1	0	1	1	1	0	Nothing to return					
1000465856	0070	529902	39	1/16/2023	7214016	CONNECTOR BOLTED AL OH MID SPAN	3	EA	3	0	3	3	3	0	Nothing to return					
1000465882	0080	529908	33	1/16/2023	7214016	CONNECTOR BOLTED AL OH MID SPAN	24	EA	24	0	24	24	24	0	Nothing to return					
1000465858	0070	529904	36	2/21/2023	7214200	CONNECTOR CU GRD WRENCH LOC 3/4" ROD	6	EA	6	0	6	6	6	0	Nothing to return					
1000465858	0050	529904	27	2/21/2023	7214201	CONNECTOR GRD ROD AMPACT	1	EA	1	0	1	1	1	0	Nothing to return					
1000465858	0060	529904	32	2/21/2023	7214201	CONNECTOR GRD ROD AMPACT	1	EA	1	0	1	1	1	0	Nothing to return					
1000465882	0040	529908	15	1/16/2023	7214413	CONNECTOR CU U BOLT PARALLEL GRV	1	EA	1	0	1	1	1	0	Nothing to return					
1000465881	0020	529907	4	1/16/2023	7223064	COVER SLEEVE EPDM RUBBER FOR 2 HOLE NEMA	18	EA	18	0	18	18	18	0	Nothing to return					
1000465856	0120	529902	66	1/16/2023	7230030	CONNECTOR AMPACT AL TAP #4 ACSR TO #4	3	EA	3	0	3	3	3	0	Nothing to return					
1000465856	0120	529902	89	1/16/2023	7230050	CONNECTOR AMPACT AL TAP 1/0 ACSR	9	EA	9	0	9	9	9	0	Nothing to return					
1000465856	0110	529902	55	1/16/2023	7230060	CONNECTOR AMPACT AL TAP 2/0 ACSR	1	EA	1	0	1	1	1	0	Nothing to return					
1000465856	0100	529902	49	1/16/2023	7230090	CONNECTOR AMPACT AL TAP 2/0 ACSR	3	EA	3	0	3	3	3	0	Nothing to return					
1000465858	0050	529904	28	2/21/2023	7230100	CONNECTOR AMPACT AL TAP 2/0 STR TO	1	EA	1	0	1	1	1	0	Nothing to return					
1000465882	0080	529908	36	1/16/2023	7230100	CONNECTOR AMPACT AL TAP 2/0 STR TO	12	EA	12	0	12	12	12	0	Nothing to return					
1000465882	0080	529908	35	1/16/2023	7230130	CONNECTOR AMPACT AL TAP 4/0 ACSR	12	EA	12	0	12	12	12	0	Nothing to return					
1000465856	0100	529902	50	1/16/2023	7231355	COVER AMPACT TAP CONNECTORS 600V	3	EA	3	0	3	3	3	0	Nothing to return					
1000465885	0020	529911	5	1/16/2023	7231375	COVER AMPACT TAP CONNECTORS MINIWEDGE	3	EA	3	0	3	3	3	0	Nothing to return					
1000465856	0110	529902	57	1/16/2023	7231380	CARTRIDGE AMPACT YELLOW	3	EA	3	0	3	3	3	0	Nothing to return					
1000465856	0100	529902	51	1/16/2023	7231385	CARTRIDGE AMPACT BLUE	3	EA	3	0	3	3	3	0	Nothing to return					

											WSP Verification										
Order	Activity	Reservation	Item number of reservation	Requirements date	Material	Material Description	Requirement Quantity	Base Unit of Measure	Removed quantity	Difference Quantity	Quantities as per original Estimate	Issued (Delivered) Quantities	Used Quantities	Differences Quantities (Issued - Used on site)	WSP Comments	Record of Returned items	Material Returned	$/unit	$ Need Return	$ Returned	
1000465856	0110	529902	59	1/16/2023	7231385	CARTRIDGE AMPACT BLUE	1	EA	1	0	1	1	1	0	Nothing to return						
1000465858	0050	529904	30	2/21/2023	7231385	CARTRIDGE AMPACT BLUE	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0120	529902	69	1/16/2023	7231395	CARTRIDGE AMPACT WHITE	12	EA	12	0	12	12	12	0	Nothing to return						
1000465859	0020	529906	6	1/16/2023	7240001	ELBOW LOADBREAK 1/0 AL 28KV 200A	3	EA	3	0	3	3	3	0	Nothing to return						
1000465859	0020	529906	7	1/16/2023	7240004	BUSHING INSERT LOADBREAK 28KV 200A	6	EA	6	0	6	6	6	0	Nothing to return						
1000465859	0020	529906	8	1/16/2023	7240021	CAP PROTECTIVE INSULATED CW PROBE	3	EA	3	0	3	3	3	0	Nothing to return						
1000465856	0110	529902	60	1/16/2023	7251065	CONNECTION AMPACT STIRRUP 556.5 THRU	3	EA	3	0	3	3	3	0	Nothing to return						
1000465856	0120	529902	81	1/16/2023	7251095	CONNECTOR STIRRUPS GROUNDING AS PER	3	EA	3	0	3	3	3	0	Nothing to return						
1000465882	0050	529908	20	1/16/2023	7360306	CRADLE INSULATING FOR STD UG ARM AS PER	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0050	529902	25	1/16/2023	7600001	TAPE ELECTRICAL VINYLE 3/4 "X 66' X	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0060	529902	33	1/16/2023	7600001	TAPE ELECTRICAL VINYLE 3/4 "X 66' X	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0070	529902	38	1/16/2023	7600001	TAPE ELECTRICAL VINYLE 3/4 "X 66' X	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0120	529902	76	1/16/2023	7600001	TAPE ELECTRICAL VINYLE 3/4 "X 66' X	2	EA	2	0	2	2	2	0	Nothing to return						
1000465859	0020	529906	17	1/16/2023	7600001	TAPE ELECTRICAL VINYLE 3/4 "X 66' X	1	EA	1	0	1	1	1	0	Nothing to return						
1000465882	0020	529908	2	1/16/2023	7600001	TAPE ELECTRICAL VINYLE 3/4 "X 66' X	1	EA	1	0	1	1	1	0	Nothing to return						
1000465882	0030	529908	7	1/16/2023	7600001	TAPE ELECTRICAL VINYLE 3/4 "X 66' X	2	EA	2	0	2	2	2	0	Nothing to return						
1000465882	0040	529908	18	1/16/2023	7600001	TAPE ELECTRICAL VINYLE 3/4 "X 66' X	1	EA	1	0	1	1	1	0	Nothing to return						
1000465882	0040	529908	19	1/16/2023	7600007	TAPE RUBBER MASTIC 1KV 2" X .065	1	EA	1	0	1	1	1	0	Nothing to return						
1000465859	0020	529906	20	1/16/2023	7600012	TAPE VINYL 3/4" X 66' X 0.007" THICKNESS	1	EA	1	0	1	1	1	0	Nothing to return						
1000465882	0030	529908	9	1/16/2023	7600012	TAPE VINYL 3/4" X 66' X 0.007" THICKNESS	2	EA	2	0	2	2	2	0	Nothing to return						
1000465859	0020	529906	18	1/16/2023	7600013	TAPE VINYL 3/4" X 66' X 0.007" THICKNESS	1	EA	1	0	1	1	1	0	Nothing to return						
1000465882	0030	529908	11	1/16/2023	7600013	TAPE VINYL 3/4" X 66' X 0.007" THICKNESS	2	EA	2	0	2	2	2	0	Nothing to return						
1000465882	0030	529908	12	1/16/2023	7600014	TAPE VINYL 3/4" X 66' X 0.007" THICKNESS	2	EA	2	0	2	2	2	0	Nothing to return						
1000465859	0020	529906	19	1/16/2023	7600015	TAPE VINYL 3/4" X 66' X 0.007" THICKNESS	1	EA	1	0	1	1	1	0	Nothing to return						
1000465859	0020	529906	3	1/16/2023	7600026	TAPE INSULATING VINYL MASTIC 600V 4"	1	EA	1	0	1	1	1	0	Nothing to return						
1000465858	0040	529904	18	2/21/2023	7630052	GUY STRAIN INSULATOR 54" ROD CLEVIS/	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0030	529902	15	1/16/2023	7630057	INSULATOR DEAD END 28KV AS PER CEA	3	EA	3	0	3	3	3	0	Nothing to return						
1000465856	0110	529902	61	1/16/2023	7630066	INSULATOR RISER SUPPORT 35KV AS PER CEA	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0020	529902	7	1/16/2023	7630102	INSULATOR UNIVERSAL LINE POST 35KV. AS	3	EA	3	0	3	3	3	0	Nothing to return						
1000465856	0120	529902	64	1/16/2023	7903986	BUCKLE 3/4" BANDING STEEL	6	EA	6	0	6	6	6	0	Nothing to return						
1000465856	0030	529902	17	1/16/2023	8220681	MARKER WHITE PHASE ADHESIVE 3" ROUND	1	EA	1	0	1	1	1	0	Nothing to return						
1000465859	0020	529906	12	1/16/2023	8220681	MARKER WHITE PHASE ADHESIVE 3" ROUND	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0030	529902	18	1/16/2023	8220683	MARKER BLUE PHASE ADHESIVE 3" ROUND	1	EA	1	0	1	1	1	0	Nothing to return						
1000465859	0020	529906	13	1/16/2023	8220683	MARKER BLUE PHASE ADHESIVE 3" ROUND	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0030	529902	19	1/16/2023	8220688	MARKER RED PHASE ADHESIVE 3" ROUND	1	EA	1	0	1	1	1	0	Nothing to return						
1000465859	0020	529906	11	1/16/2023	8220688	MARKER RED PHASE ADHESIVE 3" ROUND	1	EA	1	0	1	1	1	0	Nothing to return						
1000465882	0030	529908	14	1/16/2023	8940004	ALCOHOL ISOPROPYL 99% PURE 500 ML	2	EA	2	0	2	2	2	0	Nothing to return						
1000465859	0020	529906	4	1/16/2023	8940010	CAP CABLE END HEAT SHRINK FOR	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0090	529902	48	1/16/2023	9652703	COUPLING PIPE GALV NOMINAL 4"	1	EA	1	0	1	1	1	0	Nothing to return						
1000465882	0060	529908	23	1/16/2023	9655813	DEGREASER PF SOLVENT 32 OZ BOTTLE CW	4	EA	4	0	4	4	4	0	Nothing to return						
1000465885	0020	529911	4	1/16/2023	9656247	CONNECTOR AMPACT AL MINIWEDGE	3	EA	3	0	3	3	3	0	Nothing to return						
1000465881	0020	529907	5	1/16/2023	9656992	HORIZONTAL 1" PANEL 7 POSITION CABLE	1	EA	1	0	1	1	1	0	Nothing to return						
1000465882	0060	529908	25	1/16/2023	9657056	SLEEVE INSULATING #8 TO 2/0 ROLL ON TYPE	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0120	529902	82	1/16/2023	9662293	BOLT CARRIAGE GALV 3/8" X 1 1/2"	3	EA	3	0	3	3	3	0	Nothing to return						
1000465859	0020	529906	16	1/16/2023	9662341	PADLOCK ABLOY KEYED GROUP 7 25MM	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0110	529902	58	1/16/2023	9662733	WIRE 2/0 SOL CU MHD AS PER ASTM B2	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0030	529902	16	1/16/2023	9663964	WASHER GALV RECTANGLAR 3-1/2" X 4-1/2"	4	EA	4	0	4	4	4	0	Nothing to return						
1000465859	0020	529906	2	1/16/2023	9665812	LABEL WARNING, ADHESIVE TYPE FOR LOW	2	EA	2	0	2	2	2	0	Nothing to return						
																				$ 6,498.38	
						Total Material Released for the project	**$ 58,183.77**														
						Total Material to be returned	**$ 6,498.38**														
						Total Material for project	**$ 51,685.39**														

APPENDIX

F

CRITICAL TASK CHECKLIST

Critical Task Checklist

Project #:	P-220200-WD151001
Project Name:	NGF1 OH VC W. PCB PHASE 1A
Contractor:	VALARD
THESL Contract Administrator:	Francine Xu

Note: Contractor must give Auditors 24 hours notice before starting tasks which Auditor must witness.

Req'd?		Critical Task:	Action:	Notes:
Civil:				
N		Vaults/Chamber Build	Auditor must witness concrete testing	
N		Remove/lift slab test at vault	Contractor to lift slab to check that there is no seal, its solid and sits properly without rocking. Auditor must witness test lift	
Y		Breaking into ducts or ductbanks containing cable	Qualified staff must be on site, holdoffs in effect and contractor safety procedures and legislative requirements followed. Auditor must witness some of breaking into ducts or ductbanks containing cable and fill out checklist. ~~Contractor to sign off on checklist.~~	
Y		Duct radius installation	Auditor must attempt to witness prior to cement pour. If auditor visit is impractical, contractor to provide photo demonstrating compliance to standard. Photo must be provided no later than 24 hours after pour.	
Y		Mandrelling of ducts	Auditor must witness mandrelling	
Y		Core Drilling into Energized Vaults/Chambers	Auditor must witness some of core drilling and fill out checklist. Contractor to sign off on checklist.	
N		Shoring design compliance for Cable chambers, network vaults, shafts	Auditor to confirm shoring in place is compliant with contractor drawings on site.	
N		Drain connection to City sewer	Auditor must witness connection	
Electrical:				
Y		Power Interruptions	Contractor to notify customers / THESL Cust. Ops.	
N		Working at a Hydro One Transformer Station Facility	Permits/Qualified staff/Authorization	
N		Cable Identfication/ Spearing	Auditor must witness some of spiking/spearing and fill out check list. Contractor to sign off on checklist.	
N		Inter-utility coordination	Communication protocol followed	
N		Energizations requiring ESA signoff: - Delta Wye Conversions - Voltage conversion meter base replacements - O/H to U/G meter base replacements	Auditor confirms ESA permits taken out & Submitted with Monthly Billing	
Y		Padmounted Tx, Submersible Tx, Network/Vault Tx, and Padmounted Switchgear final installation photographs prior to energization.	Padmounted Tx, Submersible Tx, Network/Vault Tx, Protector & Padmounted Switchgear final photographs sent to Auditor for verification within 24 hours of energization/commissioning if Auditor not on site to witness final installation.	
Environmental				
Y		Transportation of Dangerous Goods. For example, contaminated water pumped from structures	~~Auditor witness and record quantities.~~ THESL CA/FA sign off manifest. Contractor to provide 24 hours notice to auditor/CA/FA prior to pumping.	
Y		Working in vicinity of hazardous materials (AILC, PILC, RILC, Asbestos in city roads, asbestoc pipe, etc.)	Contractor PPE/procedures followed, For example, for cutting of asphalt on city roads, Auditor to verfiy cut sizes and remediation.	
Other - Project Specific:				
N		Heavy Equipment/Materials in or on top of Below Grade Structures	U/G parking, vaults, and chambers should all be indicated on construction drawings	

Critical Task Checklist Rev 21 — March 18, 2022

APPENDIX

G

PRE-JOB MEETING MEMO AND EHS FORM

231-60000-11-PJMA-2023

PRE-JOB MEETING MEMO

PROJECT INFORMATION	
Project Name /WBS Number:	P-220200-WD151001 WKPG NGF1 Conversion with PCBs Repl PH1A
Project Department:	CPW
Project CA.:	Francine Xu
Project FA:	Ken Abram
Contractor:	Valard
External Parties : (MTO, MOSAIC, CTS, Metrolinx, etc.)	n/a

MEETING INFORMATION	
Meeting Location: (THESL offices or through WebEx)	WebEx
Meeting Date:	Feb 9, 2023
Time.:	3:30 pm – 4:30 pm
Timekeeper:	Valentyna Fofana

ATTENDEES

Name	Title	Company	Email	Signature
Francine Xu	CA	THESL	fxu@torontohydro.com	Francine Xu Digitally signed by Francine Xu DN: cn=Francine Xu, email=fxu@torontohydro.com Date: 2023.02.21 17:30:57 -05'00'
Ken Abram	FA	THESL	kabram@torontohydro.com	
Aisha Tousif		THESL	atousif@torontohydro.com	
Usman Mazhar		THESL	umazhar@torontohydro.com	
Shannon Jackson		THESL	sjackson@torontohydro.com	n/a
Sunny Nagah		THESL	snagah@torontohydro.com	
Dustin Hutton		Valard	dhutton@valard.com	
Nick Dong		Valard	nxdong@valard.com	
Breanne Kellar		Valard	bkellar@valard.com	
Aby Isac		Valard	aisac@valard.com	
Vidhi Shah		Valard	vshah@valard.com	
Salah Rana		Valard	srana@valard.com	
Valentyna Fofana	PCO	WSP	Valentyna.Fofana@wsp.com	
Kamran Fallahi	DRP	WSP		
Doug Jamieson	COI	WSP	doug.jamieson@wsp.com	
Elham Zarepour	CVI	WSP	Elham.Zarepour@wsp.com	DocuSigned by: Elham Zarepour A3B06TE73F9B418...

231-60000-11-PJMA-2023

TOPICS		
MATTERS ARISING	**ACTION**	**NOTES**
1.0 Safety Moment	All	
2.0 Introductions	All	
3.0 Project scope 3.1 Background information 3.2 Notice of Project Expiration 3.3 Estimated construction completion (Project Attainment Forecast Date)	THESL CA	3.2 Jan 2023 to Dec 2023 3.3. Oct 2023
4.0 Design GCF Presentation 4.1 Design presentation by designer. Design by: ☒ **Contractor** ☐ THESL 4.2 Posting of drawings been completed? ☒Yes ☐No ☐N/a 4.3 Digitization complete? ☒Yes ☐No ☐N/a 4.4 Designer has confirmed: ▪ All 3 wire 600V services & 4 wire 347/600V services affected by the scope of this work have been identified. ☐Yes ☐No ☒N/a ▪ Design meets current standard for connections. ☐Yes ☐No ☒N/a ▪ Changes are identified on the drawings ☐Yes ☐No ☒N/a 4.5 Field checked for new assets? ☐Yes ☐No ☒N/a 4.6 AODA clearances met? ☒Yes ☐No ☐N/a 4.7 Latest construction standards used? ☒Yes ☐No ☐N/a 4.8 Any Deviation from THESL Standards? ☐Yes ☐No ☒N/a 4.9 DGO approval received for construction package? ☐Yes ☒No ☐N/a 4.10 Delta-wye conversion required? ☐Yes ☐No ☒N/a (If yes, metering GCF must be prepared) 4.11 Co-generators identified? ☐Yes ☐No ☒N/a 4.12 Shoring required? (If yes, require signed shop drawings) ☐Yes ☐No ☒N/a 4.13 Take-off sheets provided? ☒Yes ☐No ☐N/a 4.14 Job Instruction Sheet finalized and signed by CA? ☒Yes ☐No ☐N/a 4.15 Any Specific construction notes to be considered? ☐Yes ☐No ☒N/a	All	4.2 Updated drawings (with property owner sign off) to be provided. 4.6 4.9 Preliminary 4.13 4.14

TOPICS (Cont.)		
MATTERS ARISING	**ACTION**	**NOTES**
5.0 Permits and Notifications - Identify special permit conditions and DRPs. 5.1 City of Toronto Cut Permit– Construction DRP ☐Yes ☒No ☐N/a 5.2 HONI – Construction DRP ☐Yes ☒No ☐N/a 5.3 Ministry of Environment (MoE) – EHS Representative ☐Yes ☐No ☒N/a 5.4 Permit for working in the active rail corridor-Metrolinx ☐Yes ☐No ☒N/a 5.5 Ministry of Transportation – Construction DRP ☐Yes ☐No ☒N/a 5.6 City Parks – EHS Representative/Construction DRP ☐Yes ☐No ☒N/a 5.7 TRCA (Toronto and Region Conservation Authority) ☐Yes ☐No ☒N/a 5.8 Toronto & Region Conservation Authority - EHS Rep. ☐Yes ☐No ☒N/a 5.9 Notice of Project – Construction DRP ☒Yes ☐No ☐N/a 5.10 Form 1000 – Construction DRP ☒Yes ☐No ☐N/a (Form 1000 to be presented for the subcontractors as well if any) 5.11 If there is excavation, a private water discharge permit is required if any ground water is pumped out ☐Yes ☐No ☒N/a 5.12 OTHERS – Please indicate	Contractor/ Designer	5.1 Exemption request sent – for 0.5m. Expecting decision. Breanne to provide an update. 5.10 Valard to have on site.
6.0 Material availability 6.1 Is there any Electrical Material required to be delivered ☒Yes ☐No ☐N/a 6.2 Who is suppling Materials ☒THESL ☐External 3rd Party (CTS, MOSAIC) 6.3 Is there outstanding materials? If so, what is the estimated delivery date? 6.4 Does Contractor have temporary Material Lay-down Area? ☐Yes ☐No ☒N/a 6.5 Does contractor have permit for the lay-down area? ☐Yes ☐No ☒N/a	Contractor/ THESL CA	6.3 TR delivered. Pending material to be delivered Feb 21 & March.

TOPICS (Cont.)		
MATTERS ARISING	**ACTION**	**NOTES**
7.0 Construction Readiness, work schedule and site safety 7.1 Multiple contractor on-site coordination ☒Yes ☐No ☐N/a 7.2 Review Construction Schedule ☒Yes ☐No ☐N/a 7.3 Any Priority of work execution ☐Yes ☐No ☒N/a 7.4 Tree trimming requirements ☐Yes ☐No ☒N/a 7.5 Arborist or TPZ is required ☐Yes ☐No ☒N/a 7.6 THESL general Rules, PPE, FR clothing, etc. 7.7 Vacuum Truck safety, Dead man Trigger ☒Yes ☐No ☐N/a 7.8 Locates drawings are required ☒Yes ☐No ☐N/a 7.9 Premium hour authorization ☐Yes ☒No ☐N/a 7.10 Road Occupancy Permits ☐Yes ☐No ☒N/a 7.11 Traffic management Plan been submitted & approved ☒Yes ☐No ☐N/a 7.12 Site Pre-con meeting with City scheduled or conducted ☐Yes ☐No ☒N/a 7.13 Traffic & Pedestrian Control Pay Duty is required ☐Yes ☐No ☒N/a 7.14 Outage backup plan ☐Yes ☐No ☒N/a 7.15 Tunneling, Notice for tunnels ☐Yes ☐No ☒N/a 7.16 Directional Drilling ☐Yes ☐No ☒N/a 7.17 Jack and Bore ☐Yes ☐No ☒N/a 7.18 Core Drilling into Energized Vaults/Chambers ☐Yes ☐No ☒N/a 7.19 Break and Tie-in to existing duct bank ☒Yes ☐No ☐N/a 7.20 Shoring drawings been approved by P.Eng & available ☐Yes ☐No ☒N/a 7.21 COVID-19 Safety Awareness	Contractor/ THESL CA	7.2 March start (approx. 4 days civil) TPZ on the private property requirements to confirm. Be mindful of the tree protection. 7.4 . 7.8 Valard to request 7.10 Private property 7.11 On the tailboard 7.13

TOPICS (Cont.)		
MATTERS ARISING	**ACTION**	**NOTES**
8.0 Customer communication letters required? Have all the following Customer Letters been issued by either Toronto Hydro or Contractors? 8.1 Customer General Letter (Civil) – THESL Issued ☐Yes ☐No ☒N/a 8.2 Life Support ☐Yes ☒No ☐N/a 8.3 Potential Customer issue/complains/concern ☐Yes ☒No ☐N/a 8.4 Customer Equipment Letters (Civil) – Toronto Hydro Issued 8.4.1 Pad mount Transformers ☒Yes ☐No ☐N/a 8.4.2 Submersible Transformers ☐Yes ☐No ☒N/a 8.4.3 Switch Gear ☐Yes ☐No ☒N/a 8.4.4 Sight Line ☐Yes ☐No ☒N/a 8.4.5 Splice Boxes ☐Yes ☐No ☒N/a 8.4.6 Tap Boxes ☐Yes ☐No ☒N/a 8.4.7 Poles Relocation and New Pole Location – As outlined in the Customer List submitted by the designer * Property with Pre-Existing Pole - New Pole installed greater than one meter on the same property ☒Yes ☐No ☐N/a * Property without Pre-Existing Pole has pole installed ☐Yes ☐No ☐N/a 8.5 Customer Week Before Letter (Civil – UG & OH) ☒Yes ☐No ☐N/a Contractor Issued (Posted to Toronto Hydro FTP Site or e-mailed to customeroperationsnotification@torontohydro.com) 8.6 Customer Outage Letter (Electrical) ☒Yes ☐No ☐N/a Contractor Issued (Posted to Toronto Hydro FTP Site or e-mailed to customeroperationsnotification@torontohydro.com)	THESL Customer Comm Rep	8.1 8.4.7 Aisha to confirm with CoCo if issued. 8.5 & 8.6 To be issued by Valard

TOPICS (Cont.)		
MATTERS ARISING	**ACTION**	**NOTES**
9.0 Contractor Safety 9.1 Contractor Procedures provided ☒Yes ☐No ☐N/a 9.2 Work Hazards and Contractor Safety Plan 9.3 Risk Management and Hazard Mitigation/Control 9.4 Tail Board and Work Plan Steps and Site Rules 9.5 Incident reporting & investigation 9.6 First Aid, Emergency Rescue procedures 9.7 House Keeping/Environmental Plan and Public Protection	Contractor/ THESL CA	
10.0 Field Change / Design Changes 10.1 Field change to be addressed through THESL Standard 34-1000 and Appendix A of the Construction Verification Program (CVP). 10.2 Field changes to be addressed and get THESL approval in advance	All	
11.0 Billing and Change orders process 11.1 For any Change Order, pre-approval to be obtained from THESL CA 11.2 Change Order to be submitted through online process with all supportive documents 11.3 Change orders to be submitted as per PSO Calendar 11.4 Contractor to provide monthly billing as per PSO Calendar including just approved change orders 11.5 For Premium for weekend and night shift, time sheet to be provided 11.6 Contractor to submit Pandemic change order as per THESL instruction and Calendar 11.7 Contractor to attach the verified billing of the month to the Pandemic change order for verification purposes	All	

TOPICS (Cont.)		
MATTERS ARISING	**ACTION**	**NOTES**
12.0 Close Out process 12.1 Contractor to return the GCF to WSP within 15 days from attainment dated 12.2 GCF documents to be prepared as per GCF check list 12.3 As-Built drawing to be prepared as per CSA-S250-011 (THESL 31-0800) 12.4 Before and after photos to be taken as per THESL instruction for each asset	All	12.4 Valard to ensure to take before/after photos.
13.0 Critical Task List review Go through latest "Critical Task Checklist" (must be pre-filled by designer prior to pre-job meeting) 13.1 Contractor must give Auditors 24 hours notice before starting tasks which Auditor must witness as per critical task check list	All	13.1 Valard to revise Critical task checklist. 24hr notification distribution list: — Inspector — Valentyna.Fofana@wsp.com — THESLAudit@wsp.com (WSP general email for audit projects) — DRP - Kamran.Fallahi@wsp.com
14.0 Important notes / Other tasks 14.1 Review photograph requirements to capture all required details of each asset. Go through individual photograph requirements for before and after pictures 14.1.1 Photos must be provided (with tape measure) for installation of 100mm triple mix topsoil prior to sodding 14.1.2 Photos must be provided after restoration is completed (specially for areas with public access i.e. sidewalk, roadway, driveway, parking lots, etc.) 14.2 Discuss and note any other tasks that may be required from Contractor or Auditor	Auditor/ Contractor	14.1 Restorations to be completed

*** NOTE: Field Supervisor to have a copy of the signed Pre-Job Meeting Agenda on site**

Toronto Hydro Electric System Limited
Contractor Environment, Health & Safety Pre-Job Meeting Form – Construction Projects
(FRM-1810-100, Revision 5)

This Pre-Job meeting form is for Construction Projects only. If your project is non-construction (i.e. maintenance, service, staffing), use FRM-1810-157 Contractor Environment, Health & Safety Pre-Job Meeting Form – Non-Construction (Maintenance, Consulting and Staffing Agencies). For further details on the requirements outlined in this form, refer to PRG-1810-030 Contractor Safety Management Program.

Note: When a contractor company is identified in Part B as the constructor, Part H must be completed and signed off.

Meeting Location: WebEx	**Meeting Date:** 9 Feb, 2023
Meeting Start Time: 3:30 pm	**Meeting End Time:** 4:30 pm

PART A: CONTRACT INFORMATION

Name of THESL Contract Administrator	Francine Xu
Contractor Company	Valard
Start Date	Feb 2023
Target Completion Date	Dec 2023
Description of Work	PCB TX Replacement
Work Location/Address	Albion Rd & Armel Crt

PART B: CONSTRUCTION PROJECT INFORMATION

Constructor	Valard
Name of Primary Site Contract	Foreman - TBD

PART C: PROJECT TEAM/KEY ROLES

ROLE	NAME	COMPANY	CONTACT NUMBER	IN ATTENDANCE (Y/N)
Contract Administrator	Francine Xu	Toronto Hydro		y
Auditor	Elham Zarepour	WSP		y
Contractor	Dustin Hutton	Valard		y
Inspector	Doug Jamieson	WSP		y
FA	Ken Abram	THESL		y

PART D: REQUIREMENT VERIFICATION FOR CONTRACTORS
Check the boxes (✓) to indicate that each item has been reviewed and the requirements are understood.

- ☒ Confirm contractor has an A or B grade in ISNetworld
- ☒ Review incident reporting requirements as outlined in the Contractor Safety Management Program (PRG-1810-030)
- ☒ All contractors accessing THESL work centres are required to complete Contractor Orientation and sign the Work Centre Orientation Acknowledgement Form (FRM-5200-037)
- ☒ If station work is required, all contractors must be aware that
  - PIA (Person In Attendance) must be present when entering a station or the individual entering the station has taken Stations Hazard Awareness training
  - At a minimum a markup is required (as per UWPC)

PART E: NOTICE OF PROJECT (must be submitted by constructor prior to commencing any work on the project)

☒ Submitted by Contractor ☐ Submitted by THESL

PART F: CONTRACTOR MONITORING

Person Responsible to Monitor (Name)	Frequency of Monitoring
Toronto Hydro: Ken Abram	As required
Contractor: Dustin Hutton (Valard)	Daily
Auditor: Elham Zarepour (WSP)	Daily, as per the crew roster

PART G: EXCESS SOIL MANAGEMENT

The contractor (operator) will carry out the tasks of the Project Leader and operator as set out in O.Reg 406/19 and associated Soil Rules including, without limitation, the following:

- ✓ Determine applicability of the Regulation, as a whole or in part, to the project;
- ✓ File Notice(s) and update such Notice(s), when required, in the Excess Soil Registry, if required
- ✓ Before filing any Notice
  - Design, develop and implement a secure and effective tracking system containing required information
  - Prepare an assessment of past uses, sampling and analysis plan, characterization report and a destination assessment report
- ✓ Develop a soil management plan and procedures, including for stockpiling, storing, handling, loading, transporting and disposal
- ✓ Appropriately carry out any required soil sampling and analysis through accredited laboratory, in accordance with plans/procedures
- ✓ Comply with soil storage rules and processing rules in the Regulation
- ✓ Ensure transportation and disposal of all Excess Soil is to the selected and approved sites
- ✓ Retain all approvals, permits, tracking, hauling records, manifests and other documents related to soil management, including bills of lading

n/a Contractor (operator) confirms all required documentation will be submitted prior to soil excavation and legislation will be followed during the course of the project.

PART H: CONSTRUCTOR SIGN-OFF

For construction projects, where THESL is not the constructor, hazards unique to the project will be discussed with constructor and the constructor will be responsible for implementing control measures for these and all other identified hazards.

Constructor (Contractor Name): Dustin Hutton___________ Constructor Sign Off: ___________________________

PART I: PROJECT HAZARDS

Review unique known hazards to the project (e.g. PCBs, flammable materials, site access, building specific issues etc.). It is the responsibility of the contractor to identify any additional hazards and implement controls measures for all hazards identified. Known hazards include:

Safe limits of approach	PCB Transformer transportation
Traffic & pedestrian control	
Working in proximity to energized cables	
Material handling	
Working close to other utilities	
Fall protection	

PART J. ACKNOWLEDGEMENT

Contractor acknowledges that all contractor staff working on THESL property and/or assets will be required to fulfill the requirements outlined in the respective THESL Contract. Contractor agrees (and guarantees) that only qualified employees will be used to execute the contract and further agrees that the information and responsibilities contained in this Health & Safety Pre-Job Meeting Form has been adequately and clearly communicated to them. By signing this form, I acknowledge as the Authorized Representative of the Contractor, that all hazard mitigation responsibilities assigned to me will be addressed, and that every precaution reasonable in the circumstances will be taken to protect employees, subcontractors and visitors, from workplace hazards.

Contractor Representative

Name	Company	Signature	Date
Dustin Hutton	Valard	DocuSigned by: 340D4F6B0C19472...	Feb 14, 2023 | 05:19 EST

Contract Administrator

Name	Company	Signature	Date
Francine Xu	THESL	Francine Xu — Digitally signed by Francine Xu DN: cn=Francine Xu, email=fxu@torontohydro.com Date: 2023.02.21 17:32:10 -05'00'	

AtkinsRéalis	Design-Build Projects Final Audit Report	Revision		Page
		No.	Date	
	672824-P-220271-WD161000-30ZA-0001	00	2024-03-12	1

CLIENT: TORONTO HYDRO-ELECTRIC SYSTEM LIMITED

DEPARTMENT: CPW

		SIGNATURE	DATE
PREPARED BY :	Y. Ulusow	yusuf	2024-03-12
REVIEWED BY :	O. Rodriguez	O.R	2024-03-12
APPROVED BY:	T. Bateman		2024-03-14

Toronto Hydro-Electric System Limited
EB-2023-0195
JT3.1
Appendix F
REDACTED
FILED: April 22, 2024
(53 Pages)

LICENSED PROFESSIONAL ENGINEER
2024-03-13
PROVINCE OF ONTARIO

ISSUE/REVISION INDEX

Issue Code	Revision					Revision Details
	No.	By	Rev'd.	App.	Date	
RI	00	YU	OR	TB	2024-03-12	Submitted to TH for Project Close-Out

Issue Codes: RC = Released for Construction, RD = Released for Design, RF = Released for Fabrication, RI = Released for Information, RP = Released for Purchase, RQ = Released for Quotation, RR = Released for Review and Comments.

TABLE OF CONTENTS

1.0 PURPOSE

This finalization report summarizes the audit work completed on the UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1 project number P-220271-WD161000.

2.0 BACKGROUND

The UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1 project involved Installation of vault transformers, OH switch fuse upgrade at the 190, 100 Carrier Dr and 20 Humberline Dr in the Etobicoke area. The design and construction were executed by Entera Utility Contractors.

The project construction start date was June 27th, 2023, and the attainment date was January 25th, 2024.

The Toronto Hydro Electric-System Limited (THESL) Contract Administrator (CA) on this project was Francis Szto and the THESL Field Support (FA) was Kenneth Abram. The main AtkinsRéalis (ATRL) Field Auditor was Yusuf Ulusow, and the back-up was Stephen Farrar.

3.0 WORK SUMMARY

AtkinsRéalis auditors completed the following audit work on this project: pre-construction support, site visits to verify in-construction activities, verification of material and work units, safety verification, quality assurance, verification of scope changes, recognizing deficiencies, and project close-out audit.

4.0 FINDINGS

The following table summarizes the audit tasks performed on this project and lists the appendix in which audit findings are reported.

AUDIT COMPONENT	NUMBER / DATE / COMMENT	APPENDIX REFERENCE
Pre-Job Meeting	2023-05-31	A
Site Visits	3	B
Audit Photographs	Available upon request	C
Asset Installation Checklists	Included	D
Critical Tasks	N/A	E
Non-Compliance Reports (Rs)	QUA-5647 Open	F

Final Billing Verification (JIS)	2024-01-31	G
Change Orders	1 CO issued and finalized	H
Material Verification Excess Unreturned Material (NR) (Total $ value):	$3,684.97	I
Final Walk-Down *(Includes any incomplete work tickets)*	2024-03-06 outstanding deficiencies transferred to QUA-5647 Open.	J
Certificate of Substantial Performance	2024-01-21	K
Contractor Close-Out GCF Verification Checklist Score (%)	97%	L
THESL Department Requisition Form / Job Order Form	Included	M
Third-Party Transfer Form (TPTF)	N/A	N

5.0 CONCLUSION, COMMENTS AND LESSONS LEARNED

Missing Items in the GCF that prevented contractor from achieving a perfect score on the GCF return Checklist:

1. Missing after photos of KIC and MBF specification plates for each new installed TX. Entera was unable to provide.

Outstanding Items at Project Closeout:

1. Qty and description of excess unreturned material (NR):

WO#	Stock ID	Stock Item Name	Amount	Quantity
1000535670	7105160	WIRE 2/0 19 STR CU SD AS PER ASTM B8	$3,684.97	254m

2. Open NCRs and short description:
   QUA-5647: Deficiencies on site to be corrected. Please refer to Deficiency register list.

6.0 APPENDICES

Appendix A up to and including Appendix N – refer to TH File Transfer site (https://transfer.torontohydro.com/).

PRE-JOB MEETING AGENDA AND MINUTES

Project Name:	UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1	**Project Number:**	P-220271-WD161000
Constructor:	**Toronto Hydro (Specify for MEP projects)**	**Contractor:**	
Minutes Prepared by:	Yusuf Ulusow	**Minutes Revision:**	Rev.0
Meeting date:	2023-05-31	**Time/ location:**	13:30 / on Line via Webex
Attendees:	See item no. 1 & signatures on the last page	**Absent:**	

Note: *For outstanding Action Items, describe the action in the "Minutes" column and write the responsible person in the "Action By" column.*

These Meeting Minutes and ***Action Items are to be forwarded to the TH DRP and PA for addition to Contractor's bi-weekly meeting agenda.***

ITEM NO.	AGENDA	MINUTES	ACTION BY
1	**INTRODUCTION OF PROJECT TEAM** *(Please sign last page for attendance)*		ALL
a	TH Contract Administrator (CA)	Francis Szto	
b	TH Field Administrator (FA)	Ken Abram	
c	TH Project Analyst (PA)	Joseph Michel	
d	TH Corporate Communication (CC)	Shannon Jackson	
e	Designer – TH or Contractor	Mathew Huestis - Entera	
f	Contractor Supervisor	John Wood	
g	Contractor Foreman	Justin Gillespie	
h	SNC-Lavalin Field Auditor	Yusuf Ulusow	
i	SNC-Lavalin Field Auditor	Sheldon Klassen	
j			
k			

PRE-JOB MEETING AGENDA AND MINUTES

2	**SAFETY MOMENT**		**ALL**
a	Discussion of a brief safety moment	Please make sure to stay hydrated when working in the heat. Make sure to take the time to drink some water when suitable.	
b	Has the TH Contractor EH&S pre job meeting form (FRM-1810-100, Revision 4) been filled out?	Yes, has been completed	
3	**PROJECT SCOPE**		**TH CA**
a	Discussion of project scope and purpose as well as background information on project	To replace three PCB three phase vaultroom transformers from three different locations and install new fault indicators and elbows.	
b	Has the project been assigned to SNCL as the Auditor firm in the NCRDatabase with the TCSAO ID?	Yes	Contractor action item
c	Is the Job Instruction Sheet (JIS) accurate? *Justification for Custom units with verification method* *Anticipated change orders*	Yes, JIS has been completed	
d	Take-Off sheets available? Pass on to SNCL Auditors	Yes, attached to the GCF	
e	Third Party Transfer Form (TPTF) verification:	N/A	
(i)	Are TPTFs required?	N/A	
(ii)	If TPTFs are required, are they present in the GCF?	N/A	
4	**DESIGN**		**DESIGNER**
a	Project Design by TH or DB Contractor?	Entera - Contractor	
b	Presentation of project design and key points of consideration/potential third-party conflicts during construction	To replace three PCB three phase vaultroom transformers from three different locations and install new fault indicators and elbows.	
c	Digitization of drawings complete?	Yes, has been completed	

PRE-JOB MEETING AGENDA AND MINUTES

d	GEAR QA/QC & Posting of drawings complete?	Yes, has been completed.	
e	Confirm DGO (Distribution Grid Operations) construction package approval. If not, provide timeline for completion?	Waiting for control approval for DGO	
f	Construction Standards listed on drawings are up to date?	Yes, rev 60 was used for the drawing	
g	[redacted]	Yes, rev 61	
h		N/A	
i		N/A	
j		N/A	
k		N/A	
l		Yes, all TX has been confirmed to be PCB and needs to be removed	
m		N/A	
n		N/A	
o		N/A	

PRE-JOB MEETING AGENDA AND MINUTES				
17	p	[redacted]	N/A	
17	q	[redacted]	N/A	
	5	**MATERIAL STATUS**		**TH / CONT**
	a	Material purchased by TH or DB Contractor?	TH	
	b	Has material been released?	Yes, all have been released except for the transformers. Expected date of arrival is Nov 2023	
	c	Material expected delivery date?	9 transformers are to be deliveried in Nov 2023	
	d	Has all nomenclature been provided with the material?	Yes	
	e	Does Contractor have temporary Material Lay-down Area? *If yes, provide address so inspections can be made*	N/A	
	f	Does contractor have permit for the lay-down area? (Ensure lay-down area is safe or fenced off if necessary)	N/A	
	6	**CRITICAL TASKS** *(Critical Tasks Checklist to be pre-filled by Designer, put in GCF and brought to Pre-Job meeting)*		**DESIGNER**
	a	"Critical Tasks Checklist" document reviewed and marked-up as needed? *Ensure there are steps to deal with each of the identified Critical Tasks*	Yes, has been reviewed	
	b	Final photographs (as per Asset Installation Checklist photo requirements) sent to Auditor for verification within 24 hours of energization	Yes, has been reviewed	
	7	**PERMITS**		**CONT/TH**

PRE-JOB MEETING AGENDA AND MINUTES

a	[redacted]	N/A	
b	Notice of Project Validity. To be valid through the life of the project	Start Date: 2022-08-30 End Date:2023-12-31 Notice of project # 22eN674162	
c	Will tunneling & boring be required? If yes, ensure this is identified on IFC drawings and Notice for Tunnels (#0068) is on the NOP	*N/A*	
8	**CUSTOMER COMMUNICATIONS & NOTIFICATIONS**		**CONT / CC**

PRE-JOB MEETING AGENDA AND MINUTES

a	Have all the following Customer Letters been issued by either Toronto Hydro or Contractors? 1. Customer General Letter (Civil) – Toronto Hydro Issued 2. Customer Equipment Letters (Civil) – Toronto Hydro Issued ▪ Padmount Transformers ▪ Submersible Transformers ▪ Switch Gear ▪ Sight Line ▪ Splice Boxes ▪ Tap Boxes ▪ Poles Relocation and New Pole Location – As outlined in the Customer List submitted by the designer ○ Property with Pre-Existing Pole - New Pole installed greater than one meter on the same property ○ Property without Pre-Existing Pole has pole installed 3. Customer Week Before Letter (Civil – Underground & Overhead) – Contractor Issued (Posted to Toronto Hydro FTP Site) 4. Customer Outage Letter (Electrical) – Contractor Issued (Posted to Toronto Hydro FTP Site)	1. N/A 2. N/A 3. N/A 4. Contractor to contact the customer 48hrs prior to working in the area. Contractor TH if can not reach the customer.	
b	Life support identified in project area? COCO to confirm the designation is still applicable/required.	*N/A*	
9	**PROJECT PHOTOGRAPHS** *(SNCL auditors will ask contractor for photographs of items not witnessed in order to approve monthly JIS)*		**TH CA**
a	"Contractor Close-Out GCF Photographs Requirements" document reviewed?	Yes, has been reviewed	

PRE-JOB MEETING AGENDA AND MINUTES

b	Photographs must be provided for the installation of 100mm triple mix topsoil prior to laying sod. (With measuring tape showing depth of backfill) Confirm this is understood?	N/A	
c	Any additional photos requested by CA?	N/A	
10	**ADDITIONAL ITEMS**		**CONT / CA**
a	[redacted]	N/A	
b		N/A	
c		Yes, outage will be required. If failure happens, replace the new equipment with the existing equipment	
11	**REVIEW OF CONTRACTOR SAFETY PLAN**		**CONT**
a	Contractor's project specific safety plan included in GCF?	Yes	
b	Summarize the Safety plan presented by Contractor highlighting all hazards (electrical, fall potential, controlled substances, excavations, etc), and mitigation plan(s) (e.g. barriers, elimination, etc).	Wearing rubber glues, PPE, Lighting, fall arrest & spotter.	

PRE-JOB MEETING AGENDA AND MINUTES

c	**Incident Reporting Requirements:** Toronto Hydro Incident Notification Protocol to be followed. **Immediately** notify project CA, FA and 3rd party Auditor via direct phone call followed by an email, Cc to psoadmin@torontohydro.com.	Yes, reviewed	
12	**CONSTRUCTION READINESS**		**CONT**
a	What is the construction schedule? Start / End dates	Start Date: Nov 2023 End Date: Jan 2024	
b	Any premium hours needed? Managerial pre-authorization needed.	Based on customer required, incremental premium hours may be needed.	
c	Pre-job Meeting Minutes to be included to GCF? Crew Leader on site to review and sign off?	Yes, it will be sent out	
d	Have all subcontractors filled out a "Form 1000"? Ensure they all sign on to main tailboard. Also, ensure to include all subcontractors on daily emailed crew lists.	N/A	
e	Multiple contractor on-site coordination required? Coordination required by Contractor or THESL	*N/A*	
f	Traffic Control/Pedestrian Control Paid Duty required? Justification for Paid Duty: ☐ Enforcement or Authority ☐ 30m within intersection with traffic signals ☐ More than one lane or direction of traffic ☐ MCR Traffic Control (Transportation Services Requirement)	N/A	
g	Have potential tree-trimming conflicts been identified?	N/A	
h (i)	Toronto Hydro Worksite Signage Required? (Minimum duration= over 3 months)	YES NO	
(ii)	If Yes – How Many? Location(s):	N/A	
i	Is Pre-Construction Site meeting scheduled? Anticipated date	N/A	

PRE-JOB MEETING AGENDA AND MINUTES

	Ensure to invite all required attendees (City, Police, other utilities, SNCL Auditor, etc.)		
j	RODAR (Road Occupancy) Permit anticipated?	N/A	
k	Any other questions to be answered prior to the site meeting / construction start?	None	
13	**TO BE NOTED**		**ALL**

- Safety is of paramount concern when executing this project.
- All construction work is to be compliant with Ont. Reg. 22/04 and CV-CON-1.
- Any Deviations from the design are to be dealt with as per Construction Standard 34-1000.
- Any scope change requires the written approval of the Field Administrator (FA) and/or Contract Administrator (CA) and sign-off by the contractor DRP and the SNC-Lavalin auditor.
- Contractor to consult and co-ordinate with the FA concerning any field issues encountered during the execution of this project.
- Contractor to co-ordinate with SNC-Lavalin to ensure SNC-Lavalin is on-site regularly to inspect (safety, quality) the execution of this project.

PRE-JOB MEETING AGENDA AND MINUTES

14	PRE-JOB MEETING ATTENDANCE SIGN-OFF		ALL
Project Name / Number:			
Company	**Name**	**Signature**	
SNC-Lavalin	Yusuf Ulusow	yusuf	
	Uzair Zaman		
Toronto Hydro	Joseph Michel		
	Francis Szto	Francis Szto Digitally signed by Francis Szto DN: cn=Francis Szto, email=FSzto@TorontoHydro.com Date: 2023.05.31 14:45:35 -04'00'	
	Ken Abram		
	Curtis Ross		
	Shannon Jackson		
Contractor Attestation upon signing: ☑ All items discussed in this meeting will be communicated to all contractor crews and sub-contractor crews working on this project.			
Contractor: Entrow (see Att. Above)	Nima Eslami		
	Kristen Iwanczyk		
	Ted Giesbrecht		
	Tony Antinucci		
	JOHN WOOD		

Title	Creation Date	Contract Area	Project Number
55WD161000-2024-01-21-Electrical	22/01/2024	A01 - Design-Bui	672824
55WD161000-2023-12-07-Electrical	07/12/2023	A01 - Design-Bui	672824
55WD161000-2023-06-27-Electrical	05/07/2023	A01 - Design-Bui	672824

SLI Sub-Project Number	TH Department	TH Project Number	Project Description	SNCL Auditor	TH DRP/CA
55WD161000	CPW	P-220271-WD161000	UG PCBs BR-F2/BR-F:	Ulusow, Yusuf	Francis Szto
55WD161000	CPW	P-220271-WD161000	UG PCBs BR-F2/BR-F:	Zambrano, Carlos	Francis Szto
55WD161000	CPW	P-220271-WD161000	UG PCBs BR-F2/BR-F:	Zambrano, Carlos	Francis Szto

Address / Loca	Work Type Audited	Contractor	Audit Date	Time In	Inclement Wea	Crew on site at time of
119 Carrier Dr	Electrical	Entera	2024-01-21T00:00:00	2024-01-21T10:38:00	False	True
190 Carrier Dr	Electrical	Entera	2023-12-07T00:00:00	2023-12-07T11:00:00	False	False
20 Humberline	Electrical	Entera	2023-06-27T00:00:00	2023-06-27T12:30:00	False	True

Duration of visit (in minutes)	NCR Issued	NCR Number	Work Planned	Work in Progress During Site Visit
20	False		Crew's plan for	Crew had completed replacing the vaultroc
30	False		No crew was found on site. Auditor tried to contact the for	
60	False		Crew planned	Crew was installing new ground wire and th

Areas of Concern	Civil Completion	Electrical Completion	Overall Completion
Pedestrians, Isolation from vault BIA	0	61	30.5
Pedestrians, Isolation from vault BIA	0	60	30
Pedestrians, Isolation from vault BIA	0	60	30

Walk-in Vault Transformer Installation Audit Checklist
(Customer Building Vaults Containing Toronto Hydro Owned Equipment)

Prepared By: Y.Ulusow	Design/Build Contractor: Entera	Audit Date: 2024-03-06
Project Name: UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1	Project Number: P-220271-WD161000	Drawing Number: 2022-019891, 2022-019892, 2022-019893, 2022-019894
Location / Asset Number: Vault CLI	Street Name: 100 Carrier Dr	
Primary Voltage: 13.8/8kV	Secondary Voltage: 347/600V	Transformer kVA Rating: 3-167kVA

STD = THESL Construction Standard

Standards listed on this checklist are a guideline only; auditors are to use the standards listed on approved construction drawings for each specific asset.

	ELECTRICAL INSPECTION				
	Walk-in Vault Installation Type: Above Grade ☑ Below Grade ☐				
#	**Requirements**	**Yes**	**No**	**N/A**	**Comments**
1	Proper nomenclature on front of vault door as per STD 21-4700	☐	☐	☑	
2	Danger sign on front of vault door as per STD 21-4700	☐	☐	☑	
3	Proper nomenclature on inside wall of vault and on equipment as per STD 21-3000.	☐	☐	☑	
4	[redacted]	☑	☐	☐	
5		☐	☐	☑	
6		☑	☐	☐	
7		☑	☐	☐	
8		☑	☐	☐	
9		☐	☐	☑	
10		☑	☐	☐	
11		☐	☐	☑	
12	Grounds are installed as per STD 18-1000 and 18-5300	☑	☐	☐	

13	[redacted]	☑	☐	☐	
14	[redacted]	☐	☐	☑	
15	[redacted]	☑	☐	☐	
16	[redacted]	☐	☐	☑	
17	[redacted]	☑	☐	☐	
18	[redacted]	☑	☐	☐	
19	[redacted]	☐	☐	☑	

NOTES: - Digital photograph(s) are required for all items on the checklist.

- Any deviations or missing items will be identified on a Quality NCR issued to the Design/Build contractor as soon as possible.

Walk-in Vault Transformer Installation Audit Checklist
(Customer Building Vaults Containing Toronto Hydro Owned Equipment)

SNC•LAVALIN

Prepared By: Y.Ulusow	Design/Build Contractor: Entera	Audit Date: 2024-03-06
Project Name: UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1	Project Number: P-220271-WD161000	Drawing Number: 2022-019891, 2022-019892, 2022-019893, 2022-019894
Location / Asset Number: Vault KIC	Street Name: 20 Humberline Dr	
Primary Voltage: 13.8/8kV	Secondary Voltage: 416/240V	Transformer kVA Rating: 3-167kVA

STD = THESL Construction Standard

Standards listed on this checklist are a guideline only; auditors are to use the standards listed on approved construction drawings for each specific asset.

	ELECTRICAL INSPECTION				
	Walk-in Vault Installation Type: Above Grade ☑ Below Grade ☐				
#	**Requirements**	**Yes**	**No**	**N/A**	**Comments**
1	Proper nomenclature on front of vault door as per STD 21-4700	☐	☐	☑	
2	Danger sign on front of vault door as per STD 21-4700	☐	☐	☑	
3	Proper nomenclature on inside wall of vault and on equipment as per STD 21-3000.	☐	☐	☑	
4	[redacted]	☑	☐	☐	
5		☐	☐	☑	
6		☑	☐	☐	
7		☐	☐	☑	
8		☑	☐	☐	
9		☐	☐	☑	
10		☑	☐	☐	
11		☐	☐	☑	
12	Grounds are installed as per STD 18-1000 and 18-5300	☑	☐	☐	

13	[redacted]	☑	☐	☐	
14	[redacted]	☐	☐	☑	
15	[redacted]	☑	☐	☐	
16	[redacted]	☐	☐	☑	
17	[redacted]	☑	☐	☐	
18	[redacted]	☑	☐	☐	
19	[redacted]	☐	☐	☑	

NOTES: - Digital photograph(s) are required for all items on the checklist.

- Any deviations or missing items will be identified on a Quality NCR issued to the Design/Build contractor as soon as possible.

SNC•LAVALIN

Walk-in Vault Transformer Installation Audit Checklist
(Customer Building Vaults Containing Toronto Hydro Owned Equipment)

Prepared By: Y.Ulusow	Design/Build Contractor: Entera	Audit Date: 2024-03-06
Project Name: UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1	Project Number: P-220271-WD161000	Drawing Number: 2022-019891, 2022-019892, 2022-019893, 2022-019894
Location / Asset Number: Vault MBF		Street Name: 190 Carrier Dr
Primary Voltage: 13.8/8kV	Secondary Voltage: 347/600V	Transformer kVA Rating: 3-167kVA

STD = THESL Construction Standard

Standards listed on this checklist are a guideline only; auditors are to use the standards listed on approved construction drawings for each specific asset.

	ELECTRICAL INSPECTION				
	Walk-in Vault Installation Type: Above Grade☑ Below Grade☐				
#	**Requirements**	**Yes**	**No**	**N/A**	**Comments**
1	Proper nomenclature on front of vault door as per STD 21-4700	☐	☐	☑	
2	Danger sign on front of vault door as per STD 21-4700	☐	☐	☑	
3	Proper nomenclature on inside wall of vault and on equipment as per STD 21-3000.	☐	☐	☑	
4	[redacted]	☑	☐	☐	
5		☐	☐	☑	
6		☑	☐	☐	
7		☑	☐	☐	
8		☑	☐	☐	
9		☐	☐	☑	
10		☑	☐	☐	
11		☐	☐	☑	
12	Grounds are installed as per STD 18-1000 and 18-5300	☑	☐	☐	

13	[redacted]	☑	☐	☐	
14		☐	☐	☑	
15		☑	☐	☐	
16		☐	☐	☑	
17		☑	☐	☐	
18		☑	☐	☐	
19		☐	☐	☑	

NOTES: - Digital photograph(s) are required for all items on the checklist.

- Any deviations or missing items will be identified on a Quality NCR issued to the Design/Build contractor as soon as possible.

Non-Compliance (NCR) database

Welcome **olga.rodriguez2@atkinsrealis.com**! [Log Out]

Home | Track NCR's | Contact Us

NCR TRACKING

NCR ID: QUA-5647 [Search NCR]

Comments:
Limit of 800 characters

Root Cause Analysis of Non Compliance:
(To be completed by NCR Recipient)

Actions: [Update Incident With Comments]

Upload any pictures or PDF files associated with this incident
(file extensions PDF, GIF & JPG)

Upload file: [Choose File] No file chosen

File Description: [Upload File]

*All serious safety NCR's require completion of a "Risk Assessment". This should be uploaded as a PDF with the file description "Safety NCR ID-Risk Assessment" ex: SFA-1000-Risk Assessment

[Print]

QUALITY-NCR

Project Name: P-220271-WD161000 - UG PCBs BR-F2/BR-F3/BR-F1/TA-F
Address: Multiple Locations
Violation Date: 14/03/2024
Created / Issued By: Yusuf Ulusow
Department: PROGRAM SUPPORT OFFICE-W

Project Number: P-220271-W
Contractor: Entera
Incident#: QUA-5647
Did an incident occur? NA
NCR Type: QUALITY

Description of Non Compliance:
After completed the final walkdown of the project, auditor found the following deficiency in the project: Metal cable clamps were used to train the cable in Vaultroom KIC instead of the thermoplastics clamps that are required in Standard 13-7050.

Root Cause Analysis of Non Compliance:

Corrective & immediate actions taken (comments from issuer):

Yusuf Ulusow On 03-14-24 :Please return to site and install the thermoplastics clamps as required in Standard 13-7050. Please upload pictures of the completed work when updating the NCR.

Identified NCR Categories

Category	Type
Not built to a TH Standard	Other

Keep Informed

Full Name
Francis Szto
Terry Bateman

Crew Members Involved

Preventative Action (Contractor Comments):

Closure of Non Compliance issued by AtkinsRealis :
Current Status: OPEN
Closed Date:

Created Date: 14/03/2024
Last Updated: 14/03/2024

Uploaded Documents

File Description	Added By	Date
Deficiency Register	Yusuf Ulusow	14-Mar-2024
Example of the Deficiency	Yusuf Ulusow	14-Mar-2024

26-E261 Final Billing.

Job Instruction Sheet

Order No.: 1000535672

TORONTO HYDRO

WBS Element: P-220271-WD161000

Award Date :

PO NO. :

Start Date : 01-MAR-23

Issued By : JOSEPH MICHEL

Finish Date : 31-AUG-23

Project Name: UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1

Location :

No. of items in this job : 9

Contractor Name : ENTERA UTILITY CONTRACTORS

Contract Admin. Approval : Francis Szto Digitally signed by Francis Szto, DN: cn=Francis Szto, email=FSzto@TorontoHydro.com Date: 2023.02.22 13:22:34 -05'00'

Date :

Contractor Signature :

Date : 2023-02-22

No.	Service#	Unit	Description	Estim. Quant	Actual Quantities Aug. 2023	Dec. 2023	Final Billing			
Others										
1	3012806 ELE_HS_ 13-7050	each		3.000	1/1	1/2	1/3			
			312830859 - Electrical : 13-7050 : Installation of electrical equipment for 27.6kV or 13.8kV Distribution 3-1Ø Transformer Vault (any voltage or kVA size). Includes all grounding, racking, vault lighting equipment, and attachment and connecting of all cables. 13-7050 13-7060 : Price : UNDERGROUND TRANSFORMERS & SWITCHGEARS [per Vault]							
2	3019893 ELE_HS_ 13-9001	each		3.000	1/1	1/2	1/3			
			312830874 - Electrical : 13-9001 : Remove all electrical equipment and any portion of cables within 3Ø Radial transformer/switching vault. : Price : UNDERGROUND TRANSFORMERS & SWITCHGEARS [per Vault]							
3	3008772 ELE_HS_ 16-4060	each		3.000	0/0	3/3	0/3			
			313131050 - Electrical : 16-4060 : Install 15kV 1 Conductor Cu./Al. Primary TRXLPE Cable Indoor Termination (Cold Shrink Method). 16-4060 : Price : UNDERGROUND CABLE, TERMINATIONS, JOINTS and CONNECTORS [per Terminator]							

Yusuf Ulusow - SNC Lavalin - 416-346-4883 YU

OB OB OB

Toronto Hydro and the Contractor acknowledges that the Work described in this Job Instruction Sheet shall be priced and paid according to the Schedule of Unit Prices for the rate year (identified in the Job # listed in the top right corner of this Job Instruction Sheet) in which the Work pursuant to this Job Instruction Sheet relates, notwithstanding that the Work may carry over into subsequent calendar years.

Olivia Brown-Entera

YU YU YU

No.	Service#	Unit	Description	Estim. Quant	Actual Quantities Aug. 2023	Dec. 2023	Final Billing		
4	3012026 ELE_HS_ 16-4220	each	313131060 - Electrical : 16-4220 : Install 15kV 1 Conductor Cu./Al. 200A Primary TRXLPE Cable Loadbreak Elbow Termination. 16-4220 16-4180 : Price : UNDERGROUND CABLE, TERMINATIONS, JOINTS and CONNECTORS [per Elbow]	21.000	9/9	3/12	9/21		
5	3003457 ELE_HS_ 16-7001	each	313131082 - Electrical : 16-7001 : Install 2 or more underground Fault Indicators to existing terminators/splices/ elbows, at same chamber, vault, splice box or pad location. 20-3400 20-3450 20-3500 20-3600 20-3700 : Price : UNDERGROUND CABLE, TERMINATIONS, JOINTS and CONNECTORS [per Indicator]	9.000	3/3	3/6	3/9		
6	3004493 ELE_HS_ TE-0101 Reg Rate Mon-Fri 6A-7P	Hours	313631108 - Electrical : TE-0101 : Foreperson/Certified Crew Leader : Regular Rate Mon - Fri 6:00am - 7:00pm : LABOUR RATES [/ hour]	4.000	2/2	0/2	2/4		
7	3008769 ELE_HS_ TE-0102 Reg Rate Mon-Fri 6A-7P	Hours	313631109 - Electrical : TE-0102 : MEA Journey Person : Regular Rate Mon - Fri 6:00am - 7:00pm : LABOUR RATES [/ hour]	8.000	4/4	0/4	4/8		
8	3019030 ELE_HS_ TE-0301	Hours	314431131 - Electrical : TE-0301 : Pickup truck. : Price : EQUIPMENT RATES [/hour]	4.000	2/2	0/2	2/4		

Toronto Hydro and the Contractor acknowledges that the Work described in this Job Instruction Sheet shall be priced and paid according to the Schedule of Unit Prices for the rate year (identified in the Job # listed in the top right corner of this Job Instruction Sheet) in which the Work pursuant to this Job Instruction Sheet relates, notwithstanding that the Work may carry over into subsequent calendar years.

Job Instruction Sheet

Order No.: 1000535672

No.	Service#	Unit	Description	Estim. Quant	Actual Quantities Aug. 2023	Dec. 2023	Final Billing			
9	3012966 ELE_HS_ TE-0323	Hours		4.000	2/2	0/2	2/4			

314431153 - Electrical : TE-0323 : Bucket truck (double for up to 65 feet). : Price : EQUIPMENT RATES [/hour]

Remarks :

CB CB. CB.
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Toronto Hydro and the Contractor acknowledges that the Work described in this Job Instruction Sheet shall be priced and paid according to the Schedule of Unit Prices for the rate year (identified in the Job # listed in the top right corner of this Job Instruction Sheet) in which the Work pursuant to this Job Instruction Sheet relates, notwithstanding that the Work may carry over into subsequent calendar years.

Job Instruction Sheet (Additional Items) Job # : 26-E261

TORONTO HYDRO

Project No : P-220271-WD161000

Project Name : UG PCB's BR-F2/BR-F3/BR-F1/TA-F4 P.1

P.O. No :

Location :

No.	Item #	Unit	Description	CO#	Est. Qty	Actual Quantites / Dates					
						Final					
1	TE-0101	per Hour	Foreperson/Certified Crew Leader **Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm**	1	10	10/10					
2	TE-0102	per Hour	MEA Journey Person **Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm**	1	20	20/20					
3	TE-0123	per Hour	Apprentice Line Person - 3rd Year **Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm**	1	10	10/10					
4	TE-0124	per Hour	Apprentice Line Person - 1st or 2nd Year **Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm**	1	10	10/10					
5											
6											
7											
8											
9											

CHANGE ORDER

Date:	24 Jan 2024		Construction Related
Purchase Order:		**UPCMS Job#:**	2023-Horseshoe
Project Title:	P-220271-WD161000		UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1
Contractor:	Entera	**Change Order#:**	1

The following changes are contemplated to the above project. Unless indicated otherwise, this is not an authorization to proceed. All changes, which affect the final unit price, shall only proceed under the authority of an executed Change Order.To minimize delays to the contractor, approval can occur via email with the contractor submitting a Change Order within 48 hrs.

Change Order Issues:

Sunday work to complete transformer replacement at 100 Carrier Drive.

Location/Drawing/Sketch:

100 Carrier Drive

Detailed Description of Requirements:

Sunday work to complete transformer replacement at 100 Carrier Drive.

Item Description	Exist	E-Qty	A-Qty
Type: Electrical Series: TE-0100-ELECTRICAL Description: Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm TE-0101-Foreperson/Certified Crew Leader | UOM: / hour | Short Text: ELE_HS_ TE-0101 IPR W/ CI Sun&Stat 6A-7P | SAP ID: 3004492	NO	10.00	10
Type: Electrical Series: TE-0100-ELECTRICAL Description: Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm TE-0102-MEA Journey Person | UOM: / hour | Short Text: ELE_HS_ TE-0102 IPR W/ CI Sun&Stat 6A-7P | SAP ID: 3002999	NO	20.00	20
Type: Electrical Series: TE-0100-ELECTRICAL Description: Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm TE-0123-Apprentice Line Person - 3rd Year | UOM: / hour | Short Text: ELE_HS_ TE-0123 IPR W/ CI Sun&Stat 6A-7P | SAP ID: 3006964	NO	10.00	10
Type: Electrical Series: TE-0100-ELECTRICAL Description: Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm TE-0124-Apprentice Line Person - 1st or 2nd Year | UOM: / hour | Short Text: ELE_HS_ TE-0124 IPR W/ CI Sun&Stat 6A-7P | SAP ID: 3005835	NO	10.00	10
Total Change Order:) **Final Change Order Value:**			

A: Requested By: Olivia Brown Company: Entera

B: Inspector/ Auditor Name: Yusuf Ulusow | Dated: Jan-25-2024 | Accepted by Auditor: YES

Comments: Accepted. After reviewing the attached documents, the requested units have been confirmed to be valid and can be processed.

C: Design Supervisor Name: Francis Szto | Dated: Jan-25-2024 | Approved by THESL: YES

Comments: Approved for incremental premium

CHANGE ORDER

D: Approved Change Audited by THESL / External Audit Firm Inspector Name: Yusuf Ulusow | Dated: Jan29 -2024
YES : Change Order process as per RFP - followed by Contractor & PSO
YES: Approved work under Change Order has been completed

Comments: Accepted. Actual quantities have been correctly updated.

Date	Proj#	Project Description	Reason	PO#	UPCMS#	CONO	Status
1/24/2024	P-220271-WD161000	UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1	Sunday work to complete transformer replacement at		2023-Horseshoe	1	CLOSED

CHANGE ORDERS

Welcome **obrown@entera.ca**! [Log Out]

Home	Create CO	Dashboard	Change Order Log	Add Project	Contact Us

APPROVE/REJECT CHANGE ORDERS

Select Submit

Comments:

Optional: Upload files or pictures related to this change order (file extension can only be jpg, gif or pdf)
Caution: Do not upload confidential information, send via email and quote final CO Ref# in email subject

1. **File Description:**
2. **Select File (one file at a time):** Choose File No file chosen
3. **Upload file:** Upload File

CHANGE ORDER

Date: 1/24/2024
Purchase Order:
Project Title: UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1
Project#: P-220271-WD161000
CO Status: 5-SNC-Accepted

Change Order #: 1
UPCMS Job#: 2023-Horseshoe
Contractor: Entera
Change: Construction Related

The following changes are contemplated to the above project. Unless indicated otherwise, this is not an authorization to proceed. All changes, which affect the final unit price, shall only proceed under the authority of an executed Change Order.To minimize delays to the contractor, approval can occur via email with the contractor submitting a Change Order within 48 hrs.

Change Order Issue:
Sunday work to complete transformer replacement at 100 Carrier Drive.
Location/Drawing/Sketch:
100 Carrier Drive
Detailed Description of Requirements:
Sunday work to complete transformer replacement at 100 Carrier Drive.

Exist: Does this item exist on the UPCMS of the project?

R_ID	Item Description	*Exist	E-Qty	A-Qty	Price	
102438	Type: Electrical Series: TE-0100-ELECTRICAL Description: Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm TE-0101-Foreperson/Certified Crew Leader | UOM: / hour | Short Text: ELE_HS_ TE-0101 IPR W/ CI Sun&Stat 6A-7P | SAP ID: 3004492	NO	10	10	0	Edit
102439	Type: Electrical Series: TE-0100-ELECTRICAL Description: Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm TE-0102-MEA Journey Person | UOM: / hour | Short Text: ELE_HS_ TE-0102 IPR W/ CI Sun&Stat 6A-7P | SAP ID: 3002999	NO	20	20	0	Edit
102440	Type: Electrical Series: TE-0100-ELECTRICAL Description: Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm TE-0123-Apprentice Line Person - 3rd Year | UOM: / hour | Short Text: ELE_HS_ TE-0123 IPR W/ CI Sun&Stat 6A-7P | SAP ID: 3006964	NO	10	10	0	Edit
102441	Type: Electrical Series: TE-0100-ELECTRICAL Description: Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm TE-0124-Apprentice Line Person - 1st or 2nd Year | UOM: / hour | Short Text: ELE_HS_ TE-0124 IPR W/ CI Sun&Stat 6A-7P | SAP ID: 3005835	NO	10	10	0	Edit

Total Estimated Value: | Total Actual Value:

Step 1(A)
Requested By:Olivia Brown Contractor: Entera

Step 2(B) Inspector: Yusuf Ulusow Backup Inspector: SNC General Mailbox
Authorized By Inspector: Yusuf Ulusow on Thursday, January 25, 2024 | Approved: YES
Comments:
Accepted. After reviewing the attached documents, the requested units have been confirmed to be valid and can be processed.

Step 3(C) Design Supervisor: Francis Szto
Authorized By Design Supervisor: Francis Szto on Thursday, January 25, 2024 | Approved: YES
Comments:
Approved for incremental premium
Paid Under Progress Billing#: Dated:

Step 4(D) Actuals Updated By: Olivia Brown on Monday, January 29, 2024
Comments:
Actuals updated.

Step 5(E) Inspector: Yusuf Ulusow Backup Inspector: SNC General Mailbox
Verified By Inspector: Yusuf Ulusow on Monday, January 29, 2024
Comments:
Accepted. Actual quantities have been correctly updated.

- [x] Change Order process-as per RFP-followed by Contractor & PSO
- [x] Approved work under Change Order has been completed

File Description	Added By	Date
Timesheet	Olivia Brown	24-Jan-2024
Approval	Olivia Brown	24-Jan-2024

Timesheet ID:	28475																	Date:		2024-01-21		
Foreman:	417183	Brady Davidson				Approved by GF/Super:				120676	Justin Gillespie				Approved by Manager:							
		JOB#1				JOB#2				JOB#3				JOB#4								
		26261-2																TOTAL HOURS				
Employee ID	Employee Name	Straight	Night Premi	Time &Half	Double	Straight	Night Premi	Time &Half	Double	Straight	Night Premi	Time &Half	Double	Straight	Night Premi	Time &Half	Double	Straight	Night Premi	Time &Half	Double	Comments/Notes
417183	Brady Davidson				11																11	Loa
16138	Brendan Johnson				11																11	
16303	Kyle Parsons				11																11	Loa
20837	James Groves				11																11	
20894	Dave Maxwell				11																11	Loa

UNIT#	DESCRIPTION					TOTAL HOURS	Comments/Notes
2-241	2024 GMC Sierra 2500 Electrical foreman	11	0	0	0	11	
3-62	2019 Freightliner M2-106	11	0	0	0	11	
3-70	2020 Freightliner M2-106 Altec AN50E-OC S/N 0120FK2425	11	0	0	0	11	
224830	International 4300 Digger Derrick	11	0	0	0	11	
2-82	2012 Ford F550 Super Duty (gas)	11	0	0	0	11	

From:	Francis Szto
To:	Justin Gillespie; Olivia Brown
Subject:	RE: 100 Carrier drive power outage.
Date:	January 9, 2024 3:43:12 PM

CAUTION: This Email is from an EXTERNAL source. Ensure you trust this sender before clicking on any links or attachments.

Justin:

Please proceed.

Regards,

From: Justin Gillespie <jgillespie@entera.ca>
Sent: January-09-24 1:29 PM
To: Francis Szto <FSzto@TorontoHydro.com>; Olivia Brown <obrown@entera.ca>
Subject: [EXTERNAL] : RE: 100 Carrier drive power outage.

CAUTION: This email originated from outside of Toronto Hydro. Exercise caution when clicking on links or opening attachments even if you recognize the sender.

Hi Francis,

Happy New year!!!

The customer is good with us completing this job on Sunday Jan 21st as long as you are good with the ot still. Will need 1 foreman, 4 journeymen and 1 4th year apprentice to complete this vault.

Thank you

From: Justin Gillespie
Sent: Tuesday, November 28, 2023 2:48 PM
To: Francis Szto <FSzto@TorontoHydro.com>; Olivia Brown <obrown@entera.ca>
Subject: RE: 100 Carrier drive power outage.

Sounds good. I will set something up for early Jan.

Thank you

From: Francis Szto <FSzto@TorontoHydro.com>
Sent: Tuesday, November 28, 2023 2:12 PM
To: Justin Gillespie <jgillespie@entera.ca>; Olivia Brown <obrown@entera.ca>
Subject: RE: 100 Carrier drive power outage.

CAUTION: This Email is from an EXTERNAL source. Ensure you trust this sender before clicking on any links or attachments.

Justin:
This is good enough and I will keep this in file as part of the Change order approval supporting documentation.
Regards,

From: Justin Gillespie <jgillespie@entera.ca>
Sent: November-28-23 2:00 PM
To: Francis Szto <FSzto@TorontoHydro.com>; Olivia Brown <obrown@entera.ca>
Subject: [EXTERNAL] : FW: 100 Carrier drive power outage.

CAUTION: **This email originated from outside of Toronto Hydro. Exercise caution when clicking on links or opening attachments even if you recognize the sender.**

See below from the customer. Let me know if that is enough?

Thank you

From: Tony Balasingham <Tony@xcella.ca>
Sent: Thursday, June 15, 2023 9:24 AM
To: Justin Gillespie <jgillespie@entera.ca>
Cc: shipping@xcella.ca; Olivia Brown <obrown@entera.ca>; Taran | Xcella.CA <taran@xcella.ca>
Subject: Re: 100 Carrier drive power outage.

CAUTION: This Email is from an EXTERNAL source. Ensure you trust this sender before clicking on any links or attachments.

Hi Justin

further to our discussion this morning,

we will not be able to shut down our operation on weekdays due customers visiting showroom , delivery as well as pick ups

however as discussed , we could have one of our staff open the premises on Sunday or Saturday to accommodate you to carry out the work

Thank you for your understanding

Tony
416 891 0927

On Thu, Jun 15, 2023 at 8:50 AM Justin Gillespie <jgillespie@entera.ca> wrote:

> Good morning Tony,

Could you please pick the date that works best for you ? I know this is inconvenient but the equipment does need to be replaced to keep it working well.

Give me a call if you need to discuss further. 416 660 1746.

Thank you

From: Justin Gillespie <jgillespie@entera.ca>
Sent: Tuesday, June 13, 2023 11:31 AM
To: Tony Balasingham <tony@xcella.ca>
Cc: shipping@xcella.ca; Olivia Brown <obrown@entera.ca>; Taran | Xcella.CA <taran@xcella.ca>
Subject: Re: 100 Carrier drive power outage.

Hi tony,

Unfortunately we will have to keep this between the hours of 8 am and 3pm. That is when our crews work.

We are giving lots of notice if you need to move some things around. This is only for 1 day. Please let me know 1 of the days that i provided that works best.

Thank you

Sent from my Bell Samsung device over Canada's largest network.

From: Tony Balasingham <tony@xcella.ca>
Sent: Tuesday, June 13, 2023 10:54:47 AM
To: Justin Gillespie <jgillespie@entera.ca>
Cc: shipping@xcella.ca <shipping@xcella.ca>; Olivia Brown <obrown@entera.ca>; Taran | Xcella.CA <taran@xcella.ca>
Subject: Re: 100 Carrier drive power outage.

Hi Justin

Further to your request for work to be done on June 27 or 28th - 8AM to 3 PM

We have operations and showroom open during this time and it is not possible to close down .

However we could accommodate you from say 4 PM till you complete the job. Hope there is no work to be done inside the building

Pl get back to us.

Thank you
Tony
416 891 0927

Sent from my iPhone

On Jun 13, 2023, at 7:53 AM, Justin Gillespie <jgillespie@entera.ca> wrote:

Good morning,

I was out to your building a couple months ago to discuss a power outage to replace the equipment in the Toronto hydro vault room. This will impact the power to the building for the day. I have 2 dates that we can pick from Tuesday June 27 and Wednesday June 28th 8am to 3pm. Let me know which of those 2 dates works best for you and I will put in the schedule.

Thank you

SNC·LAVALIN

FINAL WALK DOWN DEFICIENCY REGISTER

PROJECT NAME: UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1	TH Project number (WBS): P-220271-WD161000	SLI AUDITOR: Yusuf Ulusow	DATE OF FINAL WALK DOWN: 2024-03-06
☐ **24 hrs notice was given to Contractor prior to final walk-down** ☐ **Contractor attended final walk-down**	CONTRACTOR & REP NAME: Entera	SITE ADDRESS / INTERSECTIONS: Multiple Locations	

A Final Walk-Down of the construction site has been performed using the Construction Drawings. The following observations have been made:

☐ *No deficiencies were found. Work was completed as per drawings and:*

- *site was left clear of any equipment, material or undue hazards*
- *all temporary and permanent restorations completed as per MCR including the application of THs Utility Cut Identifier*
- *all signage has been removed from site*
- *customer property has been restored*

☑ *Deficiencies were found, contractor to see deficiencies listed in table below and address all items by the date indicated. Contractor is to notify SLI auditor once all deficiencies have been cleared.*

NCR(s) Issued: QUA-5647

Comments:

DEFICIENCY NO.	DATE ISSUED	DESCRIPTION OF DEFICIENCY	REQUIRED CLOSE OUT DATE	ACTUAL CLOSE OUT DATE
1		Metal cable clamps were used to train the cable in Vaultroom KIC instead of the thermoplastics clamps that are required in Standard 13-7050		

FORM 9
CERTIFICATE OF SUBSTANTIAL PERFORMANCE OF THE CONTRACT UNDER SECTION 32 OF THE ACT

Construction Act

City of Toronto ,
(County/District/Regional Municipality/Town/City in which premises are situated)

190, 100 Carrier Dr and 20 Humberline Dr , Etobicoke, ON ,
(street address and city, town, etc., or, if there is no street address, the location of the premises)

This is to certify that the contract for the following improvement:

UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1 - P-220271-WD161000
(short description of the improvement)

to the above premises was substantially performed on **2024-01-21** .
(date substantially performed)

Date certificate signed:

(payment certifier where there is one) | (owner and contractor, where there is no payment certifier)

Name of owner: **Toronto Hydro-Electric System**

Address for service: **14 Carlton Street, Toronto, ON M5B 1K5**

Name of contractor: **Entera Utility Contractors**

Address for service: **1530 Birchmount Road, Scarborough, ON M1P 2H2**

Name of payment certifier (where applicable): **AtkinsRéalis Canada Inc.**

Address: **191 The West Mall, Toronto, ON M9C 5K8**

(Use A or B, whichever is appropriate)

☐ A. Identification of premises for preservation of liens:

(if a lien attaches to the premises, a legal description of the premises, including all property identifier numbers and addresses for the premises)

☒ B. Office to which claim for lien must be given to preserve lien:

Toronto Hydro Head Office, 14 Carlton Street, Toronto, ON M5B 1K5
(if the lien does not attach to the premises, a concise description of the premises, including addresses, and the name and address of the person or body to whom the claim for lien must be given)

TORONTO HYDRO

Contractor Close-Out GCF Verification Check List

Contractor Sign-Off		Audit Firm Sign-Off
Project Name: UG PCB BR-F2/BR-F3/BR-F1/TA-F4 P.1	Construction Contractor - Completed By (Print Name): Olivia Brown	Audit Firm - Date GCF Received from Contractor: ATRL 2024-02-12
Project Number: P-220271-WD161000	Date & Signature: Olivia Brown Jan.30/24	Audit Firm – Completed By (Print Name): ATRL Slawomir Domurat
Project Construction Attainment Date: January 2024.	Construction Contractor Manager Attestation (Print Name): John Wood	Audit Firm – Date & Signature: ATRL 2024-02-20 Slawomir Domurat
Construction Contractor Firm: Entera Utility Contractors	Date & Signature: Jan. 31/24	Audit Firm – Field Auditor: Main: Yusef Ulusow Backup: Stephan Farrar

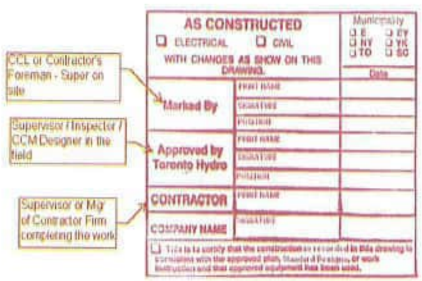
Contractor to fill out their part of this checklist (left side) completely.

****GCFs will not be accepted by Audit Firm unless all items listed in Sections A, B, and C are included in the GCF, and this checklist is properly signed off in the header above.****

Refer to notes at the end of the checklist for importance of each section.

VT = Verification Type:
A = Administrative F = Field

		Contractor Check Off			Audit Firm Verification				
Item #	Section A: Regulatory	Yes	N/A	Comments	Yes	N/A	# of pts.	VT	Comments
1	Number of GCFs returned matches the number originally issued. (This can be seen from Department Requisition)	☑	☐		✓	☐	1	A	
a	If Civil GCF was issued, all documents in the Civil GCF pertaining to this checklist are included in the Electrical GCF as ONE package	☐	☑		☐	✓	1	A	
2	GCF Checklist Title Block is completed and signed	☑	☐		✓	☐	1	A	
3	Latest version of GCF Checklist used	☑	☐		✓	☐	2	A	
4	Back of folder is completed correctly as per below.								
a	Constructor signed and dated sections 1 to 7. (Refer to "GCF Rear Sign-Off" Visual Guide, and below in b and c)	☑	☐		✓	☐	1	A & F	
b	Section 4 filled out accordingly with name of qualified staff member, their position & signature. "Partial Certificate" and/or "Final Certificate" boxes checked off according with Ontario Reg 22/04. ➢ *Qualification of staff member to be checked against the contractor's ESA Ont. Reg.22/04 training records.* ➢ *Civil Folder – Final Certificate box* ➢ *Electrical Folder – Final Certificate box; and Partial Certificate (if partial energization has occurred-i.e. partial certificate stamps on dwgs.)*	☑	☐		✓	☐	3	A & F	
c	Section 6 has two parts. 1. Material Closure signed by CCL. 2. Excess Material and Recovered Material checkboxes checked off accordingly. (*These are only needed for Electrical folder*)	☑	☐		✓	☐	1	A & F	

5	**Department requisition** is signed and dated. ("Date Work Completed", "Completed By", and "Supervisor Signature" are all filled in at bottom right of page) This must be done for each of the folders (ie: one for electrical and a separate one for civil).	☑	☐		☑	☐	1	A	
6	**As-Built Drawings** are all returned and properly stamped and signed as per below:								
a	Same number of drawings returned as issued out. (This can be seen on the Department Requisition).	☑	☐		☑	☐	1	A	
b	Drawings returned are the latest revision issued to the constructor and have proper P.Eng. and PSO stamps on them. (The stamps are only needed for externally [non THESL] designed projects).  	☑	☐		☑	☐	1	A	
c	All changes are marked-up on the as-built drawings.	☑	☐		☑	☐	10	F	
d	All mark-ups on the as-built drawings are clear and legible.	☑	☐		☑	☐	4	F	
e	All drawings are stamped "**As Constructed**" and stamp is signed and dated by competent persons as described in diagram below: *(Civil and Electrical As-Builts are signed by Civil and Electrical Foreman, respectively)*  	☑	☐		☑	☐	4	F	
f	All check boxes on the "As Constructed" stamp have been checked off accordingly. (Electrical or Civil check box, Municipality check box, and bottom "as per design" checkbox)	☑	☐		☑	☐	3	F	
g	"Primary Schematic" on As- Built drawings are complying with the latest DGO approved Feeder Print(s), and both are included in the retuned GCF	☐	☑		☐	☑	3	F	

h	**All Electrical drawings** are stamped with a "**Partial Certificate**" stamp next to all items that have been energized. This stamp was placed and dated at the time of the energization. Stamp fully completed and signed by competent person at site (CCL or Contractor's Foreman – Super on site). **Partial Certificate** Name Position Signature Date ☐ This is to certify that the construction as recorded in this drawing is consistent with the approved plan, Standard Designs, or work instruction and that approved equipment has been used. ➢ *Qualification of competent person to be checked against the contractor's ESA Ont. Reg.22/04 training records.*	☑	☐		☑	☐	10	F	
i	All Technical Deviations (refer to Std. 34-1000) have been approved by the Designer or Standards department. Revised drawings (signed by a P.Eng or designer) submitted for any deviation from approved standard or drawing, respectively	☐	☑		☐	☑	10	F	
j	As-Built drawing mark-ups are in compliance with CSA Standard S250	☑	☐		☑	☐	10	A & F	
k	As-Constructed Road Cut stamp is filled out on title page	☐	☑		☐	☑	3	A & F	
l	If **UG Primary Cable Testing** is required, then the Cable Testing Report must be submitted as part of GCF Return package	☐	☑		☐	☑	4	A & F	
m	If a project falls under **Excess Soil Regulations**, then the following documents must be be submitted as part of GCF Return package: -The filed notice on registry -Assessment of Past uses (or a Phase One ESA if that has been completed in the last 18 months) -Sampling and Analysis Plan -Soil Characterization Report -Excess Soil Destination Assessment Report	☐	☑		☐	☑	15	A & F	
n	All Disconnected Unused Lines 750V or more:	☐	☑		☐	☑			
l-1	Shall be removed completely and mark the lines as "REMOVED" on as-built drawings	☐	☑		☐	☑	15	A & F	
l-2	If removal is such line is not feasible or practical, each end of line should be cut off and grounded. Mark the lines as "GROUNDED" on as-built drawings	☐	☑		☐	☑	15	A & F	
l-3	If k-1 and k2 are not feasible or practical, field assessment to be signed off by Standards Engineer. A signed off report by P Eng should be filed to ESA. Mark the lines as "UNGROUNDED" on as-built drawings	☐	☑		☐	☑	15	A & F	
7	A signed & stamped, (by Auditor), **Certificate of Substantial Completion** is included in the GCF.	☐	☑		☐	☐	1	A	
Item #	**Section B: Corporate Records / Asset Management**	**Yes**	**N/A**	**Comments**	**Yes**	**N/A**	**# of pts.**	**VT**	**Comments**
8	**Asset Checklist** completed and included in the GCF. *(This checklist should be used in conjunction with items #9, 10, and 11 below as a check for all asset forms and photographs.)*	☑	☐		☑	☐	1	A & F	
A	All electrical assets shown on the As-Built drawings to be removed or installed are included on the asset checklist.	☑	☐		☑	☐	1	A & F	

8	All electrical assets shown on the JIS to be removed or installed are included on the asset checklist. *(These assets should be same as those on as-builts; report/fix any discrepancies, if found).*	☑	☐		☑	☐	0	A & F	
c	Equipment Change-Out Form (ECF) column is filled in as a YES for all assets of the following Equipment type: **Pole, Transformer, Switch.**	☑	☐		☑	☐	1	A	
d	Assets marked with a YES in the ECF column are labelled correctly as installed, removed or both. *(Check the As-Built drawings / JIS to see if the location specified an asset to have been installed or removed or both.)*	☑	☐		☑	☐	1	A	
e	Nomenclature Form column is filled in as a YES for the following asset types: Transformer, Switch, Vault, CC, Customer Location/Equipment, Tapbox.	☑	☐		☑	☐	1	A	
9	**Equipment Change Out forms** (ECFs) included in the GCF. *(If ECFs are checked off as N/A on this project, review JIS and As-Builts to ensure this is correct.)*	☑	☐		☑	☐	1	A & F	
a	There is a completed ECF for each asset specified with a YES in the ECF column on the Asset Document Checklist. *(This is in conjunction with item #8 above.)*	☑	☐		☑	☐	1	A	For OS41537 installation section was not filled in entirely. Entera confirmed Only fuses were upgraded.
b	The "Installation" and "Removal" sections of the ECF are filled out as required per the ECF column on the Asset Document Checklist. *(This is in conjunction with item #8 above.)*	☑	☐		☑	☐	10	A	
c	The asset number / location number, serial number, stock code, and equipment number on the ECF matches those seen on at least one of the photographs for each asset installed/removed. (Asset Removed = Before picture, Asset Installed = After picture) *(This is in conjunction with item #8 above and item #11 below.)*	☑	☐		☑	☐	1	A	
d	Technical details such as feeder, kVA, phase and voltage are completed and accurate on each ECF.	☑	☐		☑	☐	3	A & F	
e	A completed ECF Summary Form is included and filled out accordingly for all major assets (poles, transformers, and switches). *Assets are counted per individual item, not per location (e.g. 3-ph inline switches are counted as 3 assets)* - *Justification must be provided for any variance between planned and actual quantities*	☑	☐		☑	☐	15	A & F	
10	**Nomenclature** Labelling Reports included in the GCF.	☐	☑		☐	☑	1	A	
a	There is a completed Nomenclature Labelling Report for each of the assets specified with a YES in the Nomenclature Form column on the Asset Document Checklist. *(This is in conjunction with item #8 above.)*	☐	☑		☐	☑	1	A	
b	The asset number / location number on the Nomenclature form can be seen in at least one of the "After" photographs for each asset. *(This is in conjunction with item #8 above and item #11 below.)*	☐	☑		☐	☑	1	A	
c	Nomenclature Labelling Reports are fully completed and accurate.	☐	☑		☐	☑	1	A & F	

11	"Before" and "After" **photographs** are saved in digital format and included in the close-out GCF on an electronic disk.	☑	☐		☑	☐	10	A	
a	"Before" and "After" photographs are included for all assets listed on the Asset Document Checklist. *(This is in conjunction with item #8 above.)*	☑	☐		☑	☐	10	A	
b	Photographs are named/filed as per the "Contractors Close-Out GCF Photograph Requirements" document.	☑	☐		☑	☐	5	A	
c	Contents of the Before/After Photographs include all requirements as per the "Contractors Close-Out GCF Photograph Requirements" document.	☑	☐		☑	☐	5	A & F	After pictures of serial#, equip#, Stock codes for KIC and MBF locations were not provided by Entera
12	**Investment Recovery Forms** included in the GCF.	☑	☐		☑	☐	1	A	
a	Investment recovery forms are included for each asset that was removed of the following type:								
	Transformer	☑	☐		☑	☐	2	A	
	Switch	☐	☑		☐	☑	1	A	
	Pole	☐	☑		☐	☑	1	A	
	Removed Cable	☐	☑		☐	☑	1	A	
b	Investment recovery forms completed and "Received By" portion is signed and dated.	☑	☐		☑	☐	1	A	
13	**Material Return Forms** included in the GCF.	☐	☑		☐	☑	1	A	
a	Material Return forms are included for returnable items. *(e.g. empty cable reel, transformer skid, kit box, etc.)*	☐	☑		☐	☑	1	A	
b	Material Return forms are included for all unused material that was issued for the project. This includes the following:								
	Poles	☐	☑		☐	☑	1	A	
	Transformers	☐	☑		☐	☑	1	A	
	Switches	☐	☑		☐	☑	1	A	
	Cable	☐	☑		☐	☑	5	A	
	Termination / Splice Kit	☐	☑		☐	☑	1	A	
c	Material Return forms completed and "Received By" portion is signed and dated.	☐	☑		☐	☑	1	A	
14	**Street Light Change forms included in the GCF.**	☐	☑		☐	☑	1	A	
a	Number of street lights added or deleted matches the number indicated on the As-Built drawings and/or the Final JIS.	☐	☑		☐	☑	1	A & F	
15	**TPTF (Third Party Transfer Forms)** included in the GCF as follows:								
a	Updated TPTF is submitted with accurate markups	☐	☑		☐	☑	10	A & F	
b	Updated TPTF is provided in both excel and PDF format	☐	☑		☐	☑	10	A & F	
c	Updated TPTF is signed off by Auditor with total deferred pole count	☐	☑		☐	☑	5	A & F	

16	Concrete 7 day and 28 day compress strength tests included in the GCF for:								
	Cable Chambers	☐	☑		☐	✓	1	A & F	
	Vaults	☐	☑		☐	✓	1	A & F	
17	Concrete delivery tickets included for each batch (chambers, sidewalk, etc.)	☐	☑		☐	✓	2	A & F	
18	**Network Automation**								
a	Complete the Network Condition Monitoring and Control Commissioning Checklist	☐	☑		☐	✓	1	A & F	
b	Complete the Network Automation VCB Installation Checklist & Consult Job Aid	☐	☑		☐	✓	1	A & F	
c	Number of Network Automation forms from section 18a/b should match number of VCB's installed in the project.	☐	☑		☐	✓	2	A & F	
d	Fill out Network Automation forms from section 18a/b. Provide proof that forms were sent to System Planning Core (CPlanning@TorontoHydro.com).	☐	☑		☐	✓	1	A	

Item #	Section C: Financial Records	Yes	N/A	Comments	Yes	N/A	# of pts.	VT	Comments
19	Final Job Instruction Sheet (JIS) included in the GCF.	☑	☐		✓	☐	10	A	
a	JIS has been filled out as per instructions (refer to JIS tracking sheet example).	☑	☐		✓	☐	5	A & F	
b	Actual quantities are filled in one column per billing period (month).	☑	☐		✓	☐	1	A & F	
c	JIS is labelled "Final" on first page and is initialed by Contractor & Auditor on every page.	☑	☐		✓	☐	5	A & F	
d	All items on JIS that have quantities over or under the estimate are referenced to a Change Order in that billing period column.	☑	☐		✓	☐	5	A & F	
e	All items on JIS that have zero (0) as the claimed quantity have been verified as work that was not required.	☑	☐		✓	☐	1	A & F	
20	**Change Orders** are included in the GCF.	☑	☐		✓	☐	10	A & F	
a	There is a change order for all items that were not included in the original estimate on the JIS.	☑	☐		✓	☐	4	A & F	
b	Each change order has all 5 stages completed and the finalized CO is printed out and included in the GCF	☑	☐		✓	☐	5	A & F	
c	Supporting documents are included in the GCF (paper/electronic copy) for each change order.	☑	☐		✓	☐	8	A & F	
d	Additional Units Sheet is included for all items not included in the original JIS estimate and is initialed at the bottom of the page.	☑	☐		✓	☐	5	A & F	
e	Change Order Log is included and up to date.	☑	☐		✓	☐	3	A & F	
21	**Paid Duty** invoices are included in the GCF.	☐	☑		☐	✓	5	A	
a	Total paid duty hours are the same as those in the Final JIS.	☐	☑		☐	✓	5	A	

Item #		Yes	N/A	Comments	Yes	N/A	# of pts.	VT	Comments
22	**ESA Certificates** are included in the GCF.	☐	☑		☐	✓	1	A	
a	Number of certificates corresponds with the Final JIS quantities.	☐	☑		☐	✓	1	A & F	
Item #	**Section D: Other Project Records**	**Yes**	**N/A**	**Comments**	**Yes**	**N/A**	**# of pts.**	**VT**	**Comments**
23	**Materials** Requisition, packing list, and print-out of electrical material installed spreadsheet are included in the GCF.	☑	☐		✓	☐	1	A	
24	**Notice of Project** included in folder and signed. (Only needed for projects >= $50 000)	☑	☐		✓	☐	1	A	
25	All completed **OTO's Work Requests** are included in the GCF.	☑	☐		✓	☐	1	A & F	
26	All **Record "ON"** forms are included in the GCF.	☐	☑		☐	✓	1	A	
27	All **Cut Permits** are included in the GCF.	☐	☑		☐	✓	1	A	
28	**Request for Attainment** form included in GCF	☑	☐		✓	☐	1	A & F	
29	Following documents were submitted to 3rd Party Audit Firm within 15 calendar days of construction attainment:								
a	Green Construction Folders	☑	☐		✓	☐	5	A	
b	Final JIS with approved change orders	☑	☐		✓	☐	20	A	
c	Updated Third Party Transfer Forms (both Excel and PDF version)	☐	☑		☐	✓	20	A	
d	Material Return Forms	☐	☑		☐	✓	30	A	
e	Permanent restoration unit estimate	☐	☑		☐	✓	20	A	

Table 1: Close-Out GCF organized into sections as per importance and risk to Toronto Hydro, along with total close-out GCF Score

Section	Area Affected	Importance of accurate information / Risk to Toronto Hydro	Subtotal		Score	N/A total	Net total [Subtotal - N/A]
Section A Regulatory	ESA Reg. 22/04 Compliance	Cannot energize system without Reg. 22/04 Certification	135		53	82	53
Section B Corporate Records	Management of Assets Operation of Assets	Need accurate records for life cycle asset management Need accurate records for safe operation of system	125		64	55	70
Section C Financial Records	Needed for Capital Closure	OEB Rates Risk Project Financial Close-out is required for inclusion of project capital cost in rate base	74		62	12	62
Section D Other Project Records	Project Records	Additional Items for project retention	101		29	72	29
Grand total			435		208	221	214

97%

TORONTO HYDRO

DEPARTMENT REQUISITION

DATE: 21/02/2023

WBS L2 #: **P-220271-WD161000**

TO:	Jen Grado, Director - Capital Projects West - RC 3620		
DRP (CA):	Francis Szto - Supv Design CPW Contract Administrator x23754		
Supv (FA):	Kenneth Abram - CPW Field Administrator x27833 c416-903-9289		
Attn.:	THESL O/H CPLP CREW	Issued to:	
Attn.:	THESL O/H POLE CREW	Issued to:	
Attn.:	THESL U/G CPCP CREW	Issued to:	
Attn.:	THESL U/G CABLE CREW	Issued to:	
Attn.:	THESL STATION CREW(FDR Decommissioning)	Issued to:	
Attn.:	THESL STATION CREW(SCADA)	Issued to:	
Attn.:	THESL METER CREW	Issued to:	
Attn.:	CIVIL CONTRACTOR	Issued to:	
Attn.:	ELECTRICAL CONTRACTOR	Issued to:	Entera
Attn.:	INSPECTOR CIVIL & ELECTRICAL	Issued to:	SNC-Lavalin-

UG PCBs BR-F2/BR-F3 /BR-F1/TA-F4 P.1

			Proposed Start Date:	End Date (Commissioning):
NOTICE OF PROJECT #:	22eN674162		March 1, 2023	August 31, 2023
PERMIT NUMBERS:	INCLUDED			

WORK DESCRIPTION:

PLEASE SEE THE FOLLOWING DRAWINGS FOR DETAILS OF PROPOSED WORK:

DWG#	2022-019891 - Title Sheet	DWG#	
DWG#	2022-019892 - Primary Schematic	DWG#	
DWG#	2022-019893 - Electrical U/G Installations	DWG#	
DWG#	2022-019894 - Electrical U/G Removals	DWG#	
DWG#		DWG#	
DWG#		DWG#	
DWG#		DWG#	
DWG#		DWG#	
DWG#		DWG#	
DWG#		DWG#	

DESIGNER: Matthew Huestis

SUPERVISOR: Nima Eslami

Lily Dai Digitally signed by Lily Dai
DN: cn=Lily Dai, email=ldai@torontohydro.com
Date: 2023.05.11 15:04:29 -04'00'

for Sandro Nasso, Director Enterprise Program Mgmt

THESL RESOURCE REQUIREMENTS IN WORK DAYS

CPLP CREW	0
CPCP CREW	0
CABLE CREW	0
STATIONS CREW	0
METERING CREW	0

NOTES:

PLEASE SEE ATTACHED GANTT CHART FOR SCHEDULED RESOURCES AND ACTIVE WORK ORDERS APPLIED TO THIS PROJECT.

PLEASE REFER TO THE ATTACHED MATERIAL PRINTOUT FROM THE APPROVED ESTIMATE.

TEN BUSINESS DAYS PRIOR TO THE PLANNED START DATE OF THE WORK ORDER, THERE IS VISIBILITY OF THE MATERIAL USING THE "PICKING SLIP."
TEN BUSINESS DAYS PRIOR TO THE PLANNED START DATE OF THE WORK ORDER, THERE IS VISIBILITY OF THE MATERIAL USING THE "PICKING SLIP."

	ISSUED # OF CONST. FOLDERS
O/H THESL SUPV & CPLP CREW	0
O/H THESL SUPV & POLE CREW	0
U/G THESL SUPV & CPCP CREW	0
U/G THESL CABLE CREW	0
THESL SUPV METERING	0
CIVIL CONSTRUCTION BY THESL	0
THESL STATIONS CREW(FDR Decomm.)	0
THESL STATIONS CREW(SCADA)	0
CIVIL CONTRACTOR CREW	0
ELEC. CONTRACTOR CREW	1
INSPECTOR	1
TOTAL CONST. FOLDERS ISSUED	2

DATE WORK COMPLETED: 2024-01-21

COMPLETED BY: Yusuf Ulusow

SUPERVISOR SIGNATURE: yusuf

Rev 73 Jan.04, 2023

ENTERA #: 26-E261

TORONTO HYDRO

CONSTRUCTION FOLDER AND FORM(S)

Project Name/Location	UG PCBs BR-F2/BR-F3 /BR-F1/TA-F4 P.1		CAPEX
Project #	P-220271-WD161000	W.O. #	OPEX
Work Request #			DB
Construction DRP	John Wood		CLAIMS
Work #	416-746-9914	Mobile #	416-908-3524
Design Supervisor	Nima Eslami		
Work #	416-446-6493 ext. 423	Mobile #	416-892-8972
Design Technician	Matthew Huestis		
Work #	416-575-6506	Mobile #	

Feeders Associated with Project:	Type of Work Location(s):	Project Management Date of Issue:
BR-F1, BR-F2, BR-F3	U/G Electrical	PROGRAM MGMT.
Notice of Project #:	Scheduled Completion Date	DATE ISSUED OF ______
22eN674162	August 31, 2023	

EMERGENCY PROCEDURES

EMERGENCY CONTACT INFORMATION

1. For any emergency, follow the emergency plan on the tailboard document (May-Day Procedure)

2. For serious safety or environmental accidents (individual spills) call the **THESL EHS Spill Hotline; Phone 416-235-9995.** Anytime 24/7

3. For accident reporting of critical injury, or other, the Ministry of Labour field office contact info is as follows;

Ministry of Labour Contact Centre - Toronto Area
Phone: 1-877-202-0008 or
416-325-3000 (after hours). Fax: 905-577-1316
Address of District Offices:

Ministry of Labour - West Toronto
Location: 1340 Central Parkway West, 4 th Floor
Mississauga, Ontario, L5C 4R3

REQUIRED BY

Ministry of Labour - Central Toronto
Location: 5001 Yonge Street, Suite 1600
North York, Ontario, M7A 0A3

Ministry of Labour - East Toronto
Location: 2275 Midland Ave., Unit #1
Scarborough, Ontario, M1P 3E7

When complete, please return:

PMC: ______________________

Location:

Form M965-1040 (05/17)

Project Name/Location

Project #

W.O. #

TORONTO HYDRO - JOB PLANNING PROCESS

Process	Responsibility (Signature)	Date	Product
1.	John Wood Construction DRP / Contractor	2023/02/22	
	Nima Eslami Design Supervisor/ Administrator	2023/02/22	
	M. Huestis Matthew Huestis Design Technician	2023/02/22	
2. Pre-Construction Meeting	Yusuf Ulusow **Field Supervisor/CCL** (Control Authority/Tech. if required)	2024-02-20	Issue Project W.O. and Planning Document to CCL, sketches and/or notes, if required
3. Initial Site Visit With Crew	**Certified Crew Leader / Foreman**		Review steps and conditions, tailboard planning & W.O. dwgs.

4. This is to certify that the construction as recorded in this drawing(s) is consistent with the approved plan, Standard Designs, or Work Instruction, and that approved equipment has been used. Deviations in the drawing(s) present "no undue hazard" as defined in the ESA Technical Guidelines for Ontario Regulation 22/04.
CCL- Please mark changes on the drawings: indicate changes, additions, deviations revisions & include specific notes to explain red circles

☑ **Partial Certificate** **Name:** Yusuf Ulusow **Position:** Field Auditor

☑ **Final Certificate** **Date:** 2024-02-20 **Signature:** yusuf

5. Project Sign-off	yusuf **Construction DRP / Contractor**	2024-02-20 **Date**	Review material variance Complete construction project package

6. Material Closure ______ CCL
Excess material returned to Warehouse for restocking. Recovered Items returned to reclaim area at TH Work Centre, Return forms sent with item.

Excess Material	Recovered Material
☐ Returned	☐ Returned
☐ None	☐ None

7. Project Review/Closure	yusuf **Design Supervisor/ Administrator**	2024-02-20 **Date**	Assess job cost vs plan, as built, drawing, project closure, variance analysis Hold project closure meeting

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT3.2:

Reference(s): 2B-AMPCO-29

Provide the list of distribution capital projects that are greater than $5 million and those that show a variance of either +20% or -15% (relating to distribution capital).

RESPONSE:

Of the planned distribution capital projects identified in 2B-AMPCO-29, there was one project was greater than $5 million with a variance of either +20% or -15%. Please see Table 1 below for a description of the project and summary of the variance.

1 **Table 1: Planned Distribution Capital Projects greater than $5 million with +20% / -15% Variance**

Project Description	Portfolio / Project Overview	Project Variance Summary	Design Estimate	Actual Costs	Variance	
Load Demand P-180695-ZZ129001 Phase 2-P18 Transfer A256DN from A5-6DN to A5-6W TOA256DN	To maintain the Dufferin A5-6DN bus loading within firm capacity and provide capacity for conversion of 4kV Dupont feeders, new cables & load transfer.	The original design estimate did not account for all required contractor costs. Additional civil and electrical work was also required due to unforeseen site conditions found during execution (increasing material and labour costs).	$3.5M	$5.2M	$1.6M	+65%

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.3:

Reference(s): 2A-Staff-109, Appendices A and C

To verify the depreciation rates in the RGCRP models for both the HONI and the ES for 2023 going forward

RESPONSE:

The Hydro One Contributions in the RGCRP models have a useful life of 25 years.[1] This is consistent with the useful life used in Toronto Hydro's last rebasing application which remains unchanged as a result of the Concentric Depreciation study.

Energy Storage uses a simple average useful life of 15 years based on the assets provided in Table 1 below. Toronto Hydro notes that the useful lives of the assets in the table remain unchanged as a result of the study.

Table 1: Useful Life for Energy Storage

Asset Class Description		Useful Life in 2-FB
Energy Storage System Battery	A	10
Energy Storage Inverter	B	20
Simple Average	**(A+B)/2**	**15**

[1] EB-2018-0165, Interrogatory Response 2A-Staff-54 part (a)

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT3.4:

Reference(s): **n/a**

To provide a summary table for those unit costs for 2025 or that were used for the estimates of the forecast period.

RESPONSE:

Please see Appendix A to this response for Toronto Hydro's unit cost estimates used in developing the 2025-2029 expenditure plan. These unit cost estimates are unadjusted costs, i.e., without any inflation and other allocations. Additional allocations are layered on a program basis and not at the asset class level.

The methodology used to develop these unit costs can vary from one program to another. For example, the Stations Renewal program utilizes cost estimates that are specific to the project along with historical project actuals and material cost increases to determine the forecasted expenditure plan as asset specific details may already be known for the forecast period. Whereas for other renewal programs where the project-specific details have yet to be determined, an estimate is used based on historical average values. For each program and corresponding asset class, additional details on the assumptions used to generate the unit cost estimate are provided as part of Appendix A.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT3.5:

Reference(s): **4-Staff-293**

Referring to 4-Staff-293, corrective maintenance for Delta-Wye work, to provide the portion or percentage of the total impacted services that have been addressed already.

RESPONSE:

As of 2023 year-end, Toronto Hydro has addressed approximately 77 percent of the total impacted services.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.6:

Reference(s): **2-Staff-263(b)**
Exhibit 4, Tab 1, Schedule 1

Re: 2-Staff-263B, for 2020-2029, to show actual and forecasted spend, and the calculation.

RESPONSE:

Table 1 below outlines Toronto Hydro's actual costs from 2020 to 2023 and the bridge cost for 2024 for cloud computing implementation. For 2025 to 2029 cloud computing costs please refer to Toronto Hydro's response to interrogatory response 2B-Staff-263(a).

Table 1: 2020-2024 Cloud Computing Implementation Costs ($ Million)

	Actual				Bridge
	2020	**2021**	**2022**	**2023**	**2024**
Cloud Implementation (OM&A)	1.0	3.5	3.4	3.4	-
Cloud Subscription Fees (OM&A)	1.9	2.5	3.2	3.6	4.1
Cloud Implementation Deferral Account (Note 1)				0.5	3.5

Note 1: The OEB set the effective date for the Cloud Implementation Deferral Account as of December 1, 2023,[1] and therefore, the costs recorded for 2023 only cover actual costs

[1] Ontario Energy Board, Accounting Order (003-2023) for the Establishment of a Deferral Account to Record Incremental Cloud Computing Arrangement Implementation Costs, November 2, 2023.

incurred between December 1, 2023 and December 31, 2023. The 2024 forecast is for the full calendar year.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.7:

Reference(s): 4-SEC-106

Ref 4-SEC-106, to provide the percentage of customers on E-billing for 2020 and 2021, and Table 2 as well.

RESPONSE:

Table 1: Percent of Customers on ebills

Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Percent of customers on ebills	40.7%	44.7%	48.3%	50.9%	53.5%	55.2%	56.7%	57.8%	59.2%	60.1%

Table 2: Estimated Annual Savings per Customer on ebills

Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Estimated annual savings per customer on ebills	$10.67	$11.09	$11.58	$11.17	$11.53	$11.86	$12.22	$12.58	$12.94	$13.30

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.8:

Reference(s): 2B-SEC-39

Referring to 2B-SEC-39, to the extent it is possible, to provide the three most recent reports and notes or decision logs; if deemed not relevant, to set out the rationale.

RESPONSE:

As noted in the interrogatory response 2B-AMPCO-29(c), executive oversight of the capital program occurs through the monthly Investment & Operations Planning ("IOP") management review, which centers around a monthly meeting with senior leaders responsible for the planning and execution of the capital and operations work program. The company's oversight of the execution of its capital plan is comprised of numerous organizational processes and detailed work activities that feed into the monthly IOP review.

The agendas for IOP meetings are similar month over month, starting with a review of any open actions, presentation materials related the program status, and any new business that may be added monthly as required. The presentation materials can vary from month to month based on identified needs and requirements. Materials typically contain summary level visual information which is presented and discussed at the meeting using a round table approach. Deliberations, reviews and decisions may continue beyond IOP and be completed through follow-up meetings, reviews and discussions.

The requested documents enable the oversight functions that take place at the IOP. Without the full context of the discussions and presentations that occur at the IOP meeting, these documents are not relevant to evaluate the execution of the 2020-2024 plan.

The relevant evidence to evaluate the execution 2020-2024 plan has been provided across 39 capital and operational programs comprised of 87 unique segments which are detailed in Exhibits 2B and 4. In addition, Toronto Hydro has led the following evidence to help parties understand the utility's planning and execution processes and key decisions and consideration with respect to managing the execution of the 2020-2024 plan:

- Exhibit 2B, Section D1: Asset Management Process, including the investment planning and portfolio reporting process (p 7-23), scope and project development (p. 24-25), program management and execution (p. 25-26) and performance measurement (p. 27-29).
- Exhibit 2B, Section E4: Capital Expenditure Summary, including variances in forecast expenditures from the 2020-2024 capital plan versus actual expenditures over the 2020-2024 rate period (p. 2-14).
- Exhibit 1B, Tab 3, Schedule 2: Historical Performance Results, including the 2020-2022 custom measure performance asset management measures (p. 31-34) and cost control measures (p. 35-35).
- Exhibit 1B, Tab 3, Schedule 3: Productivity and Benchmarking, including 2020-2024 execution constraints (p. 9-15).
- Exhibit 4, Tab 2, Schedule 9: Asset and Program Management Program, including the Program Management and Support segment (p. 26-32)
- Relevant interrogatory responses such as:

- 1B-AMPCO-10, which describes, and provides evidentiary references to, the utility’s Asset Management Process and Investment Planning & Portfolio Reporting (“IPPR”) processes;
- 2B-AMPCO-27, which describes project and portfolio governance in the context of the IPPR process;
- 2B-AMPCO-28, which describes capital project prioritization and the iterative governance process of the Execution Work Program (“EWP”);
- 2B-AMPCO-29, which describes the process for executive oversight of the capital program and provides illustrative materials such as a flowchart of the project planning process and a template for project variance analyses;
- 2B-SEC-34, which details the changes Toronto Hydro has made to move closer to meeting ISO55001 requirements with respect to its asset management and capital planning processes;
- 2B-SEC-41, which explains how the utility is implementing new inputs to enhance its risk-based project valuation and portfolio optimization processes;
- 2B-SEC-55, which describes how the utility determines the appropriate resourcing mix for its capital and maintenance programs;
- 2B-Staff-166, which showcases how the utility applies the IPPR process with respect to managing reliability outcomes;
- 4-Staff-294, which describes Toronto Hydro’s process for acceptance of assets constructed or repaired, including how Toronto Hydro addresses correction of non-conformances and the volume of non-conformances;
- 4-Staff-297, which describes Toronto Hydro’s processes for project closure and asset acceptance;
- 4-VECC-62, which describes oversight responsibilities with respect to projects assigned to external contractor crews;

- Relevant Technical Conference undertaking responses such as JT3.1 and JT4.12, which provide third-party reports and summarize internal audit findings and management action plans with respect to the effectiveness of distribution capital and maintenance planning and execution processes;
- Relevant testimony by Toronto Hydro's witnesses, such as:
  - Day 3, page 44, line 18 to page 45, line 19;
  - Day 3, page 28, lines 12-23;
  - Day 3, page 32, line 28 to page 33, line 8;
  - Day 3, page 70, lines 6-8.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.9:

Reference(s): 2B-SEC-64(e)

Reference: 2B-SEC-64E, to provide the total cost of the AMI program regardless of rate period, if it flows into the next rate period.

RESPONSE:

Please refer to undertaking response JT3.10.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.10:

Reference(s): 2B-SEC-64(e)

To provide updated program costs, 2024-2029, based upon the new metering costs.

RESPONSE:

Table 1 below provides the most current forecast of the costs for the life of the AMI 2.0 project, as compared to the original figures included in evidence. The original forecasts for capital costs reflect the Residential and Small C&I Meter Replacement costs captured in Exhibit 2B, Section E5.4; specifically, the subsets of 2020-2024 actual and bridge costs on page 16 in Table 5 and 2025-2029 forecast costs on page 17 in Table 6 associated with the AMI 2.0 project. The original forecasts for OM&A costs reflect costs included under the Metering Services segment of the Preventative and Predictive Overhead Line Maintenance program in Exhibit 4, Tab 2, Schedule 1.

Tables 2 and 3 below break down the total costs of the AMI 2.0 project in Table 1 between the 2020-2024 and 2025-2029 rate periods, respectively. The project is scheduled to be completed in 2028.

The most current forecast as of March 31, 2024 includes updated meter hardware costs as a result of the finalized competitive procurement process. Toronto Hydro has begun a competitive process to procure the field installation contractor(s) and the system integrator, however, this process has not yet been completed and updated costs for these significant components of the project are pending. As such, Toronto Hydro's forecasts for the Metering capital program and Preventative and Predictive Overhead Line Maintenance have not changed.

Table 1: Summary of full AMI 2.0 project costs encompassing all years of the project ($ Millions)

AMI 2.0 Program Costs	Forecast at time of pre-filed evidence	Current forecast, as at March 31, 2024
Capital costs	248.7	229.0
OM&A costs	3.3	3.3
Total Project costs	252.0	232.3

Table 2: Summary of AMI 2.0 project costs, 2020-2024 ($ Millions)

AMI 2.0 Program Costs	Forecast at time of pre-filed evidence	Current forecast, as at March 31, 2024
Capital costs	47.0	41.4
OM&A costs	1.3	1.3
Total Project costs	48.3	42.7

Table 3: Summary of AMI 2.0 project costs, 2025-2029 ($ Millions)

AMI 2.0 Program Costs	Forecast at time of pre-filed evidence	Current forecast, as at March 31, 2024
Capital costs	201.6	187.6
OM&A costs	2.0	2.0
Total Project costs	203.6	189.6

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.11:

Reference(s): 2B-SEC-52

Referring to 2B-SEC-52c, the Gartner IT Cost Benchmarking Study, to provide the information with respect to the custom peer group but not the ITKMD group.

RESPONSE (PREPARED BY TORONTO HYDRO):

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request by SEC. The scope of the undertaking is to provide a breakdown of the ITKMD peer group.

RESPONSE (PREPARED BY GARTNER):

Providing the breakdown for the 123 organizations in the IT Key Metrics Data – Utilities group would take a significant amount of time, as the composition of business operations within the organizations is not a data point captured. It would require Gartner to research each company individually to determine their mix of operations. This would not be practical given the time available, and moreover, it would not provide added value, as the primary point of comparison for the benchmark analysis is the Custom Peer Group.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.12:

Reference(s): 2B-SEC-52(f); Gartner Report

Referring to 2B-SEC-52f, to provide descriptions for each maturity level.

RESPONSE (FROM GARTNER):

"Scores" refers to the Maturity Levels for the IT Domains / Functional Activities that were in scope for the assessment. Gartner has a proprietary maturity model for each IT domain that uses a 5-point scale, with 1 being the lowest maturity level and 5 being the highest.

Gartner has shared the requested maturity definitions for maturity level 1 through 5 for each IT Domain / Functional Activity, see attachment titled "Gartner IT Maturity Definitions (Confidential)". The IT maturity level definitions are proprietary to Gartner. The definitions are custom classifications created by Gartner as elements of the proprietary methodology used by Gartner to assess and evaluate an organization's maturity level. Having this information enter the public domain or shared more broadly would put Gartner at a competitive disadvantage. As such, the maturity level definitions should be treated as confidential.

RESPONSE (FROM TORONTO HYDRO):

Toronto Hydro is filing the "Gartner IT Maturity Definitions (Confidential)" document in Appendix A to this undertaking response confidentially, as Gartner has advised that it contains proprietary information.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.13:

Reference(s): Exhibit 2B, Section E8.1

To provide cost estimate for cloud computing EDC option.

RESPONSE:

Toronto Hydro considered the costs of implementing a cloud-based enterprise data centre ("EDC") at a high level but did not engage in a more detailed analysis because this option would involve the greatest drawbacks out of all possible alternatives, for the reasons the utility noted in its options analysis in Exhibit 2B, Section E8.1, at pages 25-26, as well as the following:

- Cloud-based data centres do not meet Toronto Hydro's technical requirements for critical IT/OT systems, such as low-latency and controllable communication between field devices and systems hosted in the EDC. Therefore, implementing a cloud-based data centre would require the utility to retain a significant portion of on-premises infrastructure, negating any potential benefits.
- Given the critical nature of IT/OT systems that are reliant upon Toronto Hydro's EDC, a high degree of service reliability is required. A cloud-based data centre would increase Toronto Hydro's operational risks because the utility would become dependent on vendor(s) to manage the reliability of the data centre environment, as noted in interrogatory response 2B-Staff-263(c).
- Toronto Hydro's communications costs are currently nil between on-network enterprise data centres and work centres, thanks to the utility's in-house fibre optic network. A cloud-based data centre would not allow the use of the existing

fibre optic network and would require the reconfiguration of existing facilities and/or the construction of new fibre-optic connections to sites beyond the utility's existing footprint, introducing duplicate efforts and costs.

Because of the above factors, Toronto Hydro does not consider a cloud-based data centre to be a feasible option. The utility's primary criterion for the evaluation of EDC technology solutions is operational resilience.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.14:

Reference(s): **2B-Staff-273**

To provide regulatory compliance costs included in the 2020 to 2024 budget in the last application.

RESPONSE:

The table below indicates the planned budget for regulatory compliance initiatives under the IT Software segment of the Information Technology and Operational Technology Systems capital program for 2020 to 2024, from Toronto Hydro's rate application for the same period.[1]

	2020-2024 Planned Cost ($ Millions)
Regulatory Compliance	9.3

[1] EB-2018-0165, Exhibit 2B, Section E8.4, at page 22.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.15:

Reference(s): **1B-SEC-28**

Using forecast information, to respond to 1B-SEC-28.

RESPONSE:

As noted in its response to 1B-SEC-28 part (e), Toronto Hydro is unable to provide forecast unit costs. Toronto Hydro develops baseline unit costs for both benchmarking and programmatic cost estimating purposes based on relevant historical data.[1] However, Toronto Hydro does not create a forecast for how these unit costs will change in future years. Rather, planners develop cost forecasts using the appropriate baseline unit costs, after which inflation and allocation assumptions are applied to the overall program cost.[2]

[1] Note that program-specific unit costs are not necessarily the same as the unit costs provided to UMS, as the UMS unit cost study addresses asset classes more broadly.
[2] Note that the exact approach to cost estimating varies depending on the program. For details on the program specific unit cost estimates and their corresponding assumptions, please refer to Toronto Hydro's response to undertaking JT3.4.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO

UNDERTAKING NO. JT3.16:

Reference(s): **2B-AMPCO-23**

To provide the data in Table 1 and Table 2 on a dollar basis.

RESPONSE:

Please see Table 1 and Table 2 below which reflects the dollar amounts used to calculate the response to 2B-AMPCO-23 for 2020-2024.

Table 1: 2020-2024 Capital Costs ($ Million)

	Actual				Bridge
	2020	**2021**	**2022**	**2023**	**2024**
Internal Costs (Labour)	101.0	92.3	90.2	105.3	120.1
Internal Costs (Vehicle)	4.0	6.0	6.2	5.1	6.1
External Costs (including civil materials)	325.4	377.7	414.7	400.8	453.1
Other Costs	163.5	157.2	202.7	236.8	224.1
Total Costs	**593.9**	**633.3**	**713.7**	**747.9**	**803.4**

Table 2: 2020-2024 Maintenance Costs ($ Millions)

	Actual				Bridge
	2020	**2021**	**2022**	**2023**	**2024**
Internal Costs (Labour)	12.2	11.7	9.9	11.1	11.4
Internal Costs (Vehicle)	1.5	2.0	1.9	1.8	2.3
External Costs (Including civil materials)	23.6	27.1	26.5	29.4	30.1
Other Costs	2.6	2.8	2.3	2.7	2.9
Total Costs	**39.9**	**43.7**	**40.5**	**45.0**	**46.7**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO INTERROGATORIES

UNDERTAKING NO. JT3.17:

Reference(s): **2B-AMPCO-23**

To provide the two tables for capital programs and maintenance programs showing 2025-2029.

RESPONSE:

Please see Table 1 and Table 2 below which reflects the dollar amounts used to calculate the response to 2B-AMPCO-23 for 2025-2029.

Table 1: 2025-2029 Capital Costs ($ Million)

	Forecast				
	2025	**2026**	**2027**	**2028**	**2029**
Internal Costs (Labour)	164.1	170.2	175.5	167.4	162.2
Internal Costs (Vehicle)	6.8	7.2	7.5	7.9	8.1
External Costs (including civil materials)	508.2	510.4	535.3	553.9	537.8
Other Costs	213.2	219.6	236.8	241.7	251.6
Total Costs	**892.2**	**907.4**	**955.2**	**970.9**	**959.7**

Table 2: 2025-2029 Maintenance Costs ($ Millions)

	Forecast				
	2025	**2026**	**2027**	**2028**	**2029**
Internal Costs (Labour)	13.6	14.4	15.2	16.2	17.2
Internal Costs (Vehicle)	2.6	2.6	2.7	2.8	2.9
External Costs (Including civil materials)	33.8	34.1	33.6	34.6	35.2
Other Costs	3.2	3.3	3.4	3.5	3.6
Total Costs	**53.2**	**54.4**	**54.8**	**57.1**	**58.9**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO

UNDERTAKING NO. JT3.18:

Reference(s): 2B-AMPCO-29

For each of the years 2020 to 2024, to provide copies of the project variance reports for projects greater than $1 million, where the cost variance is 30 percent or greater, including if there were multiple reports for a project, so a multiyear project that has individual project variance reports; to advise which of the project variance reports provided required approval from senior management and executive team, due to the change in cost.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not accurately capture the scope of the request. The scope of the undertaking was to provide the requested information for the years 2020-2023.

As shown in the tables below, Toronto Hydro executes hundreds of planned distribution capital projects each year as part of its execution work plan (EWP). Project variances are commonly attributable to the following types of execution challenges and complexities associated with doing work in Toronto Hydro's dense urban service territory:

- Additional work zone coordination requirements from the City of Toronto, including additional traffic control, coordination for CafeTO, work after hours and on weekends
- Unforeseen site conditions, including infrastructure conflicts with other entities, water in cable chambers, shale requiring increased depth due to soil conditions,

clearing duct bank blockages, new duct banks required for alternative routes, duct rebuilds, duct rerouting, contaminated soil, asbestos removal

- Additional scope transferred from other project (projects combined or consolidated, customer delays and changes in requirements)
- Change in standards since original design
- Additional costs required when working with legacy assets or systems such as box construction and paper-insulated lead-covered ("PILC") due to complexity and safety considerations
- Additional costs due to COVID-related work restrictions including extra vehicle and labour hour costs due to social distancing requirements (see Exhibit 1B, Tab 3, Schedule 3 at pages 9-11 for more details).
- Additional costs due to inflationary pressures, including rising costs of materials as described in Exhibit 1B, Tab 3, Schedule 3 at pages 11-13 and as shown in Exhibit 2B, Section D2 at page 14.

Tables 1 and 2 below summarize the completed projects from 2020 to 2023 with a value greater than $1 million and where the cost variance between the initial design estimate and the final project cost was +30% or greater. For additional context, Table 3 provides the total value of the cost variances relative to the total value of the work program for each year from 2020 to 2023. The project costs shown in the tables below are for the full life of the individual projects completed each year and the costs span multiple years for both design and construction. Additionally, Tables 4 and 5 below summarize completed projects from 2020 to 2023 with a value greater than $1 million and where the final project cost variance was underspent by 30% or greater. /C

Together, the tables below demonstrate Toronto Hydro successfully managed and executed its 2020-2023 distribution capital execution work program within very reasonable margins of variance.

Table 1: Distribution Capital Projects Greater than $1 million with +30% Variance

Year	# of Projects Completed	# Projects > $1 million and variance of +30%	% Projects > $1 million and variance of +30%
2020	274	7	2.6%
2021	286	9	3.1%
2022	286	7	2.4%
2023	314	4	1.3%
2020-2023	**1160**	**27**	**2.3%**

Table 2: Distribution Capital Projects Greater than $1 million with +30% Variance ($ Millions)

Year	$ Value of Projects Completed (Estimate)	Total $ Variances for Projects Greater than $1 million with +30% Variance	$ Variance for Projects Greater than $1 million with +30% as a % of Total Value of Projects Completed
2020	$195.5	$8.3	4.2%
2021	$206.6	$8.4	4.1%
2022	$238.2	$9.2	3.9%
2023	$193.0	$4.1	2.1%
2020-2023	**$833.2**	**$29.9**	**3.6%**

1 **Table 3: Distribution Capital Execution Work Program Annual Variances ($ Millions)**

Year	$ Value of Projects Completed (Estimate)	$ Value of Total Projects Actuals	Variance	% Variance
2020	$195.5	$212.1	$16.6	8.5%
2021	$206.6	$208.8	$2.3	1.1%
2022	$238.2	$234.2	-$4.0	-1.7%
2023	$193.0	$200.3	$7.3	3.8%
2020-2023	**$833.2**	**$855.3**	**$22.1**	**2.7%**

2

3 **Table 4: Distribution Capital Projects Greater than $1 million with -30% Variance**

Year	# of Projects Completed	# Projects > $1 million and variance of -30%	% Projects > $1 million and variance of -30%
2020	274	6	2.2%
2021	286	7	2.1%
2022	286	4	2.1%
2023	314	5	1.9%
2020-2023	**1160**	22	0.5%

4

5 **Table 5: Distribution Capital Projects Greater than $1 million with -30% Variance ($**
6 **Millions)** /C

Year	$ Value of Projects Completed (Estimate)	Total $ Variances for Projects Greater than $1 million with -30% Variance	$ Variance for Projects Greater than $1 million with -30% as a % of Total Value of Projects Completed
2020	$195.5	-$5.3	-2.7%
2021	$206.6	-9.5	-2.6%
2022	$238.2	-$4.4	-2.2%
2023	$193.0	-$2.8	-2.8%
2020-2023	**$833.2**	-$22.0	-0.6%

Toronto Hydro has provided all 27 project variance analysis ("PVA") reports that are responsive to the requested information in consolidated format in Appendix A to this undertaking response. /C

In reviewing the information above it is important to note that in the last rate application (EB-2018-0165) Toronto Hydro put forward a five-year capital plan for 2020-2024 that was based on a programmatic approach, and did not include project level details except for major capital projects like Copeland Phase 2. It is also key to note that the funding approved by the OEB to enable the execution of the five-year capital plan reflects an approved capital envelope, within which Toronto Hydro has the flexibility to implement its plan and to respond to changes as needed.[1] As such, the project-level variances summarized in the tables should not be interpreted as variances between OEB-approved and actual capital expenditures; that information is summarized in Exhibit 2B, Section E4 and detailed in the programmatic evidence in Exhibit 2B, Section E5, E6, and E7. From a /C work execution perspective, the information above demonstrates that over the last four years (2020-2023), Toronto Hydro successfully managed the execution work challenges and considerations (discussed in Exhibit 1B, Tab 3, Schedule 3 at pages 2-15 and summarized above) and delivered over 1,100 projects within very reasonable margins of variance.

Toronto Hydro confirms that projects with a value greater than $100,000 with variances of +/- plus or minus 20% and > $100K, including the 49 projects listed above (27 – (+30%) variance and 22 – (-30%) variance), received senior management and executive approval of the cost variance throughout execution, in accordance with the utility's change management and governance process detailed in Exhibit 2B, Section D1 at page 26, lines /C

[1] EB-2018-0165, Decision and Order (December 19, 2019) at page 59.

3-9. This process is designed to identify, as projects are being designed and constructed, changes impacting project/program schedule, cost, and scope. /C

TORONTO HYDRO

Summary Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Dat	WBS Responsible Cost	Designer Project DRP	Construction DRP
P-150129-XD129001	P0105264-X15308 Esplanade To Copeland Ph	09/10/2020	703620	FRANCIS SZTO	G HANLEY

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External		$1,924,060	$1,443,951	75.05%	$480,109
Labour		$21,388	$178,327	833.77%	-$156,939
Material		$1,655,651	$3,794,329	229.17%	-$2,138,678
Vehicle			$5,975	#DIV/0!	-$5,975
Sum:		**$3,601,099**	**$5,422,582**	**150.58%**	**-$1,821,483**

Gap Analysis Required on: Total: Material & Labour

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: March 03,2021

Project Execution Supervisor Signoff:

Francis Szto

Name:

Date: **March 03,2021**

TORONTO HYDRO

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project
P-150129-XD129001	P0105264-X15308 Esplanade To Copeland Ph	09/10/2020	3620	FRANCIS SZTO

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External		$1,924,060	$1,443,951	75.05%	$480,109
Labour		$21,388	$178,327	833.77%	-$156,939
Material		$1,655,651	$3,794,329	229.17%	-$2,138,678
Vehicle		$0	$5,975	#DIV/0!	-$5,975
Total:		**$3,601,099**	**$5,422,582**	**150.58%**	**-$1,821,483**

Total Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☐	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☒	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☒	Overtime (No provision for overtime work)
	☐	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☒	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)

Root Cause Details
(Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)

There is a Mapping issue in the financial numbers provided in this file. The project commenced construction in 2017 with packaging in Ellipse. With the transfer of actuals from Ellipse to SAP during migration, the labour cost has been captured as material.

Below is correct breakdown :

Planned Material Cost: $1,655,651
Actual Material Cost: $1,858,443

There was additional material required during construction such as cable clamps, insulating cradle, Cable heat shrinks which was not estimated in original design

Planned External Labour Costs : $1,924,060
Actual External Labour Costs: $2,829,276

The majority of the additional external labour cost overrun is coming from the following
1. Due to Site conditions and priority to get the project ready for Copeland Station load transfer, pumping of Cable chambers along Queens Quay because of excessive water in Cable chambers being next to Lake Ontario was required and had to be transported away with tankers ($300K)
2. Cable installation and removal at along Esplanade on nights because of high traffic during days. This was on request of City work zone coordinators ($279K)
3. Load transfer of pilot wire feeders on weekends for Royal Bank Plaza to limit customer outage on regular work hours ($40K)
4. Feeder Switching costs which were not incorporated in the original estimate ($110K)
5. COVID Premiums which were implemented in 2020 (10% of labour costs) and were not included in original estimate ($62K)
6. Addition Design Fee and Inspection fee due increase in labour and material Costs ($50K)
7. Additional Pay Duty officer to meet MCR Requirements ($40K)

Planned Internal Labour Costs: $21,388
Actual Internal Labour costs : $178,327
The increase of these costs came from transfer of stations cost of $109K for the support work for this project. The remaining $68K increase was in the internal project management charges which were under estimated in the original estimate.

Options / Solutions	♦	Incorporate Overtime and Switching Requirements in design stage	
Recommendation	♦	Monitor Take-off sheets to include switching and OT units as required	
Implementation Plan	♦	Discuss with Contractor designers to involve construction groups in creating estimates ,account for any planned OT to obtain accurate estimates	
	♦	**Planned Date of Implementation**	March 31-2021
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

TORONTO HYDRO

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project
P-150129-XD129001	P0105264-X15308 Esplanade To Copeland Ph	09/10/2020	3620	FRANCIS SZTO

Labour variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☒	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☒	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☒	Overtime (No provision for overtime work)
	☐	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		There is a Mapping issue in the financial numbers provided in this file. The project commenced construction in 2017 with packaging in Ellipse. With the transfer of actuals from Ellipse to SAP during migration, the labour cost has been captured as material. Planned External Labour Costs : $1,924,060 Actual External Labour Costs: $2,829,276 **The majority of the additional external labour cost overrun is coming from the following** **1. Due to Site conditions and priority to get the project ready for Copeland Station load transfer, pumping of Cable chambers along Queens Quay because of excessive water in Cable chambers being next to Lake Ontario was required and had to be transported away with tankers ($330K)** **2. Cable installation and removal at along Esplanade on nights because of high traffic during days. This was on request of City work zone coordinators ($279K)** **3. Load transfer of pilot wire feeders on weekends for Royal Bank Plaza to limit customer outage on regular work hours ($40K)** **4. Feeder Switching costs which were not incorporated in the original estimate ($110K)** **5. COVID Premiums which were implemented in 2020 (10% of labour costs) and were not included in original estimate ($62K)** **6. Addition Design Fee and Inspection fee due increase in labour and material Costs ($50K)** **7. Additional Pay Duty officer to meet MCR Requirements ($40K)**

Options / Solutions	♦	Incorporate Overtime and Switching Requirements in design stage	
Recommendation	♦	Monitor Take-off sheets to include switching and OT units as required	
Implementation Plan	♦	Discuss with Contractor designers to involve construction groups in creating estimates ,account for any planned OT to obtain accurate estimates	
	♦	**Planned Date of Implementation**	March 31-2021
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

TORONTO HYDRO

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project
P-150129-XD129001	P0105264-X15308 Esplanade To Copeland Ph	09/10/2020	3620	FRANCIS SZTO

Material Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☐	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☐	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
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	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☐	Overtime (No provision for overtime work)
	☐	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☒	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		There is a Mapping issue in the financial numbers provided in this file. The project commenced construction in 2017 with packaging in Ellipse. With the transfer of actuals from Ellipse to SAP during migration, the labour cost has been captured as material. Planned Material Cost: $1,655,651 Actual Material Cost: $1,858,443 **There was additional material required during construction such as cable clamps, insulating cradle, Cable heat shrinks which was not estimated in original design**

Options / Solutions	♦	Verify Material requirements during design stage to account for any additional material not included in standards based on site and equipment condition	
Recommendation	♦	Contractors should involve construction crews to obtain field feedback and requirements for material	
Implementation Plan	♦	Discuss with Contractor designers to involve construction groups in creating estimates obtain accurate material requirements	
	♦	**Planned Date of Implementation**	March 31-2021
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

Project Report Card

PDG-TMP-034 R1

TORONTO HYDRO

Scope #:	**W10118**				
Project Name	**Mosque Shalom DB UG Rebuild**	**Month Attained:**	**June 2020**	**Project - RC:**	**PSO W**
Ellipse Project #:	**P0129239**	**Project DRP:**	S. Remtulla **A. Shaikh**	**Construction DRP:**	**G. Hanley**
SAP Project #:	**P-170183-WD102001**		**Valard** (Designer)		

Project Total Estimate $ **2,639,063.00** **Project Total Actuals** $ **4,436,070.00** **168.09%**

% Actual of Estimate

	Estimate	Actuals	$ Variance	% Variance
Labour	$ 8,255.89	$ 72,642.00	$ 64,386.11	**879.88%**
Material	$ 192,126.29	$ 1,838,718.00	$ 1,646,591.71	**957.04%**
Vehicle	$ 198.83	$ 763.00	$ 564.17	**383.74%**
Other	$ 2,438,481.99	$ 2,523,947.00	$ 85,465.01	**103.50%**
Total	$ 2,639,063.00	$ 4,436,070.00	$ 1,797,007.00	**168.09%**

Total Project Variance
over (+) under (-)
68.09%

Note:

Labour Variance Report Printed → Not Applicable Variance %

Material Variance Report Printed → Not Applicable Variance %

Variance % is per the EMRT Report

Yes No N/A

Gap Analysis Required on: **Total $$**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date:

Total $ Variance > $100k? [X] **Yes** [ ] **No**

Change Request Approved and explains labour and cost variances? [ ] **Yes** [ ] **No**

If yes, Change Request #:

Root Cause Analysis Req'd [X] **Yes** [ ] **No**

Root Cause Analysis Complete: 19/10/2020 Adeem

Date Sign off

Analysis Complete:

(where applicable)

Date Sign off

Project Execution Supervisor Signoff:

Adeem Shaikh

Name:

Date: **19/10/2020**

Project Variance Analysis

Project Name:	W10118 Mosque Shalom DB UG Rebuild	Project #:	SAP P-170183-WD102001	Ellipse P0129239
Project RC:	PSO W	Project DRP:	A. Shaikh	

Gap Analysis ☒ **Total $$** ☐ **Labour Variance** ☐ **Material Variance**

Root Cause Analysis ☐

Cost Analysis

Total Project $$: ☒

	Estimate	Actuals	Variance
Labour	$ 8,255.89	$ 72,642.00	879.88%
Material	$ 192,126.29	$ 1,838,718.00	957.04%
Vehicle	$ 198.83	$ 763.00	383.74%
Other	$ 2,438,481.99	$ 2,523,947.00	103.50%
Totals	**$ 2,639,063.00**	**$ 4,436,070.00**	**168.09%**

Category of Variance *Note: More than one category may be selected.*	☑	**Change in Scope of Work/Accounting for Contingency** (Change in scope of work; e.g., scope change $ (re-phased); contingencies not accounted for)
	☐	**Site Related & Coordination Issues** (Issues related to the site; includes situations not foreseen prior to construction, as well as, situations that could have been avoided with thorough inspection and other actions; also includes projects that experienced variance due to coordination issues with customers or other THESL project)
	☐	**Incorrect or Missed Charges** (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accrued)
	☐	**Missed Estimate/Estimate Issues** (Missed estimates or other estimate related issues; e.g., refinement of design, discretionary estimate items, detailed design errors (missing/additional units), etc.)
	☐	**External and Regulatory Factors** (City's restrictions, policy changes from other utilities, etc. that could not be feasibly be anticipated at the design stage)
	☐	**Change from Internal to External** (Change from internal to external due to resource or scheduling constraints)
	☐	**Overtime** (No provision for overtime work)
	☐	**Rate Changes** (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	**Assembly Unit (AU)/Compatible Unit (CU) Errors** (Errors in the breakdown or composition of AUs/CUs)
	☐	**Incorrect/additional material ordered** (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details *(Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and represents $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)*		**This project was taken over by me (Adeem) from Safik when Safik retired in June 2020. However, I was involved in this project from the beginning from administrative point of view.** **Due to control room not approving our schematic based on the actual wording of the scope document, we had to expand the scope to convert Shalom Cres and rise up on Martin Grove Rd via Milkwood Ave in order to complete the 27.6kV loop and eliminate 4kV. This ended up being an entire project on its own, which is why the cost became double of what was estimated. I have attached an excel document which outlines the detailed estimate and the actual final estimate for both parts (completed under the same WBS so that we could have one set of drawings/schematic showing the entire area as per control room demand). Please see the "W10118 Variance Analysis" tab for a detailed cost breakdown for this project.**

Options / Solutions ◆

Recommendation ◆

Implementation Plan ◆

- *Planned Date of Implementation* ______
- *Actual Date of Implementation* ______

Analysis Completed ______ **Analysis By:** Adeem Shaikh on behalf of Safik Remtulla

All Implementations Completed ______

TORONTO HYDRO

Summary Report

Last Refreshed	23/04/24 | 2:11:18 PM GMT-04:00
Refreshed By	msubrama
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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180174-XD193001	X18447 **EMERGENCY** 263 Yonge St LOC 48	#	#	30/10/2020	703623	BIAGIO CERAMI	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$710,839	$1,266,054	$1,001,015	140.82%	-$290,176
Labour	$39,508	$43,380	$66,948	169.45%	-$27,440
Material	$285,675	$377,235	$398,791	139.60%	-$113,116
Vehicle	$653	$653	$563	86.16%	$90
Sum:	**$1,036,675**	**$1,687,322**	**$1,467,317**	**141.54%**	**-$430,642**

Gap Analysis Required on: **Material & Labour**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: **April 26 2024**

Project Execution Supervisor Signoff:

Mike Wu

Name:

Date: **April 26, 2024**

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Constructio
P-180174-XD193001	X18447 **EMERGENCY** 263 Yonge St LOC 48	#	#	30/10/2020	703623	BIAGIO CERAMI	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
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Vehicle	$653	$653	$563	86.16%	$90
Total:	**$1,036,675**	**$1,687,322**	**$1,467,317**	**141.54%**	**-$430,642**

Total Variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	X	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
		Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	X	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	X	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
		Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	X	Overtime (No provision for overtime work)
	X	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
		Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
		Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)

Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)	$113k additional material cost mainly due to: - Planning's direction to upsize original 2x 500kVA transformers to 2x 750kVA transformers. - Additional network secondary copper quad cables connecting to adjacent chambers previously missed from design. - Rate escalation from DSAP time of 2018 to actual construction year of 2020. $290k additional contractor cost mainly due to: - COVID premium cost from 2020 to cover additional contractor expenses as essential service. - Night time premium to work on Yonge Street in front of the Mirvish Theatre entrance, per City WZC requests. - Additional work in vault and adjacent chambers to re-connect and re-rack network secondary cables. - Rate escalation from DSAP time of 2018 to actual construction year of 2020. $27k additional internal labour cost mainly due to: - Additional time to review scope change for transformer size upgrade, and additional project DRP time

Options / Solutions	♦		Create new DSAP estimate with scope change (upsize TX) and condition change (COVID)
Recommendation	♦		Maintain close 3-way communication with Planning and PMO to update project estimate budget.
Implementation Plan	♦		Conduct regular current estimate vs. DSAP estimate checks to flag changes
	♦	**Planned Date of Implementation**	
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Constructio
P-180174-XD193001	X18447 **EMERGENCY** 263 Yonge St LOC 48	#	#	30/10/2020	703623	BIAGIO CERAMI	#

Labour variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	X	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
		Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	X	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	X	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
		Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	X	Overtime (No provision for overtime work)
	X	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
		Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
		Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		$113k additional contractor cost mainly due to: - COVID premium cost from 2020 to cover additional contractor expenses as essential service. - Night time premium to work on Yonge Street in front of the Mirvish Theatre entrance, per City WZC requests. - Additional work in vault and adjacent chambers to re-connect and re-rack network secondary cables. - Rate escalation from DSAP time of 2018 to actual construction year of 2020.
Options / Solutions	♦	Create new DSAP estimate with scope change (upsize TX) and condition change (COVID)
Recommendation	♦	Maintain close 3-way communication with Planning and PMO to update project estimate budget.
Implementation Plan	♦	Conduct regular current estimate vs. DSAP estimate checks to flag changes
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed		
All Implementations Completed		

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Constructio
P-180174-XD193001	X18447 **EMERGENCY** 263 Yonge St LOC 48	#	#	30/10/2020	703623	BIAGIO CERAMI	#

Material Variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)	
	X	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)	
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		Overtime (No provision for overtime work)	
	X	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)	
		Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)	
		Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)	
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		$113k additional material cost mainly due to: - Planning's direction to upsize original 2x 500kVA transformers to 2x 750kVA transformers. - Additional network secondary copper quad cables connecting to adjacent chambers previously missed from design. - Rate escalation from DSAP time of 2018 to actual construction year of 2020.	
Options / Solutions	♦		Create new DSAP estimate with scope change (upsize TX) and condition change (COVID)
Recommendation	♦		Maintain close 3-way communication with Planning and PMO to update project estimate budget.
Implementation Plan	♦		Conduct regular current estimate vs. DSAP estimate checks to flag changes
	♦	**Planned Date of Implementation**	
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

TORONTO HYDRO

Summary Report

Last Refreshed	30/04/2024 | 16:21:22 GMT-04:00
Refreshed By	APLUMPTR
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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180593-WD151001	P0139647-W14144 OH Rehab - Rockford/Ceda	#	#	28/08/2020	703620	AKIFF MAREDIA	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$889,313	$1,722,801	$1,572,834	176.86%	-$683,520
Labour	$0	$6	$71,382	44,614,000.00%	-$71,382
Material	$470,212	$583,400	$674,672	143.48%	-$204,459
Vehicle			$285		-$285
Sum:	**$1,359,526**	**$2,306,207**	**$2,319,172**	**170.59%**	**-$959,646**

Gap Analysis Required on: Total

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: 01/05/2024

Project Execution Supervisor Signoff:

Adeem Shaikh

Name:

Date: **01/05/2024**

TORONTO HYDRO

Gap Root Rep

Last Refreshed	30/04/2024 | 16:21:22 GMT-04:00
Refreshed By	APLUMPTR
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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180593-WD151001	P0139647-W14144 OH Rehab - Rockford/Ceda	#	#	28/08/2020	703620	AKIFF MAREDIA	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$889,313	$1,722,801	$1,572,834	176.86%	-$683,520
Labour	$0	$6	$71,382	44,614,000.00%	-$71,382
Material	$470,212	$583,400	$674,672	143.48%	-$204,459
Vehicle			$285		-$285
Total:	**$1,359,526**	**$2,306,207**	**$2,319,172**	**170.59%**	**-$959,646**

Total Variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	X	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
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	X	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
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		Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
		Overtime (No provision for overtime work)
		Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
		Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
		Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		Several factors led to substantial increase in costs for this project. See breakdown below for labour and material cost overruns: Labour: Majority of the labour cost overrun was due to COVID-19 Labour premiums applied to all units, which was not accounted for in the planning estimate ($650K). Additional cost overruns are attributed to change in scope with addition for new primary conductor on Rockford Rd; string units and primary farming units, change to secondary bus from lashed to multiplex, tree-trimming, replacement of old poles in side street, Missing civil units and the additional civil portion at vault JMN ($200K) Material: Majority of the material cost overrun was due to additional poles, wires, cables/conductors that were required due to expansion of scope of work as outlined in the Labour cost overrun section above ($100K)
Options / Solutions	♦	Cost overrun accommodated with discussions from planning by offsetting lower priority scopes
Recommendation	♦	contractor must perform a thorough site visit to confirm scope of work before finalizing detailed estimate
Implementation Plan	♦	Change orders were submitted for all additional work due to scope change, and all COVID premiums paid.
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed		
All Implementations Completed		

Summary Report

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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180605-WS170001	WPKG P0138927-S19246 Chapman MS Switchgear	#	#	15/07/2020	703310	ERIC ZHANG	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$317,359	$982,830	$1,027,952	323.91%	-$710,593
Labour	$219,254	$210,649	$59,938	27.34%	$159,316
Material	$624,393	$760,357	$805,525	129.01%	-$181,131
Vehicle	$9,083	$15,034	$603	6.64%	$8,480
Sum:	**$1,170,089**	**$1,968,870**	**$1,894,018**	**161.87%**	**-$723,929**

Gap Analysis Required on: **Total: Labour & Material**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: **April 26 2024**

Project Execution Supervisor Signoff:

Andrew Sandrasagra

Name:

Date: **26 April, 2024**

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180605-WS170001	WPKG P0138927-S19246 Chapman MS Switchgear	#	#	15/07/2020	703310	ERIC ZHANG	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$317,359	$982,830	$1,027,952	323.91%	-$710,593
Labour	$219,254	$210,649	$59,938	27.34%	$159,316
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Total:	**$1,170,089**	**$1,968,870**	**$1,894,018**	**161.87%**	**-$723,929**

Total Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☒	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☒	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☐	Overtime (No provision for overtime work)
	☒	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		This is a legacy that was constructed during peak COVID pandemic period which resulted in unforeseen overruns in the form of switchgear assembly, materials, labour rates & scheduling. - $700K extra in missed estimate for Switchgear Assembly. - $159K in reduced internal labour because it was directed to external due to the pandemic. - $8.5K reduction in Vehicle costs due to labour being directed externally - $181K additional charges for extra switchgear materials due to the purchase of additional tools & parts that were missed in the detailed estimate.

Options / Solutions	♦		For complex downtown projects have additional buffer due to unpredictable nature of the site.
Recommendation	♦		Not applicable, pandemic is not possible to foresee.
Implementation Plan	♦		Going forward stations managers will ensure an additional buffer for large scale projects.
	♦	**Planned Date of Implementation**	
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180605-WS170001	WPKG P0138927-S19246 Chapman MS Switchgear	#	#	15/07/2020	703310	ERIC ZHANG	#

Labour variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☐	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☐	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☒ X	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☐	Overtime (No provision for overtime work)
	☐	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		This is a legacy that was constructed during peak COVID pandemic period which resulted in unforeseen overruns in the form of switchgear assembly, materials, labour rates & scheduling. - $700K extra in missed estimate for Switchgear Assembly. - $159K in reduced internal labour because it was directed to external due to the pandemic. - $8.5K reduction in Vehicle costs due to labour being directed externally

Options / Solutions	♦		For complex downtown projects have additional buffer due to unpredictable nature of the site.
Recommendation	♦		Not applicable, pandemic is not possible to foresee.
Implementation Plan	♦		Going forward stations managers will ensure an additional buffer for large scale projects.
	♦	**Planned Date of Implementation**	
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

Gap Root Report

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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180605-WS170001	WPKG P0138927-S19246 Chapman MS Switchgear	#	#	15/07/2020	703310	ERIC ZHANG	#

Material Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)	
	☐	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)	
	☒	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)	
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	☐	Overtime (No provision for overtime work)	
	☐	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)	
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)	
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)	
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		This is a legacy that was constructed during peak COVID pandemic period which resulted in unforeseen overruns in the form of switchgear assembly, materials, labour rates & scheduling. - $181K additional charges for extra switchgear materials due to the purchase of additional tools & parts that were missed in the detailed estimate.	
Options / Solutions	♦		For complex downtown projects have additional buffer due to unpredictable nature of the site.
Recommendation	♦		Not applicable, pandemic is not possible to foresee.
Implementation Plan	♦		Going forward stations managers will ensure an additional buffer for large scale projects.
	♦	**Planned Date of Implementation**	
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

Summary Report

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180712-XD154003	X18365-Danforth 4kV Conv B4DA B1DA Part B	#	#	31/08/2020	703110	DUNCAN LEUNG	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$855,935	$1,686,884	$1,587,719	185.50%	-$731,784
Labour	$390,330	$229,292	$339,445	86.96%	$50,885
Material	$294,408	$269,245	$340,447	115.64%	-$46,039
Vehicle	$38,057	$19,181	$41,224	108.32%	-$3,167
Sum:	**$1,578,731**	**$2,204,601**	**$2,308,835**	**146.25%**	**-$730,105**

Gap Analysis Required on: **Total: Labour & Material**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: **April 28 2024**

Project Execution Supervisor Signoff:

Darar Abdissa

Name:

Date: **28 April, 2024**

TORONTO HYDRO

Gap Root Report

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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180712-XD154003	X18365-Danforth 4kV Conv B4DA B1DA Part B	#	#	31/08/2020	703110	DUNCAN LEUNG	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
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Vehicle	$38,057	$19,181	$41,224	108.32%	-$3,167
Total:	**$1,578,731**	**$2,204,601**	**$2,308,835**	**146.25%**	**-$730,105**

Total Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☒	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
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	☐	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)

Root Cause Details
(Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)

A total external variance of **$731,784** was due to additional external resource requirements during the construction of this project. Due to this project being located in the middle of the road on Danforth Ave, the work was completed after hours thus incurred an additional **$32,118** for shift premium and **$35,043.49** for paid duty. There as an additional **$90,345** accrued for road cut restoration due to the additional work that was required such as the following:

$50,036 for additional break & ties as well as handling asbestos ducts.
$261,167 for breaking out and rebuilding cable chambers (CC) and CC necks during construction.
$162,407 for additional test pits, duct relocations, extra depth requirements, pump and wash, core drilling, providing out ducts by man drilling, etc.
$149,319 for additional removal of abandoned gas mains and concrete structures below grade.
$63,670 for cable installation that was originally issued to internal crews.
$37,319 for additional auditor cost associated with the additional contractor cost.
$5,475 for Covid-19 premium

Options / Solutions	♦		Determine the resource requirements such as external contractors prior to finalizing the detailed estimate in SAP. Preform test pits and inspections during the design stage to ensure that all of the required additional work can be added to the scope of work via the change request process. This would reduce the requirement to rebuild chambers during construction, and the additional road cut restoration required. Also, since the location of the project is known to be a high traffic area, estimate for shift premium, paid duty and OTS in the detailed estimate.
Recommendation	♦		Review the drawing, detailed estimate and external labour resources with design / construction manager and contractor before DSAP. Verify construction responsibilities prior to issuing the project to capture any contractor resources prior to DSAP. Preform test pits and inspections to better understand the construction feasibility prior to construction.
Implementation Plan	♦		Account for external labour resources during the material finalization meeting, and JIS review with contractors for all future projects.
	♦	**Planned Date of Implementation**	
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180712-XD154003	X18365-Danforth 4kV Conv B4DA B1DA Part B	#	#	31/08/2020	703110	DUNCAN LEUNG	#

Labour variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)	
	☐	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)	
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	☐	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)	
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)	
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Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		A labour variance of **($50,885)** was due to the combination of changing resources from internal crews to contractors for cable installation and overtime requirement to complete the work. This project required full lane closures on Danforth Ave for our crews to splice the cable at the cable chambers thus was scheduled afterhours and incurred overtime charges. A vehicle variance of **$3,167** was due to COVID-19 vehicle sharing restrictions. Each crew member had to take their own vehicle to site.	
Options / Solutions	♦		Determine the labour resources requirements prior to finalizing the detailed estimate in SAP. If the resource is to be reallocated from internal crews to contractors, a re-DSAP should be captured and a change request submitted as required.
Recommendation	♦		Complete the estimate, with a non-wrench time and have a Material Finalization meeting with the design and construction manager to review all labour requirements prior to design attainment. Re-DSAP as required.
Implementation Plan	♦		Account for internal labour resources during the material finalization meeting for all future projects.
	♦	**Planned Date of Implementation**	
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180712-XD154003	X18365-Danforth 4kV Conv B4DA B1DA Part B	#	#	31/08/2020	703110	DUNCAN LEUNG	#

Material Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☒	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
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	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☒	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)

Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)	Approximately **$46,000.00** of additional material (i.e.. 500 Kcmil Cu, Splice Kits, Cable Racking, …) was issued during construction. The additional 500 kcmil Cu cable that was issued was not returned to this project prior to project closeout in SAP as the cable was originally issued to internal crews but due to resource balancing, contractors ended up installing the cable. This transfer of cable also attributed to the missing / unreturned cable. Some of the additional material like cable, splice kits and cable racking was required during construction to complete the project.

Options / Solutions	♦		Determine the material resource requirements such as underground cable, racking in cable chambers, and splice kit quantities prior to finalizing the detailed estimate in SAP.
Recommendation	♦		Conduct field measurements to determine cable lengths and material requirements with the construction manager / contractor as required. Complete a Material Finalization meeting with the design and construction manager to review all material prior to design attainment.
Implementation Plan	♦		Create a take off list to verify all material quantity prior to DSAP for future projects. This list can be used to verify the material estimated quantities and to verify the actuals and material returns. Have a post-construction meeting to ensure all of the extra material is returned prior to TECO.
	♦	**Planned Date of Implementation**	
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

Summary Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-212222-WD124001	W17257 Horner TS Egress Ph-01/CIVIL	25/11/2020	703160	JOHN TRYBEL	JOHN TRYBEL

Cost Category	Planned Cost (DSAP)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$2,592,405	$3,983,671	153.67%	-$1,391,265
Labour	$26,169	$150,861	576.49%	-$124,692
Material		$851	#DIV/0!	-$851
Vehicle		$2,564	#DIV/0!	-$2,564
Sum:	**$2,618,574**	**$4,137,947**	**158.02%**	**-$1,519,373**

Gap Analysis Required on: **Total $$**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: 30 April, 2022

Project Execution Supervisor Signoff:

John Trybel

Name:

Date: **30 April, 2022**

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description		WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-212222-WD124001	W17257 Horner TS Egress Ph-01/CIVIL		703160	JOHN TRYBEL	JOHN TRYBEL

Cost Category	Planned Cost (DSAP)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$2,592,405	$3,983,671	153.67%	-$1,391,265
Labour	$26,169	$150,861	576.49%	-$124,692
Material		$851	#DIV/0!	-$851
Vehicle		$2,564	#DIV/0!	-$2,564
Total:	**$2,618,574**	**$4,137,947**	**158.02%**	**-$1,519,373**

Total Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	X	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☐	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	X	Overtime (No provision for overtime work)
	☐	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		1. Additional Contractor charges due to digging in shale 2. Additional Contractor charges due to greater civil work on the corner of Horner Ave and Kipling Ave 3. Additional Contractor charges due to overtime. 4. Additional Contractor charges due to 10% Covid premium. 5. Additional Contractor charges due to dewatering in project area. 6. Additional Contractor charges for cable chamber digging and grounding.
Options / Solutions	♦	1. Amend the unit price contract to include proper unit for digging in shale
Recommendation	♦	
Implementation Plan	♦	Communicate out PVA issues and resolutions at next design meeting.
	♦	**Planned Date of Implementation** 01-Jun-22
	♦	**Actual Date of Implementation**
Analysis Completed	Yes	
All Implementations Completed		

Summary Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-170127-XD175004	P0130789-X11423 Stage 10&11	11/11/2021	703160	JOHN TRYBEL	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$1,032,997	$1,098,127	$964,505	93.37%	$68,492
Labour	$119,865	$119,859	$1,842,118	1,536.83%	-$1,722,253
Material	$296,524	$184,381	$593,072	200.01%	-$296,548
Vehicle	$22,332	$22,921	$160,903	720.52%	-$138,572
Sum:	**$1,471,717**	**$1,425,289**	**$3,560,598**	**241.93%**	**-$2,088,881**

Gap Analysis Required on: **$3,560,598**

Out of $3.6M, only $1.5M is DCW charges to this project. Rest are stations and PMO transfers.

Gap Analysis Completion Date: 05-Jul-22

Project Execution Supervisor Signoff:

Alli Jenkins

Name:

Date: **5-July-2022**

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-170127-XD175004	P0130789-X11423 Stage 10&11	11/11/2021	703160	JOHN TRYBEL	#

Table 1- Current PVA Table with Stations Cost not excluded

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$1,032,997	$1,098,127	$964,505	93.37%	$68,492
Labour	$119,865	$119,859	$1,842,118	1,536.83%	-$1,722,253
Material	$296,524	$184,381	$593,072	200.01%	-$296,548
Vehicle	$22,332	$22,921	$160,903	720.52%	-$138,571
Total:	**$1,471,717**	**$1,425,289**	**$3,560,598**	**241.93%**	**-$2,088,881**

Table 3- Summary of PVA Trigger

Stations + DCW Cost	$ 3,555,089.00	
DCW Charges to X11423 St 10 & 11	$ 1,543,974.00	
Approximate Station Charges	$ 2,011,115.00	These charges are coming from the WBS level. DCW is responsible for PM order charges, CJI3 with WBS level charges has been provided in CJI3 Extract Tab highlighted yellow

Table 2-DCW charges only (PM order Level)

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$1,032,997	$1,098,127	$726,391	70.32%	$306,606
Labour	$119,865	$119,859	$454,100	378.84%	-$334,235
Material	$296,524	$184,381	$297,425	100.30%	-$901
Vehicle	$22,332	$22,921	$66,058	295.81%	-$43,727
Total:	**$1,471,717**	**$1,425,288**	**$1,543,974**	**104.91%**	**-$72,257**

Total Variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	X	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	X	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
		Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
		External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	X	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
		Overtime (No provision for overtime work)
		Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
		Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
		Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		1) Charges were transferred into X11423 Stage 10/11 (P-170127-XD175004) from stations project P-170383-XS129001 . These charges were not identified at the time the PVA was triggered. 2) Please see table 2 above and table 3 for details as to DCW charges for project X11423 being $1.54M. 3) EAR + AFUDC for the entire project adds up to $705k. 4) Hence there were $2M of charges added to the WBS P-170127-XD175004 which should not be counted in the DCW PVA. 5) Table 2 is formulated from only DCW charges to this project using PM order data, which shows that our overall variance from plan is 4% higher than actual. 6) Please remove PVA requirement for this project as well as update KPI as variance is 4% and less than the required 20% for PVA.
Options / Solutions	♦	1) PMO to separate station costs before triggering PVA.
Recommendation	♦	1) PMO to separate station costs before triggering PVA.
Implementation Plan	♦	1) PMO to separate station costs before triggering PVA.
	♦	**Planned Date of Implementation** 05-Jul-22
	♦	**Actual Date of Implementation** 05-Jul-22
Analysis Completed	Y	
All Implementations Completed	Y	

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-170127-XD175004	P0130789-X11423 Stage 10&11	11/11/2021	703160	JOHN TRYBEL	#

Table 1- Current PVA Table with Stations Cost not excluded

Table 3- Summary of PVA Trigger

Labour variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
		Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
		Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
		Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
		External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	X	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
		Overtime (No provision for overtime work)
		Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
		Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
		Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		1) Internal labour charges were $334k over estimate resulting in internal labour charges of $454k. 2) External Labour charges were $306k under estimate resulting in external labour charges of $726k. 3) Due to the nature of this project, it was being designed at the same time as construction was on going. However, internal overages and external overestimates more or less cancel each other out on the dollar value scale. 4) Hence overall variance % in table 2 above is 4% above estimate cost. 5) Due to nature of project, in front of CN tower, and internal employees retiring during course of project caused the internal/external labour ratio to alter, due to access issues, evenings would be required.
Options / Solutions	♦	1) Keep additional buffer for downtown projects in case there is conflict with third parties during construction. 2) Keep in mind, staff turnover when planning the project.
Recommendation	♦	1) Keep additional buffer for downtown projects in case there is conflict with third parties during construction.
Implementation Plan	♦	1) Will ask planning for contingencies for high profile downtown projects at the time of issuance.
	♦	**Planned Date of Implementation** 05-Jul-22
	♦	**Actual Date of Implementation** 05-Jul-22
Analysis Completed	Y	
All Implementations Completed	Y	

TORONTO HYDRO

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-170127-XD175004	P0130789-X11423 Stage 10&11	11/11/2021	703160	JOHN TRYBEL	#

Table 1- Current PVA Table with Stations Cost not excluded

Table 3- Summary of PVA Trigger

Material Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☐	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☐	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☐	Overtime (No provision for overtime work)
	☐	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		1) DCW material charges on pm order level were $297,425 which is only 0.3% above the DSAP value for material charges. Hence the material section does not require PVA. 2) Reason PVA is triggered on material is that stations project costs P-170383-XS129001 were transferred in to DCW project P-170127-XD175004 which should have been flagged before starting PVA.
Options / Solutions	♦	1) PMO to separate station costs before triggering PVA.
Recommendation	♦	1) PMO to separate station costs before triggering PVA.
Implementation Plan	♦	1) PMO to separate station costs before triggering PVA.
	♦	**Planned Date of Implementation** 05-Jul-22
	♦	**Actual Date of Implementation** 05-Jul-22
Analysis Completed	Y	
All Implementations Completed	Y	

TORONTO HYDRO

Summary Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-170287-XD154002	X18331 Convert Runnymede MS B2RD from 4k	31/05/2021	703620	ANGELA LI	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$2,248,217	$3,089,625	$3,402,828	151.36%	-$1,154,611
Labour	$20,982	$20,982	$51,972	247.69%	-$30,990
Material	$465,145	$490,055	$676,180	145.37%	-$211,035
Vehicle	$392	$392	$123	31.40%	$269
Sum:	**$2,734,736**	**$3,601,055**	**$4,131,103**	**151.06%**	**-$1,396,367**

Gap Analysis Required on: **Total $$, Labour, & Material Variance**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: 21 October, 2021

Project Execution Supervisor Signoff:

Angela Li (signed)

Name:

Date: **21 October, 2021**

TORONTO HYDRO

Gap Root Report

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WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DR
P-170287-XD154002	X18331 Convert Runnymede MS B2RD from 4k	31/05/2021	703620	ANGELA LI	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$2,248,217	$3,089,625	$3,402,828	151.36%	-$1,154,611
Labour	$20,982	$20,982	$51,972	247.69%	-$30,990
Material	$465,145	$490,055	$676,180	145.37%	-$211,035
Vehicle	$392	$392	$123	31.40%	$269
Total:	**$2,734,736**	**$3,601,055**	**$4,131,103**	**151.06%**	**-$1,396,367**

Total Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☒	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☒	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☐	Overtime (No provision for overtime work)
	☐	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☒	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		1.Box premium which is not part of the UPCMS contract but is paid based on % of the units involving conversion of box poles to new standard installations- $118k 2. COVID premiums are not factored in the estimate but are paid based on construction cost: $110K 3. Design Estimate include TRXLPE cable removal where as actual cable removed was PILC, the variance was $117K 4. Due to condition of existing services unknown at the time of design causing potential hazard to the public, 204 services had to updated during construction, 10 services were included in estimate, rest charged as a change order causing a variance of $143K 5. Underestimated pay duty officer hrs- Variance of $35K 6. Because of the field conditions, additional material was required to replace poles and services: $213K 7.Pole 759 had to be replaced because of site conditions - $60K 8. Increased the design and inspection cost based on the project cost increase 9. Customer issues during the project, had to accommodate the requests resulting in additional cost -$44K 10.Third party pole accrual was higher than planned -26K
Options / Solutions	♦	1.Discuss estimate quality with contractors. Incorporate site conditions as much as possible 2. Capture COVID Premium estimates in SAP before DSAP
Recommendation	♦	1.Discuss estimate quality with contractors. Incorporate site conditions as much as possible 2. Capture COVID Premium estimates in SAP before DSAP
Implementation Plan	♦	Discuss estimates with contractors in the next design meeting
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed		
All Implementations Completed		

TORONTO HYDRO

Gap Root Report

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WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DR
P-170287-XD154002	X18331 Convert Runnymede MS B2RD from 4k	31/05/2021	703620	ANGELA LI	#

Labour variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☒	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☒	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☐	Overtime (No provision for overtime work)
	☐	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		1.Box premium which is not part of the UPCMS contract was agreed to be paid based on % of the units involving conversion of box poles to new standard installations $118k 2. COVID premiums were not factored in the estimate but are paid based on construction cost: $110K 3. Design Estimate include TRXLPE cable removal where as actual cable removed was PILC, the variance was $117K 4. Due to condition of existing services unknown at the time of design causing potential hazard to the public, 204 services had to updated during construction, 10 services were included in estimate, rest charged as a change order causing a variance of $143K 5. Underestimated pay duty officer hrs- Variance of $35K 6. Materials missed in the original BOM and additional materials based on field condition (service wires, poles, miniwedges, ampact connectors): $213K 7. Legacy duct structure required replacement relocation at base of P759 due to proximity to pole $60K 8. Increased design and inspection cost based on the project cost increase 9.Third party pole accrual was higher than planned 26K
Options / Solutions	♦	1.Discuss estimate quality with contractors. Incorporate site conditions as much as possible 2. Capture COVID Premium estimates in SAP before DSAP
Recommendation	♦	1.Discuss estimate quality with contractors. Incorporate site conditions as much as possible 2. Capture COVID Premium estimates in SAP before DSAP
Implementation Plan	♦	Discuss estimates with contractors in the next design meeting Bring up COVID premium estimation plan with CPW team during next OSR
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed		
All Implementations Completed		

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	onstruction DR
P-170287-XD154002	X18331 Convert Runnymede MS B2RD from 4k	31/05/2021	703620	ANGELA LI	#

Material Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☐	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☐	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☐	Overtime (No provision for overtime work)
	☐	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	X	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		Additional Material required upgrade old/damaged assets
Options / Solutions	♦	1.Discuss estimate quality with contractors. Incorporate site conditions as much as possible
Recommendation	♦	1.Discuss estimate quality with contractors. Incorporate site conditions as much as possible
Implementation Plan	♦	Discuss estimates with contractors in the next design meeting
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed		
All Implementations Completed		

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180268-WD151001	P0135844-W14665 Royal York and Westridge	#	#	29/10/2021	703620	SAFIK REMTULLA	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$829,231	$775,427	$1,123,123	135.44%	-$293,893
Labour			$60,732		-$60,732
Material	$513,696	$459,892	$659,438	128.37%	-$145,742
Vehicle			$251		-$251
Sum:	**$1,342,927**		**$1,843,544**	**137.28%**	**-$500,617**

Gap Analysis Required on: **Total**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: **April 26 2024**

Project Execution Supervisor Signoff:

on behalf of Safik Remtulla as execution CA

Name: Angela Li

Note: The project was executed throughout 2018 to 2020 under execution CA, however not attained or closed out for approx. 1 year, a small portion due to Covid (minimal customer outages allowed). Upon Safik's retirement, the unfinished portion was carved out to formulate Part 2 of the project and this phase was financially closed out in 2021 to minimize aged CWIP.

Date: April 26, 2024

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180268-WD151001	P0135844-W14665 Royal York and Westridge	#	#	29/10/2021	703620	SAFIK REMTULLA	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$829,231		$1,123,123	135.44%	-$293,893
Labour			$60,732		-$60,732
Material	$513,696		$659,438	128.37%	-$145,742
Vehicle			$251		-$251
Total:	**$1,342,927**		**$1,843,544**	137.28%	**-$500,617**

Total Variance

Category of Analysis Note: More than one category may be selected.	☒	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☒	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☐	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☐	Overtime (No provision for overtime work)
	☐	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)

Root Cause Details
(Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)

The project was packaged (detailed design) in Ellipse in 2018 before SAP was implemented. The High level Planning estimate was $1.087m where as the detailed estimate was $1.34m which was approved through a change request. The transition to ellipse happened in 2018/2019 and the project costs were moved to SAP. However, the DSAP estimate was never updated. The numbers are manually updated in above table such that a comparison can be completed from the detailed estimate to the actual cost

The project was executed throughout 2018 to 2020 under execution CA, however not attained or closed out for approximately 1 year, a small portion due to Covid (minimal customer outages allowed). Upon execution CA's retirement, the unfinished portion was carved out to formulate Part 2 of the project and this phase was financially closed out in 2021 to minimize aged CWIP.

External Costs variance:
There were additional change orders for the either increase in the scope of work ($159K) for additional work due to site conditions ($100K). There were OT request for Weekend outages to accommodate multiple customers (multi-residential and commercial) to prevent outages during business hours that led to additional costs as well ($75K). The additional electrical and civil work due to site conditions or scope changes included
1. Installing /Removing the submersible transformers and vaults as per revised design due to site conditions
2. Installing temporary transformers to generate power for the contractor building the high rise,
3. Reframing the poles to provide extra clearance for stringing
4. Additional streetlighting transfer
5. Installing splice box to existing direct buried cable
6. Additional pole install required based on revised design and on site pole conditions
7. Side walk restoration to ensure pedestrian safety

Material Costs variance:
Due to the increase in the scope and site conditions additional material such as transformers were required during construction that led to an increase in the material costs

Options / Solutions	♦	Additional site inspections during design to avoid scope expansion during execution
Recommendation	♦	Discuss importance of inspection with designers during design and scope validation with Planning
Implementation Plan	♦	Discuss the recommendation at next design meeting
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**

Analysis Completed

All Implementations Completed

Summary Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-183220-XD183260	X18326 - G&D NW Automation - Phase 3	25/03/2021	703621	ROBERT FANONE	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$526,868	$872,244	$844,258	160.24%	-$317,389
Labour	$41,052	$40,883	$125,143	304.84%	-$84,092
Material	$771,309	$1,067,150	$939,481	121.80%	-$168,172
Vehicle			$15,471		-$15,471
Sum:	**$1,339,229**	**$1,980,277**	**$1,924,353**	**143.69%**	**-$585,124**

Gap Analysis Required on: **Total $$, Labour Variance**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: 24-Nov-21

Project Execution Supervisor Signoff:

Robert Fanone

Name:

Date: Nov 24, 2021

TORONTO HYDRO

Gap Root Report

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WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-183220-XD183260	X18326 - G&D NW Automation - Phase 3	25/03/2021	703621	ROBERT FANONE	#

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Total:	**$1,339,229**	**$1,980,277**	**$1,924,353**	**143.69%**	**-$585,124**

Total Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☐	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
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	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☐	Overtime (No provision for overtime work)
	☑	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		1. Material Cost rate inflation. Defective Communication boxes and relays which caused the cost increase $185,605.46 in Materials. 2. Labour Cost rate inflation. Covid Premium cost since work was done during 2021 covid time. Station commissioning cost was underestimated in HL estimate. - Detailed estimate and actual cost are very close.

Options / Solutions	♦	1 Covid Premium cost will be	reduced as situation gets better
Recommendation	♦	2. Work with stations and	planning to determine an accurate estimate for station commissioning cost.
Implementation Plan	♦		
	♦	**Planned Date of Implementation**	24-Nov-21
	♦	**Actual Date of Implementation**	24-Nov-21
Analysis Completed		24-Nov-21	
All Implementations Completed	Ongoing		

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-183220-XD183260	X18326 - G&D NW Automation - Phase 3	25/03/2021	703621	ROBERT FANONE	#

Labour variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)	
	☐	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)	
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	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)	
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		Material Cost rate inflation. Defective Communication boxes and relays need to be reordered which caused the cost increase $185,605.46 in Materials.	
Options / Solutions	♦		Order new materials to replace defective equipment
Recommendation	♦		Communication Boxes and relays should be testing in 500 Commissioners Tank before issuing
Implementation Plan	♦		Have defective equipment returned.
	♦	**Planned Date of Implementation**	24-Nov-21
	♦	**Actual Date of Implementation**	24-Nov-21
Analysis Completed		**24/11/2021**	
All Implementations Completed	Ongoing		

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-183220-XD183260	X18326 - G&D NW Automation - Phase 3	25/03/2021	703621	ROBERT FANONE	#

Material Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)	
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Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		Labour Cost rate inflation. Covid Premium cost since work was done during 2021 covid time. Station commissioning cost was underestimated in HL estimate.	
Options / Solutions	♦	Work with stations to get	an accurate commissioning cost and have planning included in HL estimates
Recommendation	♦	PMO is working on analyzing	unit price to commission 1 location.
Implementation Plan	♦		
	♦	**Planned Date of Implementation**	24-Nov-21
	♦	**Actual Date of Implementation**	24-Nov-21
Analysis Completed	Y	**24/11/2021**	
All Implementations Completed	Ongoing		

TORONTO HYDRO

Summary Report

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WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190206-XD193001	X16745 4298 Vault Decommissioning and Sec	16/12/2021	703623	TSEGAYE BIRRU	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$1,396,459	$2,164,042	$1,901,002	136.13%	-$504,543
Labour	$28,906	$22,515	$124,764	431.61%	-$95,857
Material	$174,314	$467,368	$480,621	275.72%	-$306,307
Vehicle	$522	$850	$105	20.13%	$417
Sum:	**$1,600,202**	**$2,654,775**	**$2,506,492**	**156.64%**	**-$906,290**

Gap Analysis Required on: **Total $$**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: 27-May-22

Project Execution Supervisor Signoff:

Tsegaye Birru

Name:

Date: **May 27, 2022**

TORONTO HYDRO

Gap Root Report

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WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190206-XD193001	X16745 4298 Vault Decommissioning and Sec	16/12/2021	703623	TSEGAYE BIRRU	#

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Total:	**$1,600,202**	**$2,654,775**	**$2,506,492**	**156.64%**	**-$906,290**

Total Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
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Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)	1. Planned cost (DSAP) is inaccurate due to site related restrictions on the road cut permit from the city, due to this project being in a highly congested area (Bay St. & King St. W.) and therefore the condition of the road cut permits from the city is night time only OT work, driving up the labour costs. Also, a portion of the estimate was missed due to detailed design errors, and later included, adding to the gap. Overall the premium and missed portion accounts for approx. $637,372.89 labour cost increase. 2. This project was initially designed in 2019, and material ordered at the time in preparation for work. However, the project did not go until 2021, and this resulted in material requiring reordering due to misplacement and changes in material requirement through design updates.

Options / Solutions	♦		1. Discussed with planning and contractors to ensure in the future site related issues are planned for in advance by understanding the location of work, such as highly congested areas requiring special requirements to work in.
Recommendation	♦		2. DSAP process has been reviewed internally and finalized to ensure the status is changed once all estimates and materials are in place to avoid missing estimate issues in the future. And that material is not prematurely ordered until detailed design is confirmed.
Implementation Plan	♦		
	♦	**Planned Date of Implementation**	May-27-22
	♦	**Actual Date of Implementation**	May-27-22

Analysis Completed	Mircea Papuc
All Implementations Completed	Ongoing

TORONTO HYDRO

Gap Root Report

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WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190206-XD193001	X16745 4298 Vault Decommissioning and Sec	16/12/2021	703623	TSEGAYE BIRRU	#

Labour variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
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Options / Solutions	♦		1. Discussed with planning and contractors to ensure in the future site related issues are planned for in advance by understanding the location of work, such as highly congested areas requiring special requirements to work in.
Recommendation	♦		2. DSAP process has been reviewed internally and finalized to ensure the status is changed once all estimates and materials are in place to avoid missing estimate issues in the future.
Implementation Plan	♦		
	♦	**Planned Date of Implementation**	May-27-22
	♦	**Actual Date of Implementation**	May-27-22
Analysis Completed		Mircea Papuc	
All Implementations Completed	Ongoing		

Material Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
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Options / Solutions	♦		1. DSAP process has been reviewed internally and finalized to ensure the status is changed once all estimates and materials are in place to avoid missing estimate issues in the future. And that material is not prematurely ordered until detailed design is confirmed.
Recommendation	♦		
Implementation Plan	♦		
	♦	**Planned Date of Implementation**	May-27-22
	♦	**Actual Date of Implementation**	May-27-22
Analysis Completed		Mircea Papuc	
All Implementations Completed	Ongoing		

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190519-XD175001	X12414 - Strachan TS Feeder Transfer fro	30/06/2021	703160	FEI CHEN	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$569,234	$1,688,841	$1,141,219	200.48%	-$571,985
Labour	$163,092	$112,092	$1,312,036	804.48%	-$1,148,944
Material	$764,925	$835,729	$1,012,431	132.36%	-$247,506
Vehicle	$6,700	$9,810	$114,245	1,705.19%	-$107,545
Sum:	**$1,503,950**	**$2,646,473**	**$3,579,930**	**238.04%**	**-$2,075,981**

Gap Analysis Required on: **Total $$, Labour, & Material**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: Nov.17, 2021

Project Execution Supervisor Signoff:

Faye Chen

Name:

Date: **Nov.17, 2021**

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190519-XD175001	X12414 - Strachan TS Feeder Transfer fro	30/06/2021	703160	FEI CHEN	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$569,234	$1,688,841	$1,141,219	200.48%	-$571,985
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Vehicle	$6,700	$9,810	$114,245	1,705.19%	-$107,545
Total:	**$1,503,950**	**$2,646,473**	**$3,579,930**	**238.04%**	**-$2,075,981**

Total Variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	X	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
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	X	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
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	X	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
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Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		**Labour** Total labour variance of **-$1,148,944** is mainly due to the contingencies from scope changes, coordination issues with other THESL projects, missing additional units, changes from internal to external services and no provision for overtime work. **Material** Total material variance of **-$247,506** is explained by the additional primary cables, primary splices, cable racks and the tools ordered for the construction as explained in the material section below. The primary reason for this material not included in the planning stage is multiple design revisions. **Vehicle** At the time of DSAP, little amount for vehicle has been captured. As non-wrench time has been increased due to the extra cable installation and splice work, the vehicle cost variance of **$107,545** took place.
Options / Solutions	♦	
Recommendation	♦	1. Add contingency costs in the project estimate 2. Ensure major category of costs are captured such as vehicles, external services 3. Ensure major assets such as cables and splices are captured in the design phase.
Implementation Plan	♦	
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed	Yes	
All Implementations Completed	Yes	

Gap Root Report

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WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190519-XD175001	X12414 - Strachan TS Feeder Transfer fro	30/06/2021	703160	FEI CHEN	#

Labour variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	X	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
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	X	Overtime (No provision for overtime work)
		Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
		Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
		Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		Total labour variance of **-$1,148,944** The scope package of this project was first issued in November 9, 2010. There has been scope revisions for several times since then. The assumption in the latest scope was to install 2535m of primary cables and 2965m of cables to be removed. But the project ended up with installing 12,144m of primary cables. The SAP captured the labour cost for installation of cables and splices of $85,000 however, the actual was $490,500 resulting in a variance of **$405,500**. The non-wrench time cost was not sufficient to cover the actual work. It was estimated for $16,330 but the actual was $69,080 resulting in a variance of **$52,750.** There has been designer's cost collector transferred of amount **$54,320.** Lagging cost transfer of civil work from project X12638 of amount **$104,300** as a variance cost. The costs for switching of the feeders were not estimated in the SAP. The contractor spent **$275,700** for the isolation and restoration of the feeders. There was no provision for overtime work and pandemic situation. The cost for overtime and pandemic accounted for **$215,000.** The internal inspection cost was estimated as $4,400 and the actual cost was $13,700 thereby giving a variance of **$9,700**.
Options / Solutions	♦	
Recommendation	♦	Need to be consulted with construction supervisor during the planning and designing stage to confirm the approximate resource hour to do the job, specially the time required for isolating and restoring multiple feeders.
Implementation Plan	♦	
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed		
All Implementations Completed		

TORONTO HYDRO

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190519-XD175001	X12414 - Strachan TS Feeder Transfer fro	30/06/2021	703160	FEI CHEN	#

Material Variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	X	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
		Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	X	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
		External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
		Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
		Overtime (No provision for overtime work)
		Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
		Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
		Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		Total material variance of **-$247,506.** Additional cables and splice kit of amount **$136,800** were ordered. The tools, cable arms and racks, caulking, cable endcap, duct sealant and other miscellaneous materials of amount **$117,153** were not included in the original design due to the multiple revisions on account of field condition changing.

Options / Solutions	♦		
Recommendation	♦	Material finalization meeting should be held in case of complicated project like this.	
Implementation Plan	♦		
	♦	**Planned Date of Implementation**	
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

TORONTO HYDRO

Summary Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-193004-ZD161004	X18042 DAFOE STRACHAN PH4 Pt D	30/12/2021	703110	SUNNY PATEL	WILLIAM GRAHAM

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$366,073	$539,290	$562,906	153.77%	-$196,833
Labour	$331,922	$311,793	$678,217	204.33%	-$346,295
Material	$217,972	$340,889	$354,268	162.53%	-$136,296
Vehicle	$95,049	$96,428	$177,360	186.60%	-$82,311
Sum:	**$1,011,016**	**$1,288,400**	**$1,772,751**	**175.34%**	**-$761,735**

Gap Analysis Required on: **Total $$ & Labour Variance**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: 27-May-22

Project Execution Supervisor Signoff:

Sunny Patel

Name:

Date: **27 May, 2022**

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-193004-ZD161004	X18042 DAFOE STRACHAN PH4 Pt D	30/12/2021	703110	SUNNY PATEL	WILLIAM GRAHAM

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$366,073	$539,290	$562,906	153.77%	-$196,833
Labour	$331,922	$311,793	$678,217	204.33%	-$346,295
Material	$217,972	$340,889	$354,268	162.53%	-$136,296
Vehicle	$95,049	$96,428	$177,360	186.60%	-$82,311
Total:	**$1,011,016**	**$1,288,400**	**$1,772,751**	**175.34%**	**-$761,735**

Total Variance

Category of Analysis

Note: More than one category may be selected.

- [ ] Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
- [x] Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
- [ ] Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
- [ ] Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
- [ ] External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
- [ ] Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
- [x] Overtime (No provision for overtime work)
- [x] Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
- [ ] Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
- [ ] Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)

Root Cause Details

(Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)

There were several factors that drove the variance in SAP for this project.

+$346.295k variance for Labour

- incremental construction labour costs due to Typical AUs account for one CCL+2 journeypersons. Realistically for the construction DRP, crews are a minimum of one CCL + 3 journeypersons + 2 L1 apprentices. Labour rates in SAP were updated as well.
- incremental construction labor costs are also due to a significant amount of coordination involved with TTC to complete the conversion. TTC was required to transfer their trolley and feeder cables to our proposed poles prior to our secondary bus.
- incremental of administrative support costs against project due to a huge amount of coordination with the contractor and the city for cut permit applications for unexpected civil work on Queen St W for clearing existing duct banks blockages on Queen St W.

+ $83.11K variance for vehicle

- increased vehicle costs due to COVID restriction policies.
- increased vehicle costs due to downtown area and during CafeTO initiatives

+191.7K variance for External services.

- Added vendor support by OTS and Paid duty police due to congested downtown areas, especially during CafeTO initiatives.
- Added Delta Wye service conversion work and the unexpected change of the electrician sub-contract from Ainsworth which added to the final cost.
- Added unexpected civil work break and tie and duct banks, and clearing existing duct banks blockage on Queen St W.

+137.3K variance for Material.

- in material costs due to additional primary and secondary cable replacement as recommended by construction DRP to reduce outages, as well as redesign due to ongoing new customer developments in the area since the original design and overall material price changes over the last couple years while in construction.

Options / Solutions	♦	Investigate alternate methods to construct projects and add additional labour and vehicle hours to accommodate the crew size. Also, investigate if there are any additional work required by the contractor prior to construction.
Recommendation	♦	Determine construction execution steps prior to issuing to include labour, vehicle and material. Also, consult with contractor for any additional work required prior to construction.
Implementation Plan	♦	Review with planning group to include within the scope of work the construction method to utilize with the input of the outside staff
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**

Analysis Completed

All Implementations Completed

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-193004-ZD161004	X18042 DAFOE STRACHAN PH4 Pt D	30/12/2021	703110	SUNNY PATEL	WILLIAM GRAHAM

Labour variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☒	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☐	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☒	Overtime (No provision for overtime work)
	☐	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		**There were several factors that drove the variance in SAP for this project.** **+$346.295k variance for Labour** - incremental construction labour costs due to Typical AUs account for one CCL+2 journeypersons. Realistically for the construction DRP, crews are a minimum of one CCL + 3 journeypersons + 2 L1 apprentices. Labour rates in SAP were updated as well. - incremental construction labor costs are also due to a significant amount of coordination involved with TTC to complete the conversion. TTC was required to transfer their trolley and feeder cables to our proposed poles prior to our secondary bus. - incremental of administrative support costs against project due to a huge amount of coordination with the contractor and the city for cut permit applications for unexpected civil work on Queen St W for clearing existing duct banks blockages on Queen St W.

Options / Solutions	♦		Investigate alternate methods to construct projects and add additional labour and vehicle hours to accommodate the crew size
Recommendation	♦		Determine construction execution steps prior to issuing to include labour, and vehicle.
Implementation Plan	♦		Review with planning group to include within the scope of work the construction method to utilize with the input of the outside staff
	♦	**Planned Date of Implementation**	
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-193004-ZD161004	X18042 DAFOE STRACHAN PH4 Pt D	30/12/2021	703110	SUNNY PATEL	WILLIAM GRAHAM

Material Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☒	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
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	☒	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		**There were several factors that drove the variance in SAP for this project.** **+137.3K variance for Material.** - in material costs due to additional primary and secondary cable replacement as recommended by construction DRP to reduce outages, as well as redesign due to ongoing new customer developments in the area since the original design and overall material price changes over the last couple years while in construction.

Options / Solutions	♦		Investigate alternate methods to construct projects and add additional material.
Recommendation	♦		Determine construction execution steps prior to issuing to include material.
Implementation Plan	♦		Review with planning group to include within the scope of work the construction method to utilize with the input of the outside staff
	♦	**Planned Date of Implementation**	
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

Summary Report

Last Refreshed	23/04/2024 | 14:06:00 GMT-04:00
Refreshed By	AVALIJI
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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-210166-XD139012	X21041 Charles Automation 2021 PSOE Ph1	#	#	20/09/2021	703623	ROBERT FANONE	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External		$1,373,673	$1,201,741	87.48%	$171,932
Labour		$20,698	$1,725	8.33%	$18,973
Material		$12,818	$1,094,137	8,536.01%	-$1,081,319
Sum:		**$1,407,188**	**$2,297,603**	**163.28%**	**-$890,415**

Gap Analysis Required on: **Total**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: **April 25 2024**

Project Execution Supervisor Signoff:

Sophia Jiang

Name:

Date: **April 25 2024**

Gap Root Report

Last Refreshed	23/04/2024 | 14:06:00 GMT-04:00
Refreshed By	AVALIJI
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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-210166-XD139012	X21041 Charles Automation 2021 PSOE Ph1	#	#	20/09/2021	703623	ROBERT FANONE	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External		$1,373,673	$1,201,741	87.48%	$171,932
Labour		$20,698	$1,725	8.33%	$18,973
Material		$12,818	$1,094,137	8,536.01%	-$1,081,319
Total:		**$1,407,188**	**$2,297,603**	**163.28%**	**-$890,415**

Total Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☐	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
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	☐	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☐	Overtime (No provision for overtime work)
	☐	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		When project got created, it was under RC 703622 Grid Maintenance. During the construction, project got transferred over to 703623 Capital Project East. The planned costs are split between 2 RCs and 2 WBS P-210166-XD139011 and P-210166-XD139012. The total planned cost is $2,358,977.19 between 2 WBS. The variance between total planned cost $2,358,977.19 and total actual cost $2,297,602.98 is only 2.6%.
Options / Solutions	♦	Add the planned costs to the WBS P-210166-XD139012 which has all the actual costs.
Recommendation	♦	Ensure planned costs are properly allocated to the same WBS.
Implementation Plan	♦	Check planned costs in SAP.
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed		
All Implementations Completed		

TORONTO HYDRO

Summary Report

Last Refreshed	23/04/2024 | 14:06:17 GMT-04:00
Refreshed By	AVALIJI
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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-210166-XD139034	X21043 Charles Automation 2021 PSOE Ph3	#	#	29/10/2021	703623	ROBERT FANONE	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$894,439		$877,767	98.14%	$16,672
Labour	$20,698		$418	2.02%	$20,280
Material	$202,457		$616,578	304.55%	-$414,121
Sum:	**$1,117,594**		**$1,494,763**	**133.75%**	**-$377,169**

Gap Analysis Required on: **Total**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: April 25 2024

Project Execution Supervisor Signoff:

Sophia Jiang

Name:

Date: **April 25 2024**

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-210166-XD139034	X21043 Charles Automation 2021 PSOE Ph3	#	#	29/10/2021	703623	ROBERT FANONE	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$894,439		$877,767	98.14%	$16,672
Labour	$20,698		$418	2.02%	$20,280
Material	$202,457		$616,578	304.55%	-$414,121
Total:	**$1,117,594**		**$1,494,763**	**133.75%**	**-$377,169**

Total Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☐	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☐	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
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	☐	Overtime (No provision for overtime work)
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	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
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Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		When project got created, it was under RC 703622 Grid Maintenance. During the construction, project got transferred over to 703623 Capital Project East. The planned costs are split between 2 RCs and 2 WBS P-210166-XD139033 and P-210166-XD139034. The total planned cost is $1,557,229.06 between 2 WBS. The variance between total planned cost $1,557,229.06 and total actual cost $1,494,762.61 is only 4%.
Options / Solutions	♦	Add the planned costs to the WBS P-210166-XD139034 which has all the actual costs.
Recommendation	♦	Ensure planned costs are properly allocated to the same WBS.
Implementation Plan	♦	Check planned costs in SAP.
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed		
All Implementations Completed		

Summary Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180021-XD155001	X18319 Hammersmith Network Conv	31/03/2022	703620	FANGXIN XU	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$1,033,286	$2,318,425	$1,750,354	169.40%	-$717,068
Labour	$0	$0	$75,641	47,275,531.25%	-$75,641
Material	$1,685,629	$1,899,677	$2,150,199	127.56%	-$464,570
Vehicle			$3,394		-$3,394
Sum:	**$2,718,915**	**$4,218,102**	**$3,979,587**	**146.37%**	**-$1,260,672**

Gap Analysis Required on: **Total $$, Labour, and Material**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: 23 August, 2022

Project Execution Supervisor Signoff:

Francine Xu

Name:

Date: **23 August, 2022**

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180021-XD155001	X18319 Hammersmith Network Conv	31/03/2022	703620	FANGXIN XU	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$1,033,286	$2,318,425	$1,750,354	169.40%	-$717,068
Labour	$0	$0	$75,641	47,275,531.25%	-$75,641
Material	$1,685,629	$1,899,677	$2,150,199	127.56%	-$464,570
Vehicle			$3,394		-$3,394
Total:	**$2,718,915**	**$4,218,102**	**$3,979,587**	**146.37%**	**-$1,260,672**

Total Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☒	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☒	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☐	Overtime (No provision for overtime work)
	☒	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		1. Civil & electrical labour costs were using 2018 rates when the job was ready for construction but the construction was in 2021; hence, there was an increase in labour rates over the three years 2. Planning requested relocation of secondary services from TTC pole in December 2020, resulting in a restoration cost of $24k which was not accounted for in the estimate 3. $50k variance in civil labour due to approved STAMP request to install concrete raised slab to install above grade tap box 4. $550k variance to electrical labour because 24 Cable Chambers were re-inspected after 3 years to capture any changes, switching cost for 4 feeders and 12 network transformers was difficult to accurately estimate during estimate, additional cost of extra crane to deliver material from THESL warehouse to Contractor's yard (as typically, the crane permit is only issued during weekends by the City, there was an additional OT cost as well), additional cost due to change of Standards (STD 16-0340 requirement of extra transition joints to do TRXPLE WYE point - 3 joints), new cables had to be pieced out and sleeved during construction as Primary XLPE cable was not long enough for new vac switch locations and cable racking units which were not accounted for in estimate were required for the 24 cable chambers and 6 vaults 5. There is a $220k material handling fee by warehouse which accounts for 48% of material variance 6. $88k variance due to legacy material as this job was packaged in Ellipse before. 7. $15k variance resulting from network transformers and protectors which were mounted and tested by internal staff that was not accounted for in estimate 8. Internal support shows as $0 as planned in SAP. However, it seems like this is an Ellipse/SAP migration problem as this job was packaged in Ellipse in March 2018. Please see supporting documents (Ellipse screenshot, manual DSAP for internal support hours screenshot). The actual variance for the internal support was $75k - $53k - $15k = $7k (i.e. CA, FA, students, COCO) over the three years.
Options / Solutions	♦	The construction should be completed after the design is attained. Delays beyond a year should be avoided due to changes in site conditions, Standards changes or conflicts with other projects that may occur.
Recommendation	♦	The construction should be completed after the design is attained. Delays beyond a year should be avoided due to changes in site conditions, Standards changes or conflicts with other projects that may occur.
Implementation Plan	♦	We have a change request (CR#400002603) that has been approved by Planning Manager and PMC
	♦	**Planned Date of Implementation** 23/08/2022
	♦	**Actual Date of Implementation** 23/08/2022
Analysis Completed	19/08/2022	
All Implementations Completed	23/08/2022	

TORONTO HYDRO

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180021-XD155001	X18319 Hammersmith Network Conv	31/03/2022	703620	FANGXIN XU	#

Labour variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☐	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	X	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
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Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		1. $15k variance resulting from network transformers and protectors which were mounted and tested by internal staff that was not accounted for in estimate 2. Internal support shows as $0 as planned in SAP. However, it seems like this is an Ellipse/SAP migration problem as this job was packaged in Ellipse in March 2018. Please see supporting documents (Ellipse screenshot, manual DSAP for internal support hours screenshot). The actual variance for the internal support was $75k - $53k - $15k = $7k (i.e. CA, FA, students, COCO) over the three years.
Options / Solutions	♦	Internal support was estimated but due to Ellipse/SAP migration issue, it was not shown as planned.
Recommendation	♦	Internal support was estimated but due to Ellipse/SAP migration issue, it was not shown as planned.
Implementation Plan	♦	Internal support was estimated but due to Ellipse/SAP migration issue, it was not shown as planned.
	♦	**Planned Date of Implementation** 23/08/2022
	♦	**Actual Date of Implementation** 23/08/2022
Analysis Completed	19/08/2022	
All Implementations Completed	23/08/2022	

TORONTO HYDRO

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180021-XD155001	X18319 Hammersmith Network Conv	31/03/2022	703620	FANGXIN XU	#

Material Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☐	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
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Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		1. There is a $220k material handling fee by warehouse which accounts for 48% of material variance 2. $88k variance due to legacy material as this job was packaged in Ellipse before.
Options / Solutions	♦	Sometime material cost changes overtime, especially over a period of three years
Recommendation	♦	Sometime material cost changes overtime, especially over a period of three years
Implementation Plan	♦	Sometime material cost changes overtime, especially over a period of three years
	♦	**Planned Date of Implementation** 23/08/2022
	♦	**Actual Date of Implementation** 23/08/2022
Analysis Completed	19/08/2022	
All Implementations Completed	23/08/2022	

TORONTO HYDRO

Summary Report

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180695-ZZ129001	X13470-X13470 Transfer A256DN to A5-6W 2	#	#	31/10/2022	703620	FRANCIS SZTO	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$2,412,111	$4,316,047	$4,003,194	165.96%	-$1,591,083
Labour	$48,677	$48,677	$277,010	569.08%	-$228,333
Material	$1,076,223	$748,451	$851,662	79.13%	$224,561
Vehicle	$1,294	$1,294	$26,289	2,031.27%	-$24,995
Sum:	**$3,538,305**	**$5,114,470**	**$5,158,155**	**145.78%**	**-$1,619,850**

Gap Analysis Required on: **Total $$, Labour and Material**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: 30-Mar-23

Project Execution Supervisor Signoff:

Francis Szto

Name:

Date: **Mar 30, 2023**

TORONTO HYDRO

Gap Root Report

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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180695-ZZ129001	X13470-X13470 Transfer A256DN to A5-6W 2	#	#	31/10/2022	703620	FRANCIS SZTO	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
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Total:	**$3,538,305**	**$5,114,470**	**$5,158,155**	**145.78%**	**-$1,619,850**

Total Variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
		Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
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Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		See Labour variance and material variance details
Options / Solutions	♦	
Recommendation	♦	
Implementation Plan	♦	
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed		
All Implementations Completed		

TORONTO HYDRO

Gap Root Report

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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180695-ZZ129001	X13470-X13470 Transfer A256DN to A5-6W 2	#	#	31/10/2022	703620	FRANCIS SZTO	#

Labour variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
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		Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)

Root Cause Details
(Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)

$ 725,000 Electrical – Valard had misquoted cost of PILC removal unit 16-0304. An agreement was reached between TH and Valard management to compensate Valard for cost of this labour under the corrected cost as opposed to the original costs.

$ 149,000 Electrical – Additional PILC removal units paid under updated unit pricing

$ 242,000 Electrical – Framing, cable slices, guying installs and other misc. units not included on initial takeoff

$ 72,000 Electrical – Nomenclature work required to relabel CCs the feeders within them. Work in CC 4751, 4752 for cable pulling, installation of splices and racking. Removal of A32W

$ 62,000 Electrical – Work in Dufferin station to remove potheads and PILC, pulling in corresponding XLPE. Work in Dupont to abandon cable. In support of this, splicing in CC5631 and 15923

$ 37,000 Electrical – Work in Wiltshire Station and various CCs to pull new TRXLPE cable. Work to pull in 250kcmil 600V. Work in CCs 9889, 6401, 15923, 4939, 4938, for installation of splices

$ 18,000 Electrical – Install wye joints and straight joints in CC 15922, CC15923 and CC5631

$ 16,000 Electrical – Sub-contractor invoicing for tree trimming, private restoration work

$ 42,000 Civil – Additional work for break&tie and pole install due to existing hydro structure sitting at deep depth
$ 28,000 Civil – Streetlight transfers and pole concrete bases not captured on initial takeoff
$ 12,000 Civil – Cost paid as part of COVID-19 premiums

$ 33,000 Electrical + Civil – This project requires the removal of this working dead-end which was installed by Entera on a previous project. As a dead-end has to be removed by the same people who installed it, these costs were paid to compensate Entera.

$ 81,000 Design – Additional Design costs in accordance with increase in material and labour

$ 76,000 Transfer – Stations transfer costs

$ 68,000 Permanent Restoration – Perm Restoration costs and deferred pole accrual costs

$ 49,000 Inspection – Increase inspection costs as in accordance with increase in labour

Options / Solutions	♦	Create new unit to capture the true cost and true scope of work for PILC cable removals
Recommendation	♦	Supply Chain to implement into SAP system
Implementation Plan	♦	New unit 16-0306 created and fully implemented into the contracts and will be used for all PILC removal going forward
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed		
All Implementations Completed		

TORONTO HYDRO

Gap Root Report

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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180695-ZZ129001	X13470-X13470 Transfer A256DN to A5-6W 2	#	#	31/10/2022	703620	FRANCIS SZTO	#

Material Variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
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Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		Additional connectors, sleeves and splice kits required Cable caps, tags, grounding kits and other misc. items
Options / Solutions	♦	Fully capture all material on material required during design stage
Recommendation	♦	Ensure all items entered into SAP at time of project DSAP
Implementation Plan	♦	Review projects drawings and make provisions for possible additional materials as a result of field conditions
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed		
All Implementations Completed		

TORONTO HYDRO

Summary Report

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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180704-WD161001	WPKG W12767 P21 Urgent PILC Cable Repl	#	#	27/09/2022	703620	SARIM HUMAYUN	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$711,747	$1,613,937	$1,550,241	217.81%	-$838,495
Labour	$31,596	$36,874	$115,259	364.80%	-$83,664
Material	$474,634	$545,199	$504,813	106.36%	-$30,180
Vehicle	$522	$425	$1,261	241.41%	-$739
Sum:	**$1,218,498**	**$2,196,435**	**$2,171,575**	**178.22%**	**-$953,077**

Gap Analysis Required on: **Total $$ & Material**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: 21/02/2023

Project Execution Supervisor Signoff: Sarim

Name: Sarim Humayun

Date: 21/02/2023

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180704-WD161001	WPKG W12767 P21 Urgent PILC Cable Repl	#	#	27/09/2022	703620	SARIM HUMAYUN	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
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Labour	$31,596	$36,874	$115,259	364.80%	-$83,664
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Vehicle	$522	$425	$1,261	241.41%	-$739
Total:	**$1,218,498**	**$2,196,435**	**$2,171,575**	**178.22%**	**-$953,077**

Total Variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	X	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
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Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		Major cost variance was due to increase in external labour costs. Details are given in Labour section below

Options / Solutions	♦		
Recommendation	♦		
Implementation Plan	♦		
	♦	**Planned Date of Implementation**	
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

TORONTO HYDRO

Gap Root Report

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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180704-WD161001	WPKG W12767 P21 Urgent PILC Cable Repl	#	#	27/09/2022	703620	SARIM HUMAYUN	#

Labour variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	X	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
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Root Cause Details
(Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)

$280K of Stations labour cost in support of decommissioning old PILC and commissioning new TRXLPE feeder in Palmwood station. This was labelled as external costs within SAP

$247K of labour variance was caused by the construction of new civil infrastructure not included in original scope. Ducts under Valhalla Inn Road were in very poor state. There was a great risk that the existing feeders could not be removed from them, or the ducts would collapse after them. No spare ducts were available in existing duct bank. New ducts were constructed to allow the new feeders to be pulled while keeping existing feeders energized.

$206K of labour variance caused by labour unit cost escalation. Contractor had misquoted on various cable pulling and splicing units and an escalation process was approved by Procurement to compensate contractor to negotiated unit cost levels.

$84K in permanent restoration was accrued to the project. The initial scope did not have civil work as detailed above.

Options / Solutions	♦	Increase the estimate of stations work to support decommissioning and commissioning of feeders. Request for through investigation of state of civil structure during planning phase
Recommendation	♦	Break up and re-issue scopes into civil and electrical phases so that relevant issues can be isolated to their respective projects. Perform civil inspection work during Planning and design phase
Implementation Plan	♦	Rod and mandrel ducts during design phase of upcoming Palmwood conversion scopes
	♦	**Planned Date of Implementation** 06/06/2023 (DD/MM/YY) according to design timelines of civil scopes
	♦	**Actual Date of Implementation**

Analysis Completed

All Implementations Completed

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180704-WD161001	WPKG W12767 P21 Urgent PILC Cable Repl	#	#	27/09/2022	703620	SARIM HUMAYUN	#

Material Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☐	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☐	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☐	Overtime (No provision for overtime work)
	☐	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	X	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		Additional splice kits required for #2 PILC cable on the laterals

Options / Solutions	♦		
Recommendation	♦		
Implementation Plan	♦		
	♦	**Planned Date of Implementation**	
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

Summary Report

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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190022-ED161002	WPKG E15593 Port Royal Circuit Reconfig.	#	#	29/11/2022	703110	Darar Abdissa	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$1,728,762	$3,024,605	$2,938,851	170.00%	-$1,210,089
Labour	$105,954	$105,954	$164,594	155.35%	-$58,640
Vehicle			$934		-$934
Sum:	**$1,834,716**	**$3,130,559**	**$3,104,379**	**169.20%**	**-$1,269,663**

Gap Analysis Required on: **Total $$ & Labour Variance**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: 27 April, 2024

Project Execution Supervisor Signoff:

Darar Abdissa

Name: **27 April, 2024**

Date:

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190022-ED161002	WPKG E15593 Port Royal Circuit Reconfig.	#	#	29/11/2022	703110	Darar Abdissa	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$1,728,762	$3,024,605	$2,938,851	170.00%	-$1,210,089
Labour	$105,954	$105,954	$164,594	155.35%	-$58,640
Vehicle			$934		-$934
Total:	**$1,834,716**	**$3,130,559**	**$3,104,379**	**169.20%**	**-$1,269,663**

Total Variance

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Root Cause Details
(Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)

The total cost variance of $1,269,663 for this project was due to increased external, labour, material and vehicle resources for this project. See breakdown below and note that this project has an approved CR400002811.
(X:\Change Requests\1. CR Pre-Submission Approvals\Year of 2022\DCE - 3110\400002811)

- A total external resource cost variance of **$1,210,089** was due to additional external resources required due to underground utilities that were in conflict with the original records that were provided by the Utilities for permitting. This led to additional road/sidewalk cuts and repair. Also, asbestos was identified in the field and required additional change orders to dispose remove and dispose.

- A total labour cost variance of **$58,640** was due to the requirement of additional design resources during construction to update/issue revisions, support contractors during construction and engaging standards.

- A total vehicle variance of **$934** was due to zero hours being estimated since the work was going to be fully executed by contractors, but pool vehicle were required for design and construction support. There was also TH construction crews site meetings and support required during the project that was not identified prior to project start.

Options / Solutions	♦		Determine the resource requirements such as external resources, field conditions, inspect the existing civil, and design time (based on the complexity of the project) prior to finalizing the detailed estimate in SAP (DSAP). Also, ensure all lagging costs are identified upfront.
Recommendation	♦		Conduct field visits with the project DRP, TH crews and external stakeholders during the project detailed estimate stage to identify and address all potential issues. The designer and design supervisor should review the detailed estimate thoroughly prior to packaging and approving the design. The detailed design cost should be updated to reflect the actual design time prior to finalizing the detailed estimate. Any time there is a business process change, change management process for in-flight projects should be implemented.
Implementation Plan	♦		Account for labour hours and material requirements based on field consultation and coordination meetings with all internal and external stakeholders for all future projects. Capture all legacy design/construction cost in the WBS prior to DSAP. Submit CR if required.
	♦	**Planned Date of Implementation**	Future U/G Civil Rebuild Projects.
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

Summary Report

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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190182-XD154010	X18291 Danforth 4kV Conv Ph3-Pt 1-Ph B	#	#	16/12/2022	703110	SCOTT WILGOSH	Sean Fletcher

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$429,864	$583,007	$577,159	134.27%	-$147,294
Labour	$449,769	$450,565	$927,549	206.23%	-$477,780
Material	$442,449	$589,745	$548,035	123.86%	-$105,586
Vehicle	$162,831	$163,103	$241,663	148.41%	-$78,833
Sum:	**$1,484,914**	**$1,786,420**	**$2,294,407**	**154.51%**	**-$809,493**

Gap Analysis Required on: **Total $$ & Labour Variance**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: 17-May-23

Project Execution Supervisor Signoff:

Scott Wilgosh

Name:

Date: **May 17, 2023**

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190182-XD154010	X18291 Danforth 4kV Conv Ph3-Pt 1-Ph B	#	#	16/12/2022	703110	SCOTT WILGOSH	Sean Fletcher

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Total Variance

Category of Analysis Note: More than one category may be selected.	x	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	x	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
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Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		**The Total Project Variance from DSAP ($1,484,914) to Actual ($2,294,407) = $809,493 or 55%.** For eight PM orders, 1000344959, 100344987, 1000344997, 1000345065, 1000345105, 1000345108, 1000271587 & 1000345109 the planned costs were $113,835.65 and the actual costs $879,520.84.19 for a variance of $765,685.19 for labor, materials and vehicle. - The labour variance is related to this project being a box construction project and not having the experience staff to safely execute the work so additional time has been incurred using the apprentices on the crew to execute the work. - The material variance is for additional cost incurred by the crews to remove the box construction and complete a 4kv underbuilt on new cross arms and install all 55ft poles to allow additional height to safely execute the voltage conversion. - The vehicle variance is a result of the staff having to travel to the site is separate vehicles to due to the COVID restrictions of one employee per vehicle. For PM order 1000271587 DCE Design the estimated cost was $30,718.62 to actual $118,254.92 for a variance of $87,536.30. - The designer for this project had to address numerous customer questions regarding the pole installation.

Options / Solutions	♦		
Recommendation	♦		
Implementation Plan	♦		
	♦	**Planned Date of Implementation**	
	♦	**Actual Date of Implementation**	
Analysis Completed	Scott Wilgosh / Eugene Posada		
All Implementations Completed			

Gap Root Report

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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190182-XD154010	X18291 Danforth 4kV Conv Ph3-Pt 1-Ph B	#	#	16/12/2022	703110	SCOTT WILGOSH	Sean Fletcher

Labour variance

Category of Analysis Note: More than one category may be selected.	x	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
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Options / Solutions	♦		
Recommendation	♦		
Implementation Plan	♦		
	♦	**Planned Date of Implementation**	
	♦	**Actual Date of Implementation**	
Analysis Completed	Scott Wilgosh / Eugene Posada		
All Implementations Completed			

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190182-XD154010	X18291 Danforth 4kV Conv Ph3-Pt 1-Ph B	#	#	16/12/2022	703110	SCOTT WILGOSH	Sean Fletcher

Material Variance

Category of Analysis Note: More than one category may be selected.	x	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	x	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
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Options / Solutions	♦		
Recommendation	♦		
Implementation Plan	♦		
	♦	**Planned Date of Implementation**	
	♦	**Actual Date of Implementation**	
Analysis Completed	Scott Wilgosh / Eugene Posada		
All Implementations Completed			

TORONTO HYDRO

Summary Report

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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190193-XD124002	X19210 Gerrard Carlaw New Tie Feeders Ph	#	#	27/05/2022	703620	FRANCIS SZTO	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance	
External	$673,763	$2,571,846	$2,510,604	372.62%	-$1,836,841	3.726243269
Labour	$26,137	$27,965	$297,784	1,139.31%	-$271,647	
Material	$1,462,141	$1,793,075	$1,739,392	118.96%	-$277,252	
Vehicle			$14,075		-$14,075	
Sum:	**$2,162,041**	**$4,392,886**	**$4,561,856**	**211.00%**	**-$2,399,815**	

Gap Analysis Required on: **Labour**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: **April 24 2024**

Project Execution Supervisor Signoff:

Francis Szto

Name: Francis Szto

Date: **April 24,2024**

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190193-XD124002	X19210 Gerrard Carlaw New Tie Feeders Ph	#	#	27/05/2022	703620	FRANCIS SZTO	#

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Material	$1,462,141	$1,793,075	$1,739,392	118.96%	-$277,252
Vehicle			$14,075		-$14,075
Total:	**$2,162,041**	**$4,392,886**	**$4,561,856**	**211.00%**	**-$2,399,815**

Total Variance

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Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		The Project was DSAP'd in 2019 with white design folder with the new A7EK-A8EK feeders were routed through cable chambers on the south side of Gerrard Street E using empty ducts vacated by the removal of the old A9EK-A10EK and once the new A7EK-A8EK were installed and energized, the existing non-PILC 1000kCmil cables for the existing A7EK-A8EK feeders on the north side of Gerrard Street E would be removed. The cable removal units for existing A7EK-A8EK were planned as cable removal for non-PILC cable per circuit-metres. It was determined that the civil infrastructure where the new A7EK-A8EK were planned to be routed through using the vacated ducts from the old A9EK-A10EK feeders might not be accessible. Based on the site conditions and discussion with Planning Department, a new proposal was made to use the old A9EK-A10EK (planned removal under X18096) as temporary A7EK-A8EK while the existing A7EK-A8EK running on the north side of Gerrard St W in newer civil infrastructure were removed for the installation of the new A7EK-A8EK. Once the new A7EK-A8EK were energized, the temporary A7EK-A8EK (using the old A9EK-A10EK) were removed under this project. The temporary A7EK-A8EK cables were 1000kCmil single conductor PILC cables which could not be paid by circuit-metre removal units. A total approx. 7400m of single conductor 1000kCmil PILC cables were removal resulting in the contactor labour cost increases of approx. $1.66m. The remaining $178K increase came from the following increases: -Term Contract unit price escalation since project was packaged in 2019 and construction started in 2021 ($30K), -Pump and wash of cable chambers due to excessive water ($15K), -Cable testing (10K), Additional T&M units to work inside the station pit ($65K), -Switching costs($3K) and -Additional design/inspection fee due to increase in labour and material costs ($52K). During covid in 2020-2021, the cost of all materials went up by almost 20% which led to the increase in the cost of material planned for this project even though the material quantities especially for the cable were lower by 10% based on the revised drawings . There were also costs for material that the stations team required to complete the transfer($10K) This scope also involved stations engineering and construction crew involvement to complete work at the station level so we can energize the line(Project #P-190012XS175002). In order to capitalize, the station cost was transferred to this project ($289K). The request was approved by Stations and capital projects leaders

Options / Solutions	♦	Inspections should be performed before finalizing the design to avoid design changes	
Recommendation	♦	Contractor to conduct inspections during design to avoid changes and not design in a rush to meet attainments	
Implementation Plan	♦	To discuss importance of proper inspections during design stage	
	♦	**Planned Date of Implementation**	
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

TORONTO HYDRO

Gap Root Report

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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190193-XD124002	X19210 Gerrard Carlaw New Tie Feeders Ph	#	#	27/05/2022	703620	FRANCIS SZTO	#

Labour variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
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	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☒ X	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☐	Overtime (No provision for overtime work)
	☐	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		This scope also involved stations engineering and construction crew involvement to complete work at the station level so we can energize the line(Project #P-190012XS175002). In order to capitalize, the station cost was transferred to this project ($289K). The request was approved by Stations and capital projects leaders
Options / Solutions	♦	Collaborate with PMO to include Stations dependence in the forecast plan and include station spending in capital projects estimates ahead of time
Recommendation	♦	Collaborate with PMO to include Stations dependence in the forecast plan and include station spending in capital projects estimates ahead of time
Implementation Plan	♦	Collaborate with PMO to include Stations dependence in the forecast plan and include station spending in capital projects estimates ahead of time
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed		
All Implementations Completed		

TORONTO HYDRO

Summary Report

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WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190301-ED151001	E20035 Whitehorn Kingslake Rd OH VC SS68	19/04/2022	703623	TSEGAYE BIRRU	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$664,005		$970,937	146.22%	-$306,932
Labour	$23,047		$15,763	68.39%	$7,285
Material	$385,596		$545,045	141.35%	-$159,448
Vehicle	$653				$653
Sum:	**$1,073,301**		**$1,531,744**	**142.71%**	**-$458,443**

Gap Analysis Required on: **Total $$ & Labour**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: 30-Sep-22

Project Execution Supervisor Signoff:

Tsegaye Birru

Name:

Date: **September 30, 2022**

TORONTO HYDRO

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190301-ED151001	E20035 Whitehorn Kingslake Rd OH VC SS68	19/04/2022	703623	TSEGAYE BIRRU	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$664,005		$970,937	146.22%	-$306,932
Labour	$23,047		$15,763	68.39%	$7,285
Material	$385,596		$545,045	141.35%	-$159,448
Vehicle	$653				$653
Total:	**$1,073,301**		**$1,531,744**	**142.71%**	**-$458,443**

Total Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☒	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☒	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☒	Overtime (No provision for overtime work)
	☒	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		1. Site related issues occurred during this project which involved Change Orders to be submitted during the construction timeline. These were related to the various duct work including rerouting, core-drilling, trenching, break and ties, and finally extending the ducts. This was not captured in the design stage of the work mainly due to many years having passed since DSAP was completed. This accounted for approximately $120,000 worth of extra labour and additional material cost. 2. The estimate and design were completed in 2020, which meant there was a requirement to refine the design to account for changes on the system and in the field that were not previously identified. There was a requirement to replace the concrete lids for two locations due the conversion from existing switchgear pad to splice vault, resulting in labour of approximately $135,000. As well as other portions of the project change requiring transformer material changes of up $40,000. 3. Also there was requirement for OT for the school portion of the work, as well as rates/material costs majorly changing from the time of DSAP to the time of the project being done. OT, rate changes, pole removal, cut repairs, and COVID premium portions accounted for $41,965, while the drastic material cost increase accounted for $60,405.

Options / Solutions	♦		1. Discussed with the contractors to ensure we will conduct more thorough inspection during the design stage, to avoid high cost Change Orders required during construction.
Recommendation	♦		2. Worked with PMO and forecasting team to ensure there is a smaller gap between the design and implementation stage of projects. This way we can avoid the design missing changes on the system which need to be accounted for later, and also avoid large rate changes not being accounted for during DSAP, which were especially prominent during the pandemic with premiums and supply chain issues.
Implementation Plan	♦		
	♦	**Planned Date of Implementation**	Sept-30-2022
	♦	**Actual Date of Implementation**	Sept-30-2022
Analysis Completed		Mircea Papuc	
All Implementations Completed	Ongoing		

WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190301-ED151001	E20035 Whitehorn Kingslake Rd OH VC SS68	19/04/2022	703623	TSEGAYE BIRRU	#

Labour variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☒	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☒	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☒	Overtime (No provision for overtime work)
	☒	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		1. Site related issues caused Change Orders being required for further labour for duct work including rerouting, core-drilling, trenching, break and ties, and finally extending the ducts. This was not captured in the design stage of the work mainly due to many years having passed since DSAP was completed. This accounted for approximately $95,000 worth of extra labour. 2. The labour estimate and design were completed in 2020, which resulted in design refinement being required for field issues found that required further labour. Replacing of the concrete lids for two locations due the conversion from existing switchgear pad to splice vault, labour cost of approximately $135,000. 3. Overtime was required in terms of labour for the school portion of the work, as well as labour rates majorly changing from the time of DSAP to the time of the project being done. OT, rate changes, pole removal, cut repairs, and COVID premium portions accounted for approximately $41,965 increase.

Options / Solutions	♦		1. Discussed with the contractors to ensure we will conduct more thorough inspection during the design stage, to avoid high cost Change Orders required during construction.
Recommendation	♦		2. Worked with PMO and forecasting team to ensure there is a smaller gap between the design and implementation stage of projects. This way we can avoid the design missing changes on the system which need to be accounted for later, and also avoid large rate changes not being accounted for during DSAP.
Implementation Plan	♦		
	♦	**Planned Date of Implementation**	Sept-30-2022
	♦	**Actual Date of Implementation**	Sept-30-2022
Analysis Completed		Mircea Papuc	
All Implementations Completed	Ongoing		

TORONTO HYDRO

Gap Root Report

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WBS Element Level 2	WBS Element Level 2 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190301-ED151001	E20035 Whitehorn Kingslake Rd OH VC SS68	19/04/2022	703623	TSEGAYE BIRRU	#

Material Variance

Category of Analysis Note: More than one category may be selected.	☐	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	☒	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☒	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☐	Overtime (No provision for overtime work)
	☒	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)

Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)	1. Site related issues caused Change Orders being required for duct work including rerouting, core-drilling, trenching, break and ties, and finally extending the ducts. This was not captured in the design stage of the work mainly due to many years having passed since DSAP was completed. This required any additional $25,000 worth of secondary and primary cable, and lugs to be ordered. 2. The estimate and design were completed in 2020, which meant there was a requirement to refine the design and order additional material due to field changes not previously found. Portions of the project change required transformer material changes of up $40,000. 3. Material costs majorly changed from the time of DSAP to the time of the project being done. This was mainly the pandemic increasing the costs on the supply chain side of various materials, the material cost increase accounted for $60,405.

Options / Solutions	♦		1. Discussed with the contractors to ensure we will conduct more thorough inspection during the design stage, to ensure accurate material ordering and avoid high cost additional material ordered during construction.
Recommendation	♦		2. Worked with PMO and forecasting team to ensure there is a smaller gap between the design and implementation stage of projects. This way we can avoid the design missing changes on the system which need to be accounted for later, and also avoid large material cost increases not including in DSAP, which were especially prominent during the pandemic with supply chain issues.
Implementation Plan	♦		
	♦	**Planned Date of Implementation**	Sept-30-2022
	♦	**Actual Date of Implementation**	Sept-30-2022
Analysis Completed		Mircea Papuc	
All Implementations Completed	Ongoing		

TORONTO HYDRO

Summary Report

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180710-WD152006	W21065-JAMESTOWN REAR LOT CONV. ELC. PH3	#	#	31/10/2023	703160	ALLISON JENKINS	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$614,752	$929,558	$811,981	132.08%	-$197,229
Labour	$217,209	$215,292	$577,869	266.04%	-$360,660
Material	$402,990	$619,499	$615,120	152.64%	-$212,130
Vehicle	$62,189	$61,302	$99,780	160.45%	-$37,591
Sum:	**$1,297,139**	**$1,825,651**	**$2,104,750**	**162.26%**	**-$807,611**

Gap Analysis Required on: **External, Internal, Material**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: 24/04/2024

Project Execution Supervisor Signoff:

Ekundayo Ashwood

Name:

Date: **24/04/2024**

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180710-WD152006	W21065-JAMESTOWN REAR LOT CONV. ELC. PH3	#	#	31/10/2023	703160	ALLISON JENKINS	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$614,752	$929,558	$811,981	132.08%	-$197,229
Labour	$217,209	$215,292	$577,869	266.04%	-$360,660
Material	$402,990	$619,499	$615,120	152.64%	-$212,130
Vehicle	$62,189	$61,302	$99,780	160.45%	-$37,591
Total:	**$1,297,139**	**$1,825,651**	**$2,104,750**	**162.26%**	**-$807,611**

Total Variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
		Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	X	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
		Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
		External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
		Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
		Overtime (No provision for overtime work)
	X	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
		Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
		Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		As per the below analysis: Total Variance: 836k Total Material Variance: 242k Total Internal Variance: 399k Total External Variance: 195k Total External Variance: Project was delayed multiple years causing rates to increase Jamestown Ph2 (electrical removal and installation) was carved out into this project causing additional required work Total unaccounted for CO's (minus contingency) 315k-120k = 195k
Options / Solutions	♦	Confirm with External crews required labour units before DSAP
Recommendation	♦	Confirm with External crews required labour units before DSAP
Implementation Plan	♦	Confirm with External crews required labour units before DSAP
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed		
All Implementations Completed		

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180710-WD152006	W21065-JAMESTOWN REAR LOT CONV. ELC. PH3	#	#	31/10/2023	703160	ALLISON JENKINS	#

Labour variance

Category of Analysis Note: More than one category may be selected.	x	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)	
		Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)	
		Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)	
		Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)	
		External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)	
		Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)	
		Overtime (No provision for overtime work)	
	x	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)	
		Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)	
		Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)	
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		Project was delayed multiple years causing rates to increase Jamestown Ph2 (electrical removal and installation) was carved out into this project causing additional required work - additional design work : 37k - additional electrical labour: 145k - additional internal inspection 60k	
Options / Solutions	♦	Confirm with internal crews required labour units before DSAP	
Recommendation	♦	Confirm with internal crews required labour units before DSAP	
Implementation Plan	♦	Confirm with internal crews required labour units before DSAP	
	♦	**Planned Date of Implementation**	
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-180710-WD152006	W21065-JAMESTOWN REAR LOT CONV. ELC. PH3	#	#	31/10/2023	703160	ALLISON JENKINS	#

Material Variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
		Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
		Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
		Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
		External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
		Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
		Overtime (No provision for overtime work)
	X	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
		Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
		Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		Project was delayed multiple years causing rates to increase Jamestown Ph2 (electrical removal and installation) was carved out into this project causing additional required work - additional materials required to complete additional work : 241k - additional tools required to complete work: 158k
Options / Solutions	♦	Confirm material units required before DSAP Add contingency for material inflation
Recommendation	♦	Confirm material units required before DSAP Add contingency for material inflation
Implementation Plan	♦	Confirm material units required before DSAP Add contingency for material inflation
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed		
All Implementations Completed		

Summary Report

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190128-XD124006	X20138 Cecil A5A6 Bus LD TRF Civ Part B	#	#	18/09/2023	703623	HACHIN HOWLADER	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$1,707,091	$3,112,449	$2,918,542	170.97%	-$1,211,450
Labour	$29,719	$29,719	$10,127	34.07%	$19,593
Material	$14,462	$14,462	$14,603	100.98%	-$142
Sum:	**$1,751,273**	**$3,156,630**	**$2,943,271**	**168.06%**	**-$1,191,999**

Gap Analysis Required on: Labour

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: 22 February, 2024

Project Execution Supervisor Signoff:

Hachin Howlader

Name:

Date: **22 February, 2024**

TORONTO HYDRO

Gap Root Report

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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190128-XD124006	X20138 Cecil A5A6 Bus LD TRF Civ Part B	#	#	18/09/2023	703623	HACHIN HOWLADER	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$1,707,091	$3,112,449	$2,918,542	170.97%	-$1,211,450
Labour	$29,719	$29,719	$10,127	34.07%	$19,593
Material	$14,462	$14,462	$14,603	100.98%	-$142
Total:	**$1,751,273**	**$3,156,630**	**$2,943,271**	**168.06%**	**-$1,191,999**

Total Variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	X	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☐	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☐	Overtime (No provision for overtime work)
	☐	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		Extra work required due to close proximity of existing utilities such as gas, ttc, hydro one etc. ($330k) 1600 additional hours of traffic control and 250 hrs. of paid duty officer based on city work zone coordinator feedback ($370k) Overtime required due to working near TMU a key accounts customer ($71K) Additional 7.7m of cap & leg tunneling required due to conflict with other utilities ($106K) Additional concrete breakout as well as duct route change resulting in $40K of costs Disposal of contaminated water from site ($41k) Design and inspection costs were prorated to match this increase in labour ($88K) Additional tunnelling, concrete break-out on Gerrard St as well as on Gerrard & Church intersection ($145K)

Options / Solutions	♦		For complex downtown projects have additional buffer due to unpredictable nature of the site.
Recommendation	♦		Update estimate to capture this buffer effectively and have additional traffic support units.
Implementation Plan	♦		Ensure the aforementioned procedures are performed before DSAP
	♦	**Planned Date of Implementation**	22.02.2024
	♦	**Actual Date of Implementation**	22.02.2024
Analysis Completed	22.02.2024		
All Implementations Completed	22.02.2024		

Gap Root Report

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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-190128-XD124006	X20138 Cecil A5A6 Bus LD TRF Civ Part B	#	#	18/09/2023	703623	HACHIN HOWLADER	#

Labour variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
	X	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
		Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
		Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
		External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
		Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
		Overtime (No provision for overtime work)
		Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
		Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
		Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		Extra work required due to close proximity of existing utilities such as gas, ttc, hydro one etc. ($330k) 1600 additional hours of traffic control and 250 hrs. of paid duty officer based on city work zone coordinator feedback ($370k) Overtime required due to working near TMU a key accounts customer ($71K) Additional 7.7m of cap & leg tunneling required due to conflict with other utilities ($106K) Additional concrete breakout as well as duct route change resulting in $40K of costs Disposal of contaminated water from site ($41k) Design and inspection costs were prorated to match this increase in labour ($88K) Additional tunnelling, concrete break-out on Gerrard St as well as on Gerrard & Church intersection ($145K)

Options / Solutions	♦		For complex downtown projects have additional buffer due to unpredictable nature of the site.
Recommendation	♦		Update estimate to capture this buffer effectively
Implementation Plan	♦		Ensure the aforementioned procedures are performed before DSAP
	♦	**Planned Date of Implementation**	22.02.2024
	♦	**Actual Date of Implementation**	22.02.2024
Analysis Completed	22.02.2024		
All Implementations Completed	22.02.2024		

TORONTO HYDRO

Summary Report

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-210141-WD161000	W17061-BenjaminBoake UGReb Ele-85M24 Ph6	#	#	23/11/2023	703620	FANGXIN XU	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$1,627,034	$2,490,673	$2,378,252	146.17%	-$751,218
Labour	$23,987	$24,093	$82,012	341.91%	-$58,026
Material	$267,439	$951,154	$923,583	345.34%	-$656,144
Vehicle			$483		-$483
Sum:	**$1,918,459**	**$3,465,919**	**$3,384,330**	**176.41%**	**-$1,465,870**

Gap Analysis Required on: **Labour & Material**

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: 25/04/2024

Project Execution Supervisor Signoff:

Francine XU

Name:

Date: **25/04/2024**

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-210141-WD161000	W17061-BenjaminBoake UGReb Ele-85M24 Ph6	#	#	23/11/2023	703620	FANGXIN XU	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$1,627,034	$2,490,673	$2,378,252	146.17%	-$751,218
Labour	$23,987	$24,093	$82,012	341.91%	-$58,026
Material	$267,439	$951,154	$923,583	345.34%	-$656,144
Vehicle			$483		-$483
Total:	**$1,918,459**	**$3,465,919**	**$3,384,330**	**176.41%**	**-$1,465,870**

Total Variance

Category of Analysis Note: More than one category may be selected.	☒	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g.,Scope change $ (re - phased); contingencies not accounted for)
	☒	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	☐	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	☒	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
	☐	Externaland Regulatory Factors (City's restriction,policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
	☐	Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	☐	Overtime (No provision for overtime work)
	☐	Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
	☐	Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	☐	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note:Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If nededed, please discuss with your Supervisor.)		1. External Labour - The $ 542 K(approx) is accounted for meter base replacement . We had a meeting in the past with standards and planning to have the deviation of meter base height related to this area, however the height of the meters was not as per standards, we had to replace meterbases for almost entire neighborhood. The contractor designer did not do a good job for field inspeciton during design stage to identify these type of meterbase issue and this was not considered when detail design was finalized. This is the reason for more than 50 Change orders in the project related to meter base change. 2. Due to increase in labour cost for material base , the design fee approx 60K and 30 K Inspection also increased. 3. External Labour - The $110 K account for rate difference, The project was DSAPed with 2021 rates. Project started construction in 2023. The CR 400003436 has explained the variance. 4. Material - $ 582 K - Contractor missed adding primary and secondary cables required for the project at the time of design attainment and later added in Sep 2022. The CR 400003436 has explained the variance. **Note**: Executive Summary for CR 400003436 and supporting document related to meter base changes are attached to this PVA.
Options / Solutions	♦	
Recommendation	♦	*The Contractor Designer needs to do thorough field inspection during design stage instead of fixing issue during construction. This cost variance should be avoided if the designer identified the needs to replace meter base for the entire job. *The Contractor should submit both material units and labour units to THESL for review before finalizing design. Typically, this given contractor only submits labour units to THESL for review before finalizing design. Almost majority of the materials were missed during design finalization stage. They added materials into SAP half years later after design was fainalized without telling THESL. QUA-5172 was issued against this contractor regarding this.
Implementation Plan	♦	* Contractor needs to have thorough field inspection for rebuilt project in residential area, such as meter base * Contractor needs to entera all materials into SAP before finalizing the design.
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed		
All Implementations Completed		

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-210141-WD161000	W17061-BenjaminBoake UGReb Ele-85M24 Ph6	#	#	23/11/2023	703620	FANGXIN XU	#

Labour variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g.,Scope change $ (re - phased); contingencies not accounted for)
	X	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
		Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
	X	Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
		Externaland Regulatory Factors (City's restriction,policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
		Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
		Overtime (No provision for overtime work)
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Root Cause Details (Note:Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If nededed, please discuss with your Supervisor.)		1. External Labour - The $ 542 K(approx) accounted for meter base replacement in this job . We had a meeting with standards and planning to have the deviation, however the height of the meters was not as per standards we had to replace meterbases. Also during the site inspections at design stage it was not noticed by the contractor and that is the reason for more than 50 Change orders in the project as well. 2. Due to increase in labour cost for material base , the design fee approx 60K and 30 K Inspection also increased. 3. External Labour - The $110 K account for rate difference, The project was DSAPed with 2021 rates. Project started construction in 2023. The CR 400003436 has explained the variance.
Options / Solutions	♦	
Recommendation	♦	
Implementation Plan	♦	
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed		
All Implementations Completed		

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-210141-WD161000	W17061-BenjaminBoake UGReb Ele-85M24 Ph6	#	#	23/11/2023	703620	FANGXIN XU	#

Material Variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g.,Scope change $ (re - phased); contingencies not accounted for)
	X	Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
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Root Cause Details (Note:Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If nededed, please discuss with your Supervisor.)		1.Material - $ 582 K - Contractor missed adding primary and secondary cables required for the project at the time of design attainment and later added in Sep 2022. The CR 400003436 has explained the variance.
Options / Solutions	♦	
Recommendation	♦	
Implementation Plan	♦	
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed		
All Implementations Completed		

Summary Report

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Refreshed By	avaliji
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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project D	Construction DRP
P-220035-WD151000	W19044 OH Rebuild 85M26	#	#	21/04/2023	703620	HUZEFA MIKAIL	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$784,600	$1,222,751	$1,222,590	155.82%	-$437,990
Labour	$19,216	$19,218	$33,548	174.58%	-$14,332
Material	$241,096	$375,249	$382,355	158.59%	-$141,259
Vehicle	$503	$503	$789	156.76%	-$286
Sum:	**$1,045,415**	**$1,617,721**	**$1,639,281**	**156.81%**	**-$593,866**

Gap Analysis Required on: Total: Labour & Material

Specify area(s) to analyze (e.g., Labour Variance, $$ Variance, etc.)

Gap Analysis Completion Date: 21 September, 2023

Project Execution Supervisor Signoff:

Huzefa Mikail

Name:

Date: **21 September, 2023**

Gap Root Report

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-220035-WD151000	W19044 OH Rebuild 85M26	#	#	21/04/2023	703620	HUZEFA MIKAIL	#

Cost Category	Planned Cost (DSAP)	Planned Cost (CHKL)	Actual Cost	Variance (% Actual of Estimate)	Total Project Variance
External	$784,600	$1,222,751	$1,222,590	155.82%	-$437,990
Labour	$19,216	$19,218	$33,548	174.58%	-$14,332
Material	$241,096	$375,249	$382,355	158.59%	-$141,259
Vehicle	$503	$503	$789	156.76%	-$286
Total:	**$1,045,415**	**$1,617,721**	**$1,639,281**	**156.81%**	**-$593,866**

Total Variance

Category of Analysis Note: More than one category may be selected.	x	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
		Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
	X	Incorrect or Missed charges (Charges missed or incorrectly classified; i.e. missed charges or recurring ways in which incorrect charges are accured)
		Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
		External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
		Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	x	Overtime (No provision for overtime work)
		Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
		Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
	X	Incorrect/additional material ordered (Materials taken/charged to the project that were not in the original estimate; e.g., double ordering, not taking materials that were in the estimate)
Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		The overall variance for this project was found to be due to the inclusion of COS portion and the carved out portion from the previous phase which could not be completed on time due to two poles (P62 and 58 Stadacona Dr), 1. Carved Out Portion: The location of the two poles being in the middle of Wilson Ave, the contractors were unable to energize the 4kv without completing the riser at these poles as there is no other option to feed from. 2. COS (now DCW) had a project which was to be completed prior to our work starting, as per agreement. However due to customer non-payment, they were unable to do so. With agreement from Engineer, we absorbed that portion to our scope of work. For the COS portion, as it is in the middle of both Ph2 and Ph3 (Between P1 Cadillac on W18077 and P31 Cadillac on W19044; as well as P396 Laurentian on W18077), it was decided with the permission of the Engineer to include this work in W19044 Ph3 project so the overhead cable can be installed and energized without disruption. If the COS portion could not be completed then they would have been unable to energize and continue on both W18077 and W19044 which will result in having both projects incomplete which can pose safety hazards and customer issues.

Options / Solutions	♦	Please see below	
Recommendation	♦		
Implementation Plan	♦		
	♦	**Planned Date of Implementation**	
	♦	**Actual Date of Implementation**	
Analysis Completed			
All Implementations Completed			

Gap Root Report

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WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-220035-WD151000	W19044 OH Rebuild 85M26	#	#	21/04/2023	703620	HUZEFA MIKAIL	#

Labour variance-EXTERNAL

Category of Analysis Note: More than one category may be selected.	x	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
		Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
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		Missed Estimate/Estimate Issue (Missed estimates or other estimate related issue; e.g., refinement of design, discretionary estimate items, detailed design errors(missing/additional units), etc.)
		External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
		Changes from Internal to External (Change from internal to external due to resource or scheduling constraints)
	x	Overtime (No provision for overtime work)
		Rate Changes (Changes in rates such as UPCMS, material, cut repair, etc.)
		Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
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Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		**For P62 Stadacona Dr. location:** •Existing cable was not long enough to meet standard on new pole so it was required to pull new cable to S1 in PT58903 •Duct structure ended at curb line, would not be able to finish duct structure over to new pole •PT58903 is slab on grade, had to change and add new foundation to have proper cable loop •Needed to change out PT58903 if decided to go that route existing pad mount will not cover access hole on new foundation •Cable to S2 at PT58903 was too short and so it was needed to pull new cable into vault room YHF, and was needed to find duct structure at curb line of Wilson and Stadacona Dr to connect both duct structures. **For P58 Stadacona Dr. Location:** •Existing cable had direct buried splice at base of pole so there was a need for splice kits •Duct at this location was direct buried so it was preferred to install splice vault to northwest of pole to splice onto existing cable. Duct that is there goes under patio of Marcelna's restaurant. 1. The total External labor increment for COS portion was **$108,041.88** (Elec+Civil Lab) 2. The change orders for the original project were worth **$134,260.18** This involves: i) Civil Change orders worth $57K including Trenching, Break and Tie, Labor rates etc. II) Electrical Change orders worth $76K which involved Labor units, PDO and UG Cable Termination, Joints & connector units 3. Deferred pole removal labor was found to be worth **$110K** for both Wilson Ph2&3.
Options / Solutions	♦	No work package with formal cost breakdown was provided (was an older scope). Detailed work instructions along with project coordination with other RCs requested
Recommendation	♦	All scopes with older revision dates to be revised
Implementation Plan	♦	RC process implemented to reach out to planning for revision of older scopes
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed		
All Implementations Completed		

WBS Element Level 2	WBS Element Level 2 Description	WBS Element Level 3	WBS Element Level 3 Description	Construction Attained Date	WBS Responsible Cost Center	Designer Project DRP	Construction DRP
P-220035-WD151000	W19044 OH Rebuild 85M26	#	#	21/04/2023	703620	HUZEFA MIKAIL	#

Material Variance

Category of Analysis Note: More than one category may be selected.	X	Change in Scope of Work/Accounting for Contingency (Change in scope of work; e.g., Scope change $ (re - phased); contingencies not accounted for)
		Site related & Coordination Issues (Issues related to the site; includes situation not foreseen prior to construction, as well as, situations that could been avoided with thorough inspection and other actions; also includes project that experienced variance due to coordination issues with customers or other THESL project)
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		External and Regulatory Factors (City's restriction, policy changes from other utilities, etc. that could not be feasible be anticipated at the design stage)
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		Overtime (No provision for overtime work)
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		Assembly Unit (AU)/Compatible Unit (CU) Error (Errors in the breakdown or composition of AUs/CUs)
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Root Cause Details (Note: Please provide enough information to explain the variance, including the associated $ for the variance; e.g., OT is not accounted for in the project and $25k of the variance, apprentices were not included in the estimate and accounts for $20k of extra charges, etc. If needed, please discuss with your Supervisor.)		Due to addition in the scope, the contractor has to add material for the extra work to be done. The additional material was worth $124K for the COS portion.
Options / Solutions	♦	No work package with formal cost breakdown was provided (was an older scope). Detailed work instructions along with project coordination with other RCs requested
Recommendation	♦	All scopes with older revision dates to be revised
Implementation Plan	♦	RC process implemented to reach out to planning for revision of older scopes
	♦	**Planned Date of Implementation**
	♦	**Actual Date of Implementation**
Analysis Completed		
All Implementations Completed		

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO

UNDERTAKING NO. JT3.19:

Reference(s): 2B-AMPCO-48

To provide a breakdown of EV vehicles, 2020-2024, including actual purchase cost.

RESPONSE:

During the 2020 to 2024 rate period, Toronto Hydro purchased 19 fully electric vehicle units at a cost of $2.8 million, shown in Table 1 below. This figure excludes hybrid vehicles.

Table 1: Number and Cost ($ Millions) of Electric Vehicles Purchased in 2020-2024

Description	2020		2021		2022		2023		2024		Total Cost
	No.	Cost	No.	Cost	No.	Cost	No.	Cost	No.	Cost	
Pickup Truck	0	0	0	0	0	0	0	0	7	0.7	**0.7**
Full Size Van - Cargo	0	0	0	0	0	0	1	0.1	5	0.7	**0.8**
Car	5	0.3	0	0	0	0	0	0	0	0	**0.3**
Single Bucket Truck	0	0	0	0	0	0	1	1.0	0	0	**1**
Total	**5**	**0.3**	**0**	**0**	**0**	**0**	**2**	**1.1**	**12**	**1.4**	**2.8**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO CONSUMERS COUNCIL OF CANADA

UNDERTAKING NO. JT3.20:

Reference(s): **Exhibit 2B, Section E8.3**
2B-AMPCO-65
2B-SEC-77

To reconcile the evidence at 2B, E8.3, Table 4 on Page 11, and Table 5 on page 12, compared to 2B-AMPCO-65, Part A, and 2B-SEC-77.

RESPONSE:

As noted in interrogatory response 2B-SEC-77(c), the original Table 4 and Table 5 provided in Exhibit 2B, Section E8.3 at pages 11 and 12 contained summation errors with respect to annual columns and the breakdown of costs across vehicle and equipment categories. The tables provided in 2B-SEC-77(c) and 2B-AMPCO-65(b) for 2025-2029 have corrected these errors and reflect the most current breakdown of units and costs for that rate period. These errors did not affect the aggregate program cost forecast of $43.7 million for 2025-2029.

The tables for 2020-2024 in 2B-SEC-77(c) and 2B-AMPCO-65(a) are different because they provide two distinct sets of data. 2B-SEC-77(c) shows historical actual or near-term annual capital expenditures, whereas the table in 2B-AMPCO-65(a) reflects of the number of vehicle units and their costs when the units are put into service.
As purchases are completed and actual data is collected, these two views will not always match, as some vehicles drive capital expenditures that may be realized in years other than when the vehicle is put in service. For example, many heavy-duty units have several

milestone payments over the course of the purchasing project (e.g. when the chassis is delivered, when the body is installed and when the aerial package is delivered). These lag effects may cause some purchases to drive capital expenditures in certain years such as 2022 and 2023, but not become part of in-service additions until another year, such as 2024.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO CONSUMERS COUNCIL OF CANADA

UNDERTAKING NO. JT3.21:

Reference(s): **1B-CCC-49**

To provide a chart similar to the one at Exhibit 4, Tab 2, Schedule 9, Page 12 for 2020-2024.

RESPONSE:

Table 2: On-going Customer Engagement

Program /Segment	Description of Activities	Annual Costs ($ Millions)				
		2020	2021	2022	2023	2024
Customer Operations – Key Accounts Segment (Exhibit 4, Tab 2, Schedule 8 at Page 22)	Proactive and responsive engagement activities with Key Account customers. Please refer to for more information.	0	0.5	0.8	0.9	1.2
Customer Operations – Customer Connections Segment (Exhibit 4, Tab 2, Schedule 8 at Page 16)	Communications with customers relating to connection and upgrade requests, from intake through the completion process, and general inquiries.	3.7	1.6	1.6	3.2	3.6
Customer Care - Customer Relationship Management Segment (Exhibit 4, Tab 2, Schedule 14 at Page 34)	Communications across various channels to provide customers information in relation to service offerings and the utility's operations.	11.4	11.4	12.1	14.4	15.1
Customer Care - Collections Segment (LEAP) (Exhibit 4, Tab 2, Schedule 14 at page 26).	Application of financial assistance programs such as the Low-Income Energy Assistance Program ("LEAP") and Ontario Energy Support Program ("OESP").	24.9	9.0	7.8	9.6	10.2

<table>
<tr><th rowspan="2">Program /Segment</th><th rowspan="2">Description of Activities</th><th colspan="5">Annual Costs ($ Millions)</th></tr>
<tr><th>2020</th><th>2021</th><th>2022</th><th>2023</th><th>2024</th></tr>
<tr><td>Public, Legal and Regulatory Affairs – Communications and Public Affairs Segment (Exhibit 4, Tab 2, Schedule 18 at page 28)</td><td>Includes channels that facilitate two way communication with customers such as costs for surveys, focus groups, and the Customer Advisory Panel. This also includes town halls and other communications with customers regarding planned capital work.</td><td>3.6</td><td>4.1</td><td>4.1</td><td>5.5</td><td>6.4</td></tr>
<tr><td rowspan="2">Asset and Program Management – System Planning Segment (Exhibit 4, Tab 2, Schedule 9 at Page 12)</td><td>The utility uses the City of Toronto’s development pipeline to engage large customers and developers with upcoming projects to understand their needs, determine their load requirements and timelines, provide technical guidance, explore innovation opportunities, and provide support in understanding the connection process. For more information, about development planning please see coordinate planning Exhibit 2B, Section B.</td><td rowspan="2">5.6</td><td rowspan="2">6.1</td><td rowspan="2">7.5</td><td rowspan="2">8.1</td><td rowspan="2">8.1</td></tr>
<tr><td>Toronto Hydro participates in the Regional Planning process which includes community and stakeholder engagement, including webinars, led by the IESO.</td></tr>
</table>

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT3.22:

Reference(s): **4-Staff-296**

To take Table 1 at 4-Staff-296 and recast that table to include 2020, 2021, and 2022.

RESPONSE:

Table 1: 2020-2025 Actual and Forecast Locate Costs and Volumes

	Actual	Actual	Actual	Forecast	Actual	Forecast	
	2020	**2021**	**2022**	**2023**	**2023**	**2024**	**2025**
Volumes	147,710	134,805	120,234	122,400	133,520	110,400	105,000
Cost ($ millions)	$4.7	$4.4	$5.4	$7.3	$6.9	$6.8	$10.4
Cost Data Source	Table 6	Table 6	Table 6	Table 6	4-SEC-89 (c) and (d)	Table 6	Table 7

Cost data source tables 6 and 7 are from Exhibit 4, Tab 2, Schedule 8.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT3.23:

Reference(s): **1B-VECC-09**

To produce the last year's 12 months worth of reports showing data about customer feedback.

RESPONSE:

Table 1 provides the pre-defined categories as coded by Toronto Hydro's Contact Centre staff upon the conclusion of a call and the major call drivers within each category. Table 2 below reflects the total volume of customer calls by major call category for the most recent 12-month period, in a monthly view.

Table 1: Major call drivers within each Call Category

Major Call Category	Most common call reasons within the category
Accounts	- Account balance and due date requests - Authorized access authorization and changes - Mailing address updates
Billing (Commercial Customers)	- Bill explanations - Security deposit inquiries - Higher than expected bill concerns
Billing (Residential Customers)	- Bill explanations - Higher than expected bill concerns - Bill not yet received inquiries
Conservation Demand Management (CDM) *(category removed Feb. 2024)*	- Inquiries regarding CDM programs

Major Call Category	**Most common call reasons within the category**
Collections	- Late payment notices or auto-dialler calls received - Making a payment - Setting up an arrears payment agreement or other payment plan
Environmental Inquiries *(added in Feb. 2024)*	- Electric Vehicles - DERs
Flat Rate Water Heater Calls	- Water heater conversion inquiries
General Inquiries	- Non-account holder requests - Transfers to other departments - Payment option inquiries
Moves	- Move in/move out - Move confirmations - Customer moves to another address
Online Tools	- Residential self-serve portal inquiries - Commercial self-serve portal inquiries - eBills enrollment or inquiries
Premise	- Meter inquiries - Inquiries related to the customer property
Remittance	- Payment options inquiries - Pre-authorized debit enrollments - Security deposit or credit balance refunds

1 **Table 2: Major Call Categories and Volume of Calls for April 2023 - March 2024**

Call Categories	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	TOTAL	% of TOTAL
Accounts	3,066	3,496	3,243	3,072	3,225	2,622	3,266	3,300	2,727	3,129	2,718	2,819	**36,683**	**11%**
Billing Commercial	419	434	508	496	525	496	489	430	360	639	517	462	**5,775**	**2%**
Billing Residential	2,030	2,675	2,540	2,317	2,963	2,825	2,282	2,176	2,115	2,652	2,378	2,198	**29,151**	**9%**
Conservation Demand Management	-	-	-	2	-	-	-	2	-	-	n/a	n/a	**4**	**0%**
Collections	5,664	9,870	7,943	6,505	8,722	8,093	8,223	5,440	3,729	4,983	5,011	5,780	**79,963**	**24%**
Environmental Inquiries	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3	5	**8**	**0%**
Flat Rate Water Heaters	8	6	-	4	5	9	6	9	2	5	4	4	**62**	**0%**
General Inquiries	6,203	8,886	7,837	6,994	7,454	7,574	8,155	7,422	5,042	6,132	5,456	6,049	**83,204**	**25%**
Moves	4,271	5,599	6,075	5,961	6,955	5,285	4,897	4,836	3,740	4,861	4,722	4,934	**62,136**	**18%**
Online Tools	1,215	1,293	1,312	1,149	1,279	1,181	1,193	1,119	866	1,303	1,033	1,118	**14,061**	**4%**
Premise	285	380	430	319	448	341	350	192	91	127	131	127	**3,221**	**1%**
Remittance	1,981	2,003	1,971	1,843	2,120	1,782	1,931	1,812	1,690	2,105	1,832	2,053	**23,123**	**7%**
TOTAL	**25,142**	**34,642**	**31,859**	**28,662**	**33,696**	**30,208**	**30,792**	**26,738**	**20,362**	**25,936**	**23,805**	**25,549**	**337,391**	**100%**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT3.24:

Reference(s): **N/A**

To describe the communication protocol between Toronto Hydro and the customer with respect to scheduled outages.

RESPONSE:

Toronto Hydro issues its customers communications for planned (scheduled) outages in accordance with section 4.4.7 of the Distribution System Code and section 2.3.2.5 of the utility's Conditions of Service.

Toronto Hydro's Community Relations team[1] communicates with customers and various stakeholders regarding planned capital construction projects. Depending upon the particular circumstances of each communication, such as scope, audience, complexity, or other factors, the utility uses multiple channels, including email, letter, telephone, auto-dialler, face-to-face meetings, newsletters, community meetings, and notices on Toronto Hydro's website. Regardless of the channel, these communications are issued a minimum of 48 hours in advance of the planned outage date.

[1] For more information about this function, please refer to evidence on the Communications and Public Affairs segment of the Public, Legal and Regulatory Affairs program, specifically pages 36-38 of Exhibit 4, Tab 2, Schedule 18.

Once prepared, outage notifications are reviewed by construction crews for accuracy and confirmation of the date and time. Once confirmed, the notifications are scheduled for delivery and released to the target audience.

Appendix A of this undertaking response provides a template of the most commonly used planned outage notice that Toronto Hydro uses to notify impacted customers, with information about the outage date and duration, contact information for customer inquiries, and links to additional resources.

Toronto Hydro-Electric System Limited
EB-2023-0195
Technical Conference
Schedule JT3.24
Appendix A
FILED: April 22, 2024
(1 Page)

Planned Power Outage

TORONTO HYDRO®

HAND-DELIVERED

June 12, 2023

In order for our crews to safely perform maintenance on our equipment, a power outage is required and has been scheduled for **Monday, June 19, 2023.**

THIS POWER OUTAGE IMPACTS ONLY THOSE WHO RECEIVE THIS NOTICE

POWER OUTAGE

OUTAGE DATE[1]	LOCATION
Monday, June 19, 2023	**[Address]**
TIME[2]	**DURATION[2]**
9 a.m. – 12 p.m.	**3 hours**
REASON FOR OUTAGE	
Equipment maintenance	

[1] Should unexpected circumstances arise (inclement weather, equipment failure, etc.), the power outage will be rescheduled to **Tuesday, June 20, 2023** for the same time and duration.
[2] Approximate

IMPORTANT TIPS

- Consider removing your vehicle(s) from your garage if you have an electric garage door opener
- Charge mobile devices prior to the power outage
- Consider charging any electric vehicle prior to the power outage
- Ensure your electric cooktop, stove and other sensitive equipment are turned off prior to the power outage
- Advise your security or fire alarm monitoring agency (if applicable) of the power outage
- Provide unobstructed access to workers at all times and exercise caution around construction areas
- Reset electrical clocks, automatic timers and alarms upon power restoration

QUESTIONS?

COMMUNITY RELATIONS REPRESENTATIVE	PHONE	EMAIL
[Staff name]	**416-542–3366**	**outages@torontohydro.com**

For questions about the outage, please contact the representative listed above. If power is not restored on the day of the outage after the above-noted time period, please call our Power Outage Hotline during regular business hours at **416-542-8000 (press 1).**

Thank you for your patience, cooperation and understanding.

To learn more, scan the code to visit
torontohydro.com/constructionmap

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT3.25:

Reference(s): Exhibit 4, Tab 2, Schedule 1

To provide the number of suite meters installed by year of installation, and the number of units that require seal extensions, 2020-2029.

RESPONSE:

Table 1: Number of Installed Suite Meters 2020-2029

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Suite Meters	4,924	2,974	2,559	3,576	2,581	2,623	2,363	2,131	1,924	1,740

Table 2: Number of Suite Meters Requiring Seal Extensions

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Suite Meters	13,188	4,834	8,208	9,821	11,472	8,977	11,395	13,773	14,402	10,684

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT3.26:

Reference(s): Exhibit 2B, Section E8.3

To provide a fleet asset condition assessment, for the vehicles within a two-year window of replacement, relative to the LCA; to include the vehicle numbers that haven't been included in that assessment.

RESPONSE:

Please refer to Appendix A to this undertaking response, in which column F shows the current condition assessment rating of fleet vehicles within scope of this undertaking and column G shows a description of the relevant condition assessment. The number of vehicles that are not included in this table and make up the balance of Toronto Hydro's current vehicle fleet is 292.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT3.27:

Reference(s): Exhibit 2B, Section E8.3

To show the calculation of the 6.4 years under deterioration in Table 8.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request made by OEB Staff. The scope of the undertaking is to show the calculation of the average fleet age of 6.7 years under the deterioration option in Table 8.

Table 1 below provides shows the estimated average age of vehicles per vehicle category under a managed deterioration approach by 2029, inclusive of the effects of any vehicles replaced between now and 2029 under this scenario. The regular average (mean) of the age of all 451 units that would comprise Toronto Hydro's fleet by 2029 is 6.7 years.

Table 1: Estimated Average Age per Vehicle Category (Managed Deterioration)

	Average Age of M-2029 (Years)
Crane Truck	4.8
Cube Van	3.9
Digger Derrick	4.9
Double Bucket	7.6
Dump Truck	4.0
Line Truck	8.2
Single Bucket	9.1
Single Bucket-Van Mount	6.0
Car	4.3

Cargo Minivan	5.0
Fullsize Van	6.1
Passenger Minivan	4.8
Pick-Up	6.1
SUV	6.7
Equipment	11.0
Trailer	14.6
Total Average Vehicle Age	**6.7**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.28:

Reference(s): **4-SEC-89**

Exhibit 1, Tab 3, Schedule 1

For the table in 4-SEC-89, to show at a high-level changes for 2023 and 2024.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request made by School Energy Coalition. The scope of the undertaking is to provide the information only for 2023.

Figure 1 below shows high-level changes from 2023 Bridge to 2023 Actuals.

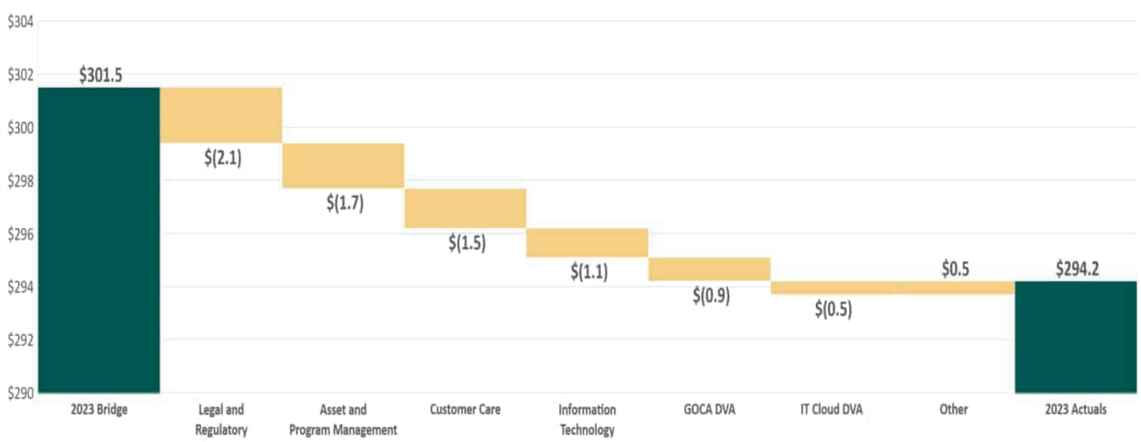

Figure 1: OM&A Causal 2023 Bridge to 2023 Actual

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.29:

Reference(s): **Exhibit 4, Tab 1, Schedule 1**

To explain how the dollar figures related to customer growth were calculated based on the growth in customers for figures 14 and 15, B-1-1.

RESPONSE:

Toronto Hydro noted a classification error in the split between inflation increase and customer growth in Figure 14 (Exhibit 4, Tab 1, Schedule 1). The summation of increase between inflation and customer growth remains unchanged. The split between inflation and customer growth is corrected in Figure 1 below.

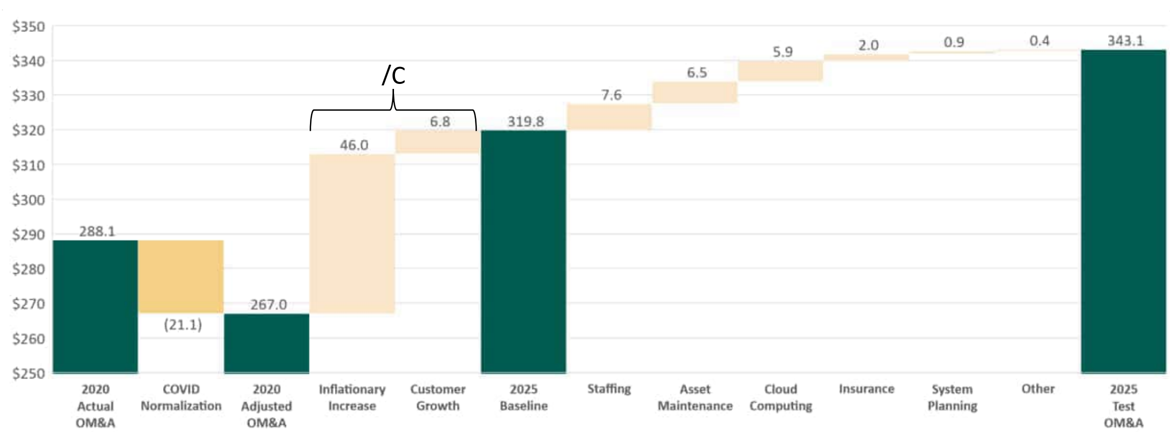

Figure 1: OM&A Causal Track Analysis 2020 Test versus 2025 Test ($ Million)

The following tables set out the calculation of the "customer growth" element of the referenced figures.

Table 1: Customer Growth Calculation 2021-2025 ($ Millions)[1]

	Actual		Bridge		Test	Total Increase
	2021	**2022**	**2023**	**2024**	**2025**	
Inflation (a)	2.2%	3.3%	3.7%	4.8%	2.0%	***N/A***
Customer Growth (b) – *Note 1*	0.6%	0.6%	0.4%	0.4%	0.4%	***N/A***
Combined Escalation (a + b)	**2.8%**	**3.9%**	**4.1%**	**5.2%**	**2.4%**	***N/A***
Opening OM&A (Adjusted for COVID) (c)	**267.0**	**274.5**	**285.2**	**296.9**	**312.4**	***N/A***
Inflation Increase (d = a x c)	5.9	9.1	10.6	14.3	6.2	**46.0**
Customer Growth Increase (e = b x c)	1.7	1.6	1.2	1.2	1.2	**6.8**
Ending OM&A (c + d + e)	**274.5**	**285.2**	**296.9**	**312.4**	**319.8**	**$52.8**

[1]*Numbers may not sum due to rounding*

Table 2: Customer Growth Calculation 2025-2029 ($ Millions)[2]

	Actual	Bridge		Test	Total Increase
	2026	**2027**	**2028**	**2029**	
Inflation (a)	2.0%	2.0%	2.0%	2.0%	*N/A*
Customer Growth (b) – *Note 1*	0.4%	0.3%	0.3%	0.3%	*N/A*
Combined Escalation (a + b)	**2.4%**	**2.3%**	**2.3%**	**2.3%**	***N/A***
Opening OM&A (Adjusted for COVID) (c)	**343.0**	**351.1**	**359.3**	**367.7**	***N/A***
Inflation Increase (d = a x c)	6.9	7.0	7.2	7.3	28.4
Customer Growth Increase (e = b x c)	1.3	1.2	1.2	1.2	4.9
Ending OM&A (c + d + e)	**351.1**	**359.3**	**367.7**	**376.2**	**$33.2**

[2]*Numbers may not sum due to rounding*

Note 1: Please see Table 3 below which shows the calculation of the customer growth rate using the data from OEB Appendix 2-L.

1 **Table 3: Customer Growth Rate Calculation 2021 – 2029**

Year	Number of Customers	Growth Rate (%)
2020 Actual	781,374	-
2021 Actual	786,258	0.6%
2022 Actual	790,699	0.6%
2023 Bridge	794,025	0.4%
2024 Bridge	797,318	0.4%
2025 Test	800,374	0.4%
2026 Forecast	803,334	0.4%
2027 Forecast	806,017	0.3%
2028 Forecast	808,731	0.3%
2029 Forecast	811,245	0.3%

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.30:

Reference(s): 1B-CCC-14

To provide the underlying data and calculations for Figure 1 in 1B-CCC-14

RESPONSE:

Below tables 1 to 3 below which provides underlying data that supports the information in Exhibit 4, Tab 1, Schedule 1, Figure 1 for 2015-2019, 2020-2024 and 2025-2029 rate application periods.

Table 1: 2015-2019 FTE per $1 million CAPEX

	Actual				
	2015	**2016**	**2017**	**2018**	**2019**
FTEs (a) – (Note 1)	**1,483**	**1,484**	**1,473**	**1,425**	**1,386**
Net CAPEX (b) – (Note 2)	491.4	511.6	497.8	435.6	443.0
OEB Inflation Factor (c) – (Note 3)	1.60%	2.10%	1.90%	1.20%	1.50%
2023 Index (d)	0.84	0.86	0.87	0.88	0.90
Inflation Adjusted CAPEX to 2023 (e = b – b * (d – 1))	**571.0**	**585.5**	**561.6**	**486.9**	**489.3**
FTE per $1 Million CAPEX (a / e)	**2.60**	**2.53**	**2.62**	**2.93**	**2.83**

Table 2: 2020-2024 FTE per $1 million CAPEX

	Actual			Bridge	
	2020	**2021**	**2022**	**2023**	**2024**
FTEs (a) – (Note 1)	**1,321**	**1,203**	**1,227**	**1,307**	**1,463**
Net CAPEX (b) – (Note 2)	448.1	533.2	597.9	582.9	625.3
OEB Inflation Factor (c) – (Note 3)	2.00%	2.20%	3.30%	3.70%	4.80%
2023 Index (d)	0.91	0.93	0.96	1.00	1.05
Inflation Adjusted CAPEX to 2023 (e = b – b * (d – 1))	**486.9**	**568.6**	**619.2**	**582.9**	**595.2**
FTE per $1 Million CAPEX (a / e)	**2.71**	**2.12**	**1.98**	**2.24**	**2.46**

Table 3: 2025-2029 FTE per $1 million CAPEX

	Forecast				
	2025	**2026**	**2027**	**2028**	**2029**
FTEs (a) – (Note 1)	**1,531**	**1,572**	**1,596**	**1,617**	**1,631**
Net CAPEX (b) – (Note 2)	728.2	756.7	814.4	823.7	804.8
OEB Inflation Factor (c) – (Note 3)	2.00%	2.00%	2.00%	2.00%	2.00%
2023 Index (d)	1.07	1.09	1.11	1.13	1.16
Inflation Adjusted CAPEX to 2023 (e = b – b * (d – 1))	**678.0**	**688.3**	**723.1**	**713.0**	**678.4**
FTE per $1 Million CAPEX (a / e)	**2.26**	**2.28**	**2.21**	**2.27**	**2.40**

Note 1:

- 2015-2019 FTEs from EB-2018-0165, Draft Rate Order filed January 21, 2020, Schedule 8, OEB Appendix 2-K with 2019 bridge updated for actuals.
- 2020-2029 FTEs from EB-2023-0195, OEB Appendix 2-K.

Note 2:

- 2015-2019 Net Capex from EB-2018-0165, Draft Rate Order Update filed February 12, 2020, Schedule 4, OEB Appendix 2-AB with 2019 bridge updated for actuals.
- 2020-2029 Net Capex from EB-2023-0195, Appendix 2-AB

Note 3:

- 2015-2024 OEB annual inflation factors applicable to electricity distributors.
- 2026-2029 inflation assumed to be 2% annually.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.31:

Reference(s): 1B-SEC-01

Provide revised rate base tables for 2025 to 2029, based on the updated 2023/2024 numbers or to provide the reference in the evidence.

RESPONSE:

Please refer to Table 10 at Exhibit 1B, Tab 1, Schedule 3, page 9 filed April 2, 2024. Toronto Hydro also notes that the 2024 Working Capital Allowance presented in 1B-SEC-01 at Table 1 has been updated to reflect the latest information as presented in Table 9 in Exhibit 1B, Tab 1, Schedule 3, page 9 filed on April 2, 2024.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.32:

Reference(s): 1B-SEC-3

To provide for 2020-2024 referenced in 1B-SEC-3, the full corporate scorecard that shows the correct weightings, the thresholds, the targets, the stretch targets for each.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request made by School Energy Coalition. The scope of the undertaking is to either provide the following requested information or, if Toronto Hydro is not in a position to or has an objection, to advise: the full corporate scorecard that shows the correct weightings, the thresholds, the targets, the stretch targets for each for 2020-2024 as referenced in 1B-SEC-3.

The tables below provide the weight, threshold, target, stretch and year-end results for 2020 to 2024. Toronto Hydro has not provided the result for 2024 as no year-end results are available.

Table 1: 2020 Corporate Scorecard

Metric	Weight	Threshold	Target	Stretch	Result
New Services Connected on Time[1]	5%	92.2%	97.7%	98.9%	**99.7%**
Estimated Time of Restoration	5%	57.0%	60.0%	62.0%	**89%**
First Contact Resolution	5%	80%	86%	88%	**92%**
Total Recordable Injury Frequency	10%	1.5	1.30	1.25	**0.58**
Employee Engagement	5%	5.0	5.5	6.0	**9.0**
SAIFI (Defective Equipment)	10%	0.61	0.50	0.48	**0.40**
SAIDI (Defective Equipment)	10%	32.20	26.47	25.23	**21.82**
In-Service Assets ($M)[2]	10%	$ 418.1	$ 423.1	$ 428.1	**$438.0**
Consolidated Net Income ($M)[3]	10%	$ 141.9	$ 146.9	$ 151.9	**$156.0**
Cash Flow Management ($M)	30%	$ 1,200.0	$ 1,000.0	$ 950.0	**$360.0**

Table 2: 2021 Corporate Scorecard

Metric	Weight	Threshold	Target	Stretch	Result
New Services Connected on Time[1]	5%	93.0%	98.0%	99.0%	**99.9%**
Estimated Time of Restoration	5%	70%	75%	80%	**90%**
First Contact Resolution	5%	80%	86%	88%	**91%**
Total Recordable Injury Frequency	10%	1.20	1.15	1.10	**0.56**
Employee Engagement	5%	6.5	7.0	7.5	**9.4**
SAIFI (Defective Equipment)	10%	0.61	0.50	0.48	**0.46**
SAIDI (Defective Equipment)	10%	32.20	26.47	25.23	**21.35**
In-Service Assets ($M)[2]	10%	$ 415.8	$ 420.8	$ 425.8	**$ 452.3**

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[1] Please note that the trending for this metric included in the business plans provided in response interrogatory 1A-CCC-01 may differ from scorecard results. The trending provide in the business plan are "point in time" results subject to validation/correction.
[2] Refer to Toronto Hydro's response to JTC3.33 for additional details
[3] The scope of the Net Income KPI in 2020-2022 applied certain exclusions and was not necessarily the same as Net Income as per audited financial statements.

Consolidated Net Income ($M)[4]	30%	$ 135.2	$ 140.2	$ 145.2	**$ 156.8**
Cash Flow Management ($M)	10%	$ 514.0	$ 469.0	$ 432.0	**$ 325.0**

Table 3: 2022 Corporate Scorecard

Metric	Weight	Threshold	Target	Stretch	Result
New Services Connected on Time	5%	93.0%	98.0%	99.0%	**99.9%**
Estimated Time of Restoration	5%	80%	85%	90%	**94%**
First Contact Resolution	5%	82%	86%	88%	**92%**
Total Recordable Injury Frequency	10%	1.15	1.10	1.05	**0.47**
Employee Engagement	5%	7.0	7.5	8.0	**10.9**
SAIFI (Defective Equipment)	10%	0.61	0.50	0.48	**0.46**
SAIDI (Defective Equipment)	10%	32.20	26.47	25.23	**20.38**
In-Service Assets ($M)[5]	10%	$ 429.1	$ 434.1	$ 439.1	**$ 450.5**
Consolidated Net Income ($M)	25%	$ 151.0	$ 156.0	$ 161.0	**$ 165.7**
Cash Flow Management ($M)	5%	$ 559.0	$ 532.0	$ 500.0	**$ 655.0**
Fleet Electrification	5%	3%	5%	8%	**9%**
Building Emissions Reduction	5%	2235.7	2213.6	2191.5	**2001.2**

Table 4: 2023 Corporate Scorecard

Metric	Weight	Threshold	Target	Stretch	Result
New Services Connected on Time	5%	93.0%	98.0%	99.0%	**99.9%**
Estimated Time of Restoration	5%	80%	85%	90%	**96%**
First Contact Resolution	5%	82%	86%	88%	**92%**
Total Recordable Injury Frequency	10%	1.05	1.00	0.95	**0.30**
Employee Engagement	5%	7.5	8.0	8.5	**10.5**
SAIFI (Defective Equipment)	10%	0.61	0.50	0.48	**0.33**

[4] The scope of the Net Income KPI in 2020-2022 applied certain exclusions and was not necessarily the same as Net Income as per audited financial statements.
[5] Refer to Toronto Hydro's response to JTC3.33 for additional details

SAIDI (Defective Equipment)	10%	32.20	26.47	25.23	**15.07**
In-Service Assets ($M)[2]	10%	$ 494.7	$ 499.7	$ 504.7	**$ 507.1**
Consolidated Net Income ($M)	30%	$ 128.0	$ 133.0	$ 138.0	**$ 139.9**
Fleet Electrification	5%	11%	13%	15%	**20%**
Building Emissions Reduction	5%	2213.6	2191.5	2145.8	**1657.2**

Table 4: 2024 Corporate Scorecard

Metric	Weight	Threshold	Target	Stretch
New Services Connected on Time	10%	93.0%	98.0%	99.0%
Estimated Time of Restoration	5%	80%	85%	90%
First Contact Resolution	10%	82%	86%	88%
Total Recordable Injury Frequency	10%	1.00	0.95	0.90
Employee Engagement	5%	8.0	8.5	9.0
SAIFI (Defective Equipment Only)	10%	0.61	0.50	0.48
SAIDI (Defective Equipment Only)	10%	30.69	25.23	24.19
In-Service Assets[6]	10%	496.0	501.0	506.0
Consolidated Net Income	30%	100.0	105.0	110.0

[6] Note: The Target for this metric is under review based on 2023 Audited Financials.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.33:

Reference(s): 1B-SEC-03

To provide what's included in in-service additions for the scorecard, as compared to the OEB-approved numbers and your actual numbers provided in the other tables in the evidence.

RESPONSE:

Please see Table 1 below for the OEB approved in-service additions as well as the actual/bridge in-service additions.

Table 1: In-Service Additions (ISA)[1] ($M)

	2020	2021	2022	2023	2024	
Corporate KPI – ISA Actuals/Target	438.0	452.3	450.5	507.1	501.0	
OEB Approved ISA (annual)	527.4	456.2	565.1	565.8	559.1	
OEB Approved ISA (cumulative)	527.4	983.5	1,548.6	2,114.3	2,673.4	**A**
ISA Custom Scorecard Measure Actual/Bridge (annual)	447.9	485.2	554.4	594.2	619.8	
ISA Custom Scorecard Measure Actual/Bridge (cumulative)	447.9	933.2	1,487.6	2,081.8	2,701.6	**B**
ISA Custom Measure Actual/Bridge (cumulative 5-year plan % attainment)	17%	35%	56%	78%	101%	**B/A**

The corporate ISA KPI excludes one or more of the following programs/projects.

[1] 1B-SEC-01, Appendix A

- **Renewable Enabling Improvement ("REI") Investments,** subject to provincial rate recovery and do not form part of rate base;
- **Externally Driven Capital Projects,** driven by third-party relocation requests;
- **Contributions to Hydro One,** driven by the transmitter
- **Streetlighting Investments,** funded by the City of Toronto
- **Customer Choice Initiative,** funded through a new DVA
- **Customer Connections**, exclusion starting in 2022 due to increased variability in timing of expenditures and additions related to this type of demand-driven work

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.34:

Reference(s): 1B-CCC-18

To provide the scan of the Key Performance Indicators in other jurisdictions.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not accurately capture the request made by the School Energy Coalition (“SEC”). The scope of the undertaking is, with reference to 1B-CCC-18, to provide the scan of KPIs in other jurisdictions grouped into the four categories outlined in the OEB’s renewed regulatory framework of customer focused, operational effectiveness, public policy responsiveness and financial performance.

Please see Appendix A for the list of Key Performance Indicators.

OEB Performance Outcome	Performance Category	Description/Examples	HI	WA	MA	NY	UK
Customer Focus	Customer Satisfaction	Survey results (residential, major customer connections)		✓	✓		✓
	Customer Complaints	Complaints lodged		✓			✓
	Customer Engagement	Online data platform use, Bill pay use, mobile app use, text messages, outage map use, hosting capacity map use, marketing impressions made, Green Button etc.	✓		✓		
	Customer Participation	Program participation (DER, DR, etc.), TOU Participation, AMI Opt-Out	✓				
	Customer Service Equity	Language interpretation services, public engagement with vulnerable communities, proportion of vulnerable customers, vulnerable customer satisfaction			✓		✓
	Timeliness	Customers connected on time			✓		
Operations Effectiveness	Reliability & Resilience	SAIDI, SAIFI, CAIDI, CAIFI, MAIFI, unplanned interruptions, planned interruptions, CEMI IEEE Standard, exceptional events, loss of load, total time critical loads are without power, fire and non-fire season outages, worst served customers, physical site security	✓	✓	✓		✓
	Emergency Response Preparedness	Number of employees NIMS certified, number employees that attend Emergency Response Training, Avg Emergency Response Time	✓	✓			
	Peak and Energy Demand	Peak demand and energy demand growth, primary network forecasting accuracy, Peak Demand Reduction, Peak Reduction Target			✓	✓	✓

OEB Performance Outcome	Performance Category	Description/Examples	HI	WA	MA	NY	UK
Operations Effectiveness	Equipment Performance	Overhead equipment failures, transformer utilization, asset resilience (NARM), flexibility procured transformer utilization		✓			✓
	Vegetation and Wildlife Management	Number of trees trimmed, vegetation management completed on time, number of hazard trees removed, miles of wildland urban interface, wildlife guards installed, etc.		✓			
	Infrastructure Upgrades	SCADA upgraded circuit breakers, copper conductors replaced, circuit length added ratio to peak load capacity caused by low carbon tech, transformer capacity released ratio to LCT demand, small copper wire units removed, conductors underground, reclosers installed, # open wire secondary districts removed, # wedge/bail clamps installed, transmission steel replacement poles installed, etc.		✓			✓
	Distributed Energy Resources	DER capability (MW), DER enrolled in grid service programs, DER utilization for grid services, number of users on non-firm connections	✓			✓	✓
	Innovation	To support network innovation that contributes to the achievement of net zero, while delivering real net benefits to network companies and consumers					✓
	Workforce Resilience	Retention, diversity, wellbeing, etc.					✓
Public Policy Responsiveness (Environment)	GHG Emissions	Emissions from: energy delivery systems, plant air emissions, business operations, embodied carbon Types: CO_2, SF_6	✓	✓	✓		✓

OEB Performance Outcome	Performance Category	Description/Examples	HI	WA	MA	NY	UK
Public Policy Responsiveness (Environment)	Carbon Intensity	Emissions intensity in CO2e per year in grams/kWh	✓	✓			
	Emissions Avoided NWA	Annual utility system CO2e emissions avoided through non-pipe, non-wire alternative programs		✓			
	Days Exceeding Health Levels	Weighted average days exceeding health levels		✓			
	Ratio New Gas to New Elec customers	Ratio of new gas customers to new electric customers		✓			
	Home Heating Wood Use	Metric related to decreased wood use for home heating		✓			
	Fluid Filled Cables	A leakage reduction target (in both percentage and liters)					✓
	Climate and Environment Plan	Sets environmental and climate goals; track, measure and report annually against targets and activities related to climate goals			✓		
	LED Lighting Replacement	Achievement of lighting replacement timelines			✓		
Public Policy Responsiveness	Interconnection Timeliness	Total DER interconnection time, IPP interconnection time, solar installation timeliness	✓		✓		
	Interconnection Cost	Cost overrun, expected vs actual cost to interconnect, study deposit, etc.	✓				
	Producer Satisfaction	Survey results	✓		✓		
	Truck Roll Response Time	response times for meter change outs for DER and non-DER customers	✓				
	Peak Load Reduction	Total DER curtailment, Capable DR peak load reduction, actual DR peak load reduction, Load Factor Improvement		✓		✓	

OEB Performance Outcome	Performance Category	Description/Examples	HI	WA	MA	NY	UK
Public Policy Responsiveness	Electric Vehicle Load Management	% load shift to off-peak due to tariff, % EV load subject to managed charging, %EVSE in DR programs, %EVSE in TOU rates		✓			
	EV Growth	Measured energy load, measured demand load, estimated load, EV count, fleet electrification, number of ride share fueling hubs, etc.	✓			✓	
	Energy Efficiency	Incentives for savings tied either to efficiency achievements or clean energy targets				✓	
	Energy Use	Electric usage intensity				✓	
	NWA Costs	NWA Capital Expenditures		✓			
	% Generation in WA or Avista Connected	% Generation in WA or Avista Connected		✓			
	Price Charged at EVSE	Price Charged at EVSE		✓			
	Types of Electric Transport Technology Supported as % of total TE investments	Types of Electric Transport Technology Supported as % of total TE investments		✓			
	Hosting Capacity Map Usage	Hosting Capacity Map Usage Metric			✓		
Financial Performance	Customer Equity	Low income customer program participation; % energy efficiency, DR, DER, and renewable spending on load income communities, etc.	✓	✓			
	Disconnections & Terminations	Disconnections by customer class, low income terminations	✓	✓	✓		

OEB Performance Outcome	Performance Category	Description/Examples	HI	WA	MA	NY	UK
Financial Performance	Customer Affordability	Average bill, Annual bill as % of low income avg income, Average annual bill as a percentage of income by census tract, arrearages for residential and small commercial customers, % and number of customers with high energy bill burden, etc.	✓	✓			
	Revenue Growth	Rate of annual revenue growth, revenue through riders	✓	✓			
	Payment Arrangements	% of low income customers on bill assistance, % customers in payment arrangements	✓	✓			
	NWA	Avoided T&D investment, NWA total cost	✓				
	Rate Base per Customer	Rate Base per customer	✓	✓			
	O&M per Customer	O&M per customer	✓	✓			
	Credit Rating	Credit rating, annual outlook	✓	✓			
	Costs & Expenses	Incremental spending, Annual sum of Energy Cost Recovery Clause ("ECRC") costs, Purchased Power Adjustment Clause ("PPAC") costs, Major Project Interim Recovery/Exceptional Project Recovery Mechanism ("MPIR" and EPRM") costs	✓	✓			
	Diversity	% Suppliers that are minority, woman, or veteran owned, % of Employees and management who are female, non-binary, person of color		✓			
	ROE	Return on equity		✓			

OEB Performance Outcome	Performance Category	Description/Examples	HI	WA	MA	NY	UK
Financial Performance	EV Infrastructure	% of utility owned EVSE, number of charging stations, miles of transport provided by community based orgs		✓			
	# of Customers	Number of customers served		✓			
	Program Participation	Number of residential appliance and equipment rebates provided, Commercial Customer Program Participation		✓			
	Third-Party Generation	Percentage of third-party generation on system	✓				

Hawaii (HI) Source: Docket No. 2018-0088, Decision and Order No. 37787			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Customer Focus	Customer Participation	Program Participation	Number and percent of customers participating in any of the following programs: CERE projects, DER programs, and DR programs
	Customer Engagement	Green Button Connect My Data	Number and percent of customers that have used Green Button Connect My Data to enable sharing of information
	Customer Engagement	Green Button Download My Data	Number and percent of customers that have used Green Button Download My Data
	Customer Participation	TOU Participation	Number and percent of customers participating in time-varying tariffs, by customer class
	Customer Participation	AMI Opt-Out	Percentage of customers opting out of advanced meters
Operations Effectiveness	Reliability & Resilience	Critical Load	Total amount of time that critical loads are without power in a year
	Emergency Response Preparedness	NIMS Certification	Total number of employees completing National Incident Management System Incident Command System 100, 200, and 300 certifications
	Emergency Response Preparedness	Emergency Response Training	Total number of employees that have attended emergency response training, annually

Hawaii (HI) Source: Docket No. 2018-0088, Decision and Order No. 37787			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Operations Effectiveness	Distributed Energy Resources	DER Grid Services Capability	Percentage and total MW of DER systems capable of providing grid services
	Distributed Energy Resources	DER Grid Services Enrollment	Percentage and total MW of capable DER systems enrolled in grid services programs
	Distributed Energy Resources	DER Grid Services Utilization	Percentage and total MW of DER systems enrolled in grid services programs that are being utilized to provide grid services
	Peak and Energy Demand	DER Curtailment	Total MW and MWh of curtailment from DERs, including partial curtailment or power reductions
Public Policy Responsiveness	GHG Emissions	GHG Emissions	GHG emissions in CO2e emissions per year in metric tons, reflecting emissions that both include and exclude biogenic CO2e
	Carbon Intensity	GHG Intensity	Emissions intensity in CO2e per year in grams/kWh, reflecting emissions that both include and exclude biogenic CO2e. Calculated as absolute emissions/total kWh
	Interconnection Timeliness	Total DER Interconnection Time	The Companies' respective average (mean) total number of calendar days to interconnect DER systems <100 kW in size, in a calendar year
	Producer Satisfaction	IPP Experience	Percentage of IPP surveys sent within six months and results provided in full and in summary to the Commission annually

Hawaii (HI) Source: Docket No. 2018-0088, Decision and Order No. 37787			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Public Policy Responsiveness	Truck Roll Response Time	Truck Roll Response Time	Truck roll-related response times, related to steps within the Companies' control, for meter change-outs for DER and non-DER customers, by individual Company
	Interconnection Cost, Timeliness	IPP Interconnection	For each IPP Project with a Power Purchase Agreement approved by the Commission: Location, Technology, Procurement type, Size (MW), Interconnection voltage; Time to interconnect by step (steps both in and out of the Companies' control, to the extent known); RFP unit cost information; Cost to interconnect (original interconnection requirements study deposit, IRS advanced payments, IRS actual costs, system impact study, taxis, company owned interconnection facilities, estimated interconnection costs, actual interconnection costs, delta between estimated and actual costs, etc.)
	Interconnection Cost	Interconnection Cost Overrun	The percentage of times the cost of interconnection has exceeded the estimated cost of interconnection for utility scale IPP projects.
	EV Growth	Fleet Electrification	Total number of the Companies' light-duty EV miles as a percentage of their total light-duty vehicle ("LDV") fleet miles
	EV Growth	Measured EV Load (Energy)	Measurable energy (kWh) delivered at EV charging stations in approved EV tariffs by time period

Hawaii (HI) Source: Docket No. 2018-0088, Decision and Order No. 37787			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Public Policy Responsiveness	EV Growth	Measured EV Load (Demand)	Average demand (kW) attributable to measured EV charging in approved EV tariffs by hour, to be expanded to include any subsequently approved EV tariffs
	EV Growth	Estimated EV Load	Estimated total EV load (kWh), measured by: Number of registered light-duty EVs and average vehicle miles traveled, Average kWh/mile (expected to be approx. 0.31), and Load (kWh) from e-Buses
	EV Growth	EV Count	Total number of registered light-duty
	EV Growth	Ride Share Fueling Hubs	Number of shared fueling hubs for Ride Share Only (with stored energy capabilities)
Financial Performance	NWA	Avoided T&D Investment	Total value ($) of deferred and/or avoided T&D capital investments due directly to the installation or acquisition of an NWA, reported annually by T&D capital investment with a description of the NWA that enabled the deferral, by service territory.
	NWA	NWA Total Cost	Total cost ($) of NWAs deployed by the utility or acquired through a program or procurement, which are owned or operated by the Companies or third-party that defers or avoids T&D capital investment, reported annually by capital investment and service territory
	Low Income Customer Affordability	LMI Energy Burden	Typical and average annual bill as a percentage of low-income average income. LMI = low to moderate income, 150% of the Hawaii Federal Poverty Limit

Hawaii (HI) Source: Docket No. 2018-0088, Decision and Order No. 37787			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Financial Performance	Payment Arrangements	Payment Arrangement	Percent of customers entered into payment arrangements by zip code
	Disconnections & Terminations	Disconnections	Percent of disconnections for non-payment by customer class by zip code
	Credit Rating	Credit Rating	Credit rating of the Companies and annual outlook, including directionality
	Third Party Gen	Third-Party Generation	Percentage of third-party generation on system (measuring total MWs of generation provided by non-utility entities as a percentage of total generation)
	Costs & Expenses	Annual sum of Energy Cost Recovery Clause ("ECRC") costs	Annual recorded metric compared to base year metric increased at the rate of inflation as measured by GDPPI (i.e., maintaining constant real expense)
	Costs & Expenses	Purchased Power Adjustment Clause ("PPAC") costs	Annual recorded metric compared to base year metric increased at the rate of inflation as measured by GDPPI (i.e., maintaining constant real expense)
	Costs & Expenses	Major Project Interim Recovery/Exceptional Project Recovery Mechanism ("MPIR" and EPRM") costs	Annual recorded metric compared to base year metric increased at the rate of inflation as measured by GDPPI (i.e., maintaining constant real expense)
	Rate Base per Customer	Rate Base per Customer	Total rate base ($) per customer for each Company

Hawaii (HI) Source: Docket No. 2018-0088, Decision and Order No. 37787			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Financial Performance	O&M per Customer	O&M cost per Customer	Total utility Operations & Maintenance costs ($) per residential customer for each Company
	Revenue Growth	Annual Revenue Growth	Rate of annual growth for overall authorized revenues compared to inflation, shown as historical record of revenues with GDPPI trend line and showing annual percentage change
	Customer Equity	LMI Program Participation	Number of LMI (low to moderate income) customers participating in each of the following programs, and percentage of program participants in each of the following programs that are LMI: CBRE projects, TOU, DR, and DER

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Customer Focus	Customer Satisfaction	Telephone Service Customer Satisfaction	Customer satisfaction, by class, with telephone service provided by customer service representatives (residential only)
	Customer Satisfaction	Field Service Representative Customer Satisfaction	Customer satisfaction, by class, with Avista’s field service representatives (residential only)
	Customer Complaints	Customer Complaints	Customer Complaints, by class, made to the Commission

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Customer Focus	Customer Satisfaction	% of Customer Calls Answered	Percentage of customers call answered live by a customer service representative within 60 seconds
	Customer Engagement	Number of Outreach Contracts	
	Customer Engagement	Number of Marketing Impressions	
Operations Effectiveness	Reliability & Resilience	SAIDI excluding major events	SAIDI excluding IEEE-defined major events for WA
	Reliability & Resilience	SAIDI all outages	SAIDI all outages for WA
	Reliability & Resilience	SAIFI excluding major events	SAIFI excluding IEEE-defined major events for WA
	Reliability & Resilience	SAIFI all outages	SAIFI all outages for WA
	Reliability & Resilience	CAIDI by feeder classification	CAIDI by feeder classification (rural, suburban, urban)

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Operations Effectiveness	Reliability & Resilience	CAIDI in highly impact communities	CAIDI in highly impacted communities, by census tract
	Reliability & Resilience	CAIFI by feeder classification	CAIFI by feeder classification
	Reliability & Resilience	CAIFI in highly impacted communities, by census tract	CAIFI in highly impacted communities, by census tract
	Reliability & Resilience	CEMI IEEE Standard 1366P-2003, by census track	CEMI IEEE Standard 1366P-2003, by census track
	Reliability & Resilience	CEMI IEEE Standard 1366P-2003 in highly impacted communities	CEMI IEEE Standard 1366P-2003 in highly impacted communities, by census tract
	Emergency Response Preparedness	Avg Emergency Response Time	Average response time to an electric system emergency
	Reliability & Resilience	Fire and Non-Fire Season Outages	Number of outages by category during the Fire Season (June 1-Oct. 1) vs No Fire Season
	Equipment Performance	Overhead Equipment Failures	Number of overhead equipment failures by subcategory (arrestors, capacitor, insulator, fuse, conductor, etc.) during Fire Season (June 1-Oct. 1) vs No Fire Season

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Operations Effectiveness	Vegetation and Wildlife Management	Vegetation Inspections and remediation performed on time	Number and percent of planned pre-season vegetation inspections and remediation performed on time. By Distribution and transmission inspections. # of Miles, % inspected on time, % remediated.
	Vegetation and Wildlife Management	Numbers of Trees trimmed	Number of trees trimmed. By distribution, transmission, and total
	Vegetation and Wildlife Management	Numbers of Hazard Trees Removed	Number of hazard trees removed. By distribution, transmission, and total
	Vegetation and Wildlife Management	Number Trees Replaced through Customer Choice Right Tree Right Place Program	Number of trees replaced through the Customer Choice Right Tree Right Place program
	Vegetation and Wildlife Management	Trees Removed by Customer Request	Number of trees removed through customer requests
	Vegetation and Wildlife Management	Trees removed/trimmed from Fuel Reduction Partnerships	Trees and brush removed and trees trimmed from the Fuel Reduction Partnerships
	Infrastructure Upgrades	Reclosers Installed	Number of reclosers installed. By distribution, fire mode ready, and total
	Infrastructure Upgrades	SCADA Upgraded Circuit Breakers	Number of circuit breakers upgraded with supervisory control and data acquisition

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Operations Effectiveness	Vegetation and Wildlife Management	Miles of Wildland Urban Interface	Miles of Wildland Urban Interface
	Infrastructure Upgrades	# and % Distribution Hardening Projects Planned vs completed	Number and percent of distribution grid hardening projects planned vs completed. # Miles Planned, # Miles Completed, % Complete
	Infrastructure Upgrades	Conductors Underground	Miles of conductors underground
	Infrastructure Upgrades	Copper Conductors replaced	Miles of copper conductor replaced
	Infrastructure Upgrades	Small Copper Wire Units Removed	Number of small copper wire units removed
	Vegetation and Wildlife Management	Wildlife Guards Installed	Number of wildlife guards installed
	Infrastructure Upgrades	# open wire secondary districts removed	: Number of open wire secondary districts removed
	Infrastructure Upgrades	# Wedge/Bail Clamps Installed	Number of wedge/bail clamps at hot tap connection points installed

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Operations Effectiveness	Infrastructure Upgrades	Other Wildfire Plan Metrics	Miles of Distribution Satellite – AiDASH Complete, Acres of Transmission Corridor Clearing Complete, Miles of Transmission LiDAR Complete, Miles of Overhead Distribution Conductor Installed/Replaced, # Steel Poles Installed, # of Fiberglass Distribution Crossarms Installed, # of Distribution Wood Poles Installed, # of Lightning Arrestors Installed, # of Distribution Fire Resistant Mesh Wrap Installed, # of Transmission Wood Pole Fire Resistant Wraps Installed, # of Failed/Damaged Transmission Replacement Poles Installed, # of Transmission Asset Condition/New Project Poles Installed, # of Transmission Steel Replacement Poles Installed: Wildfire Only
Public Policy Responsiveness (Environment)	Carbon Intensity	Carbon Intensity	Carbon intensity CO_2e/MWh; CO_2e/MW*, CO_2e/customer (E & G)
	GHG Emissions	Total Emissions from Energy Delivery Systems	Total CO_2 emissions from energy delivery systems, including customer direct use
	Emissions Avoided NWA	Annual CO_2 Emissions Avoided NWA	Annual utility system CO_2e emissions avoided through non-pipe, non-wire alternative programs
	Days Exceeding Health Levels	Days Exceeding Health Levels	Weighted average days exceeding health levels
	GHG Emissions	Plant Air Emissions	Avista plant air emissions (SO_2, Mercury, Nox, VOC)

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Public Policy Responsiveness (Environment)	Ratio New Gas to New Elec customers	Ratio New Gas to New Elect Customers	Ratio of new gas customers to new electric customers
	Home Heating Wood Use	Home Heating Wood Use	Metric related to decreased wood use for home heating
Public Policy Responsiveness	Electric Vehicle Load Management	% Load Shift to Off-Peak due to TE tariff	Percentage of load shifted to off-peak periods attributable to TE tariff (transportation electrification) offerings by use case
	Electric Vehicle Load Management	% EV Load Subject to Managed Charging	% EV Load Subject to Managed Charging
	Electric Vehicle Load Management	% EVSE in DR programs	% EVSE in DR programs
	Electric Vehicle Load Management	% of EVSE in TOU rates	% of EVSE in TOU rates
	Peak Load Reduction	Capable DR Peak Load Reduction	Peak load reduction capability attributable to demand response programs
	Peak Load Reduction	Actual DR Peak Load Reduction	Actual peak load reductions realized through dispatched DR in top 100 hours

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Public Policy Responsiveness	NWA	NWA Capital Expenditures	Annual capital expenditures avoided through non-wires alternative programs
	% Generation in WA or Avista Connected	% Generation in WA or Avista Connected	Percent of generation located in Washington or connected to Avista transmission
	Price Charged at EVSE	Price Charged at EVSE	Price Avista charges at utility-owned and supported EVSE, by use case
	Types of Electric Transport Technology Supported as % of total TE investments	Types of Electric Transport Technology Supported as % of total TE investments	Types of electric transportation technology supported by a utility portfolio as a percent of total TE investments i.e. micro-mobility, transit, etc.
Financial Performance	Customer Affordability	Average annual bill	Calculated using average billing information for each residential rate schedule, by class, by census tract
	Customer Affordability	Average annual bill as a percentage of income	Calculated using average billing information for residential customers compared to average income by census tract. By class, by census tract
	Revenue Growth	Total revenue occurring through riders	Total revenue occurring through riders and associated mechanisms not captured in the MYRP (multi-year rate plan)
	Customer Affordability	Residential arrearages	By month, measured by location and demographic information (zip code/census tract, KLI customers, Vulnerable Populations, Highly Impacted Communities, and for all customers in total)

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Financial Performance	Customer Affordability	Small commercial customer arrearages	by month, for all customers and measured by location in Vulnerable Populations, Highly Impacted Communities
	Rate Base per Customer	Rate base per customer	Rate base per customer
	O&M per Customer	O&M per customer	O&M per customer
	Revenue Growth	Rate of annual revenue growth	Rate of annual revenue growth compared to inflation
	Disconnections & Terminations	Residential Disconnections	Number and percentage of residential electric disconnections for nonpayment by month, measured by location and demographic information (zip code/census tract, KLI customers, Vulnerable Populations, Highly Impacted Communities, and for all customers in total)
	Disconnections & Terminations	Small Commercial Disconnections	Number and percentage of small commercial customer electric disconnections for nonpayment by month, for all customers and measured by location in Vulnerable Populations, Highly Impacted Communities
	Payment Arrangements	Bill Assistance Participation	Percentage of low-income customers who participate in bill assistance programs
	Customer Affordability	% Average bill of income of low income customers	Average bill as a percentage of low-income customers' average income

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Financial Performance	Customer Affordability	Number Customers with High Energy Burden	Number of households with a high-energy burden (>6%), separately identifying known low income and Named Communities. Known low-income customers are included in total of all customers and may also be included in Named Communities customers.
	Customer Affordability	% Customers with High Energy Burden	Percentage of households with a high-energy burden (>6%), separately identifying known low income and Named Communities
	Customer Affordability	Average excess burden per household	This metric is reported on an annual basis for residential customers that have a high energy (>6%). Average excess burden is calculated after taking into consideration energy assistance.
	ROE	ROE	Ratemaking return on common equity
	Credit Rating	Credit Rating	Utility credit ratings
	Customer Equity	Energy Efficiency Program Participation	Percentage of customers, by class, that participate in energy efficiency programs
	Customer Equity	Low Income Customer Program Participation	Percentage of known low-income customers that participate in demand response, distributed energy resources, or renewable energy utility program
	Program Participation	Commercial Customer Program Participation	Percentage of small commercial customers that participate in demand response, distributed energy resources, or renewable energy utility programs

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Financial Performance	Customer Equity	% Energy Efficiency Spending on Vulnerable Communities	Percentage of utility energy efficiency program spending that benefits highly impacted communities and vulnerable populations
	Customer Equity	% DR, DER, and Renewable Program Spending on Vulnerable Communities	: Percentage of utility spending on demand response, distributed energy resources, and renewable that benefits highly impacted communities and on vulnerable populations. Calculation of this metric is based on spending on renewable generation and DERs located in Named Communities. Calculation does not include spending on electric transportation or energy efficiency as those areas have separate metrics.
	Customer Equity	% Low Income Customer Participation in EV Programs	Percentage of known low-income customers that participate in utility electric vehicle programs, by program
	Customer Equity	% EV Program Spending on Vulnerable Communities	Percentage of utility electric vehicle program spending that benefits highly impacted communities and vulnerable populations
	EV Infrastructure	% of utility-owned EVSE by use case located within named communities	Percentage of utility-owned and supported EVSE by use case located within and/or providing direct benefits and servicing named communities
	Diversity	% Suppliers that are minority, woman, or veteran owned	Percentage of Avista suppliers that are minority-owned, women-owned, or veteran owned

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Financial Performance	Diversity	% of Employees and management who are female, non-binary, person of color	Percentage of Avista employees and senior management (separately identifying: a) c-suite employees and b) directors and employees more senior than directors) who identify as: i) female or non-binary; or ii) as a person of color
	EV Infrastructure	Miles of transport provided by Community Based Orgs	Number of annual passenger miles provided by Community Based Organizations for individuals utilizing electric transportation
	EV Infrastructure	Number of Charging Stations	Number of Public Charging Stations located in Named Communities
	Costs & Expenses	Incremental spending	Incremental spending each year in Named Communities
	# of Customers	# Customers and/or CBOs	Number of customers and/or Community based organizations served
	Program Participation	Residential Appliance and Equipment Rebates	Number of residential appliance and equipment rebates provided to customers residing in Named Communities and the number of residential rebates provided to customers residing in rental units
	Customer Service Equity	Translation Services	Percentage of company engagements available with translation services

Massachusetts Source: DPU 22-22, Final Order, 11.3.22			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Customer Focus	Customer Satisfaction	Overall Customer Satisfaction Metric	The Department directs the Company to include annual reporting on its J.D. Power business customer satisfaction survey results. Measures customer satisfaction using: power quality and reliability; price; billing and payment; corporate citizenship; communications; and customer service. Customer responses to these separate segments are compiled into one final index score
	Customer Satisfaction	Transactional Customer Satisfaction Index	customer satisfaction associated with: (1) unplanned outages; (2) planned outages; (3) website satisfaction; and (4) contact center. The proposed index score would be developed by summing the scores of survey responses from customers following each type of transaction and dividing by the sum of all respondents. (But not integrated into the SQ penalty framework)
	Customer Engagement	Use of Outage Map Metric	In prior years, the metric measured the total number of customer views of the outage map during both “blue sky” conditions and when the Company’s Emergency Response Plan is triggered. The Company proposes to report only on views during ERP events and to report engagements with the outage map as a percentage of total inbound customer communications during these events. The calculation will be done on a per-ERP event basis and then averaged across all ERP events for the year.
	Customer Engagement	Digital Engagement Metric	Tracks the percentage of total customer engagements that are digital, including bill pay, outage reporting, text message interactions, mobile app interactions, outage status checks, and others. Does not include customer service phone calls and manual payments

Massachusetts Source: DPU 22-22, Final Order, 11.3.22			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Customer Focus	Timeliness	New Customer Connects Metric	The % of new customer connects completed in accordance with Company targets for timeliness of new service connections. Measures the time from the creation of a work order to the point of installation of the customer's meter in number of business days. The % of new customer connects that meet certain performance targets out of the total number of new customer connects. (Not included in SQ penalty framework)
	Customer Service Equity	Equity Framework	An equity framework that would be applied to projects in all Environmental Justice ("EJ") communities. The framework: (1) rigorous EJ mapping; (2) identification of stakeholders and focused outreach to those stakeholders; (3) language translation and live interpretation services; (4) public engagement utilizing a variety of communication channels and in multiple languages, as applicable; and (5) collection of feedback
Operations Effectiveness	Peak and Energy Demand	Peak Demand Reduction Metric	Separately track peak demand reductions from six measures: (1) energy efficiency programs; (2) demand response programs; (3) company-owned storage; (4) company-owned solar; (5) upgrades to standard technologies; and (6) volt/volt-ampere reactive optimization
	Reliability & Resilience	Momentary Average Interruption Frequency Index ("MAIFI")	Reporting will be limited to devices with SCADA visibility until advanced metering infrastructure ("AMI") meters are deployed.
	Reliability & Resilience	SAIFI and SAIDI	Capture all customer interruptions and customer interruption duration without excluding major event days
Public Policy Responsiveness (Environment)	Climate adaption and mitigation plan	Climate Adaptation and Mitigation Plan	Bringing renewable energy to the region and reducing the Company's own emissions. NSTAR Electric proposes continued development of a substation flood vulnerability

Massachusetts Source: DPU 22-22, Final Order, 11.3.22			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
			model, evaluation of new equipment to improve performance in flooding conditions, and augmentation of the Company's outage prediction model to include climate impacts . Commission: "While we approve the climate adaption and mitigation plan, we direct the Company in its annual PBR filing to include a demonstration of how the plan is aligned with the objectives of the Commonwealth's decarbonization policies, including applicable sector-specific interim targets and sub-limits"
Public Policy Responsiveness (Environment)	LED Lighting Replacement	LED Lighting Replacement	Timeframes (all Eversource facilities lighting upgraded by end of calendar year, all non-LED S-1 lighting to be phased out in 2 years). In its annual PBR filings, the Company shall report on its compliance with these timelines; if the Company does not meet these timelines, it shall report on the percentage of S-1 lighting categories of (a) LED and (b) non-LED.
Public Policy Responsiveness	Producer Satisfaction	Producer Satisfaction Survey	The producer satisfaction survey will measure producer satisfaction associated with: (1) ease of enrollment; (2) ease of connection; (3) timeliness; and (4) helpfulness and communication during the interconnection process, before and after interconnection. Total satisfaction reported on a scale of one to ten. (Not included in SQ penalty framework)
	Hosting Capacity Map Usage Metric	Hosting Capacity Map Usage Metric	Measure the sum of visits to the Company's DG hosting capacity websites
	Interconnection Timeliness	Solar Development Timeline Metric	Measures the duration in business days from creation of a solar installation work order to completion, and then will calculate the percentage of solar installations meeting certain timeline performance targets by dividing the number of solar installations that meet the targets by the total number of solar installations

Massachusetts Source: DPU 22-22, Final Order, 11.3.22			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Financial Performance	Disconnections & Terminations	Low-Income Terminations Metric	Provide reports on low-income customer service terminations (for nonpayment and for accounts with past due balances at levels eligible for disconnect) by census tract

UK Ofgem Approved Metrics Source: RIIO-ED2 Final Determinations Core Methodology Document, 11.30.22			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
	Customer Satisfaction	Customer Satisfaction Survey	Scores based on three weighted surveys: general enquiries survey (20%), connections survey (50%) and supply interruptions survey (30%)
Customer Focus	Customer Complaints	Complaints Metric	Score based on four weighted indicators: complaints unresolved after one day (10%) complaints unresolved in 31 days (30%) repeat complaints (50%) the number of Energy Ombudsman decisions that go against the DNO (as a percentage of total complaints) (10%)
	Customer Service Equity, Customer Equity	Consumer Vulnerability Incentive	To assess companies' performance against our key principles and baseline expectations for consumers in vulnerable situations, and the delivery of their vulnerability strategies. This included using the following five metrics to measure DNO performance: • the proportion of customers registered on a DNO's PSR (priority services register) out of the total eligible customers in its region(s), which we refer to as PSR Reach (weighting in total score: 40%) • the value delivered as a result of DNOs providing fuel poverty support services (20%) • the value delivered as a result of DNOs supporting customers at risk of being left behind in the energy system transition (20%)

UK Ofgem Approved Metrics Source: RIIO-ED2 Final Determinations Core Methodology Document, 11.30.22			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
			• the customer satisfaction of customers who have received fuel poverty support services (10%) • the customer satisfaction of customers who have received support to ensure no one is left behind in the energy system transition. (10%)
Customer Focus	Customer Service Equity	Annual Vulnerability Report	Includes: • Performance metrics • Regularly Reported Evidence • Use of Social Value Framework • Strategy commitments delivery progress update • Winter preparedness to support those vulnerable during a loss of supply
	Customer Satisfaction	Major Connections	Major connection customers' overall satisfaction with DNOs in providing connections to their networks
Operational Effectiveness	Innovation	Whole System	Whole system minimum requirements as part of Stage 1 of the BPI. We will retain the focus on whole system solutions in our innovation stimulus, requiring DNOs to consider whole system approaches when formulating their innovation proposals. To support network innovation that contributes to the achievement of net zero, while delivering real net benefits to network companies and consumers
	Peak and Energy Demand	Primary network forecasting accuracy	Compares the accuracy of the forecast maximum demand MW in the Long Term Development Statement (LTDS) with the outturn reported in the Load Index (LI) reporting pack for each primary substation.
	Reliability & Resilience	Network Options Assessment outcomes	Reports the outcomes from the Network Options Assessment for each scheme as a % of the total against standardized categories (e.g. flexibility, reinforcement + flexibility, reinforcement, no action).

UK Ofgem Approved Metrics Source: RIIO-ED2 Final Determinations Core Methodology Document, 11.30.22			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Operational Effectiveness	Distributed Energy Resources	Curtailable connections	Number and capacity (MW) of users on non-firm connections.
	Equipment Performance	Transformer Utilization	Designed to control against sub-optimal reinforcement in transformers. The metric checks that works are occurring within areas of projected 'high' utilization. A tolerance of 10% of capacity additions in 'low' utilization bands will be permitted under the metric to account for situations where it is justified, or necessary for safety reasons, to invest in transformers with a utilization below 100%.
	Infrastructure Upgrades	Transformer capacity released ratio	Checks that transformer capacity additions (broken down by PMTs and GMTs) are proportional to changes in LCT demand, by measuring the ratio of net transformer capacity additions to the increase in peak load capacity for transformers caused by new LCT demand.
	Infrastructure Upgrades	Circuits length added ratio	Checks that the addition of circuit length (broken down by OHL and cables) is proportionate to changes in LCT (low carbon technologies) demand, by measuring the ratio of additions to the increase in peak load capacity caused by new LCT demand.
	Peak and Energy Demand	Peak demand growth and energy growth indices	Measures the change over time in the peak load and energy volume measured at the discrete points where LV monitoring equipment has been installed on the network. The metric monitors whether year on year growth is positive, with an error being produced if it is negative
	Equipment Performance	Flexibility procured transformer utilization metric	is designed to control against sub-optimal procurement of flexibility for deferring investment in PMTs and GMTs. The metric checks that flexibility is being procured for PMTs and GMTs with 'high' projected utilization.
	Reliability & Resilience	Values of Loss of Load	Introduce a single figure for VoLL, updating the RIIO-ED1 figure in line with inflation. Update incentive rates to reflect VoLL and the latest view of average consumption

UK Ofgem Approved Metrics Source: RIIO-ED2 Final Determinations Core Methodology Document, 11.30.22			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
			and GB CMLs. Move to an incentive with a cap of 150BPs of RoRE and a collar of 250BPs of RoRE
Operational Effectiveness	Reliability & Resilience	Unplanned Interruptions	Amend the CML (customer minutes lost) target setting methodology to be consistent with the CI (customer interruptions) methodology and apply. Retain improvement factors to ensure DNOs strive to deliver further reliability improvements, applying three levels set relative to DNO benchmarks (0.5%, 2% and 4%).
	Reliability & Resilience	Exceptional Events	Performance under the IIS (interruptions incentive scheme) in these circumstances is discounted to recognize the impact of these events. Severe Weather Exceptional Event (SWEE) threshold and Other Exceptional Event (OEE) eligible events
	Reliability & Resilience	Short Interruptions	DNOs to report agreed SI dataset annually as part of regulatory reporting process
	Equipment Performance	Asset Resilience	As measured through the Network Asset Risk Metric (NARM)
	Workforce Resilience	Workforce Resilience	Requiring each DNO to prepare and report their progress against a workforce resilience strategy will ensure they focus on important issues around diversity and inclusion (gender, ethnicity, disabilities, age ranges); workforce attraction and retention (number of applicants, time to fill, percentage filled internally vs external hires, retirement age, voluntary staff turnover, length of service, reasons for leaving, redundancy, reasons for absenteeism); staff wellbeing and having a future focused workforce (employee participation in upskilling, multiskilling or new skill training)

UK Ofgem Approved Metrics Source: RIIO-ED2 Final Determinations Core Methodology Document, 11.30.22			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Public Policy Responsiveness (Environment)	GHG Emissions	Annual Environmental Report	Track, measure and report annually against targets and activities as set out in their EAPs using methodologies approved by Ofgem. This will include key performance indicators as well as efforts towards a longer-term plan to net zero by 2050. Report on bespoke commitments as it relates to their EAPs. Submit their AER to Ofgem annually as well as publish on their respective websites.
	GHG Emissions	Business Carbon Footprint (BCF)	reducing emissions from building energy use, operational and business transport, carbon offsetting or removal, and temporary generation
	Fluid filled cables	Fluid-filled cables (FFC)	a leakage reduction target (in both percentage and liters) and the number of km of cable expected to be replaced during RIIO-ED2.

New York Approved Metrics Source: Order Adopting a Ratemaking and Utility Revenue Model Policy Framework, Case 14-M-0101, 5.19.2016 Source: Order Adopting Terms of Joint Proposal and Establishing Electric and Gas Rate Plan, Case 20-E-0428, 11.18.2021 Source: 2021 Con Edison Earning Adjustment Mechanism Achievement Report, Case-19-E-0065 and 19-G-0066, 6.30.2022 Source: Order Adopting Terms of Joint Proposal and Establishing Electric and Gas Rate Plan, Case 19-E-0065 and 19-G-0066, 1.16.2020			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Operational Effectiveness	Peak and Energy Demand / Peak Load Reduction	Peak Reduction Target	Incentives for reducing system peaks
Public Policy Responsiveness	Peak Load Reduction	Load Factor Improvement	Incentives for improving (raising) the load factor on the system
	EV Growth	Energy Efficiency Achievements	Incentives for savings tied either to efficiency achievements or clean energy targets
	Energy Efficiency	Energy Efficiency Achievements	Incentives for savings tied either to efficiency achievements or clean energy targets
	Energy Efficiency	Energy Efficiency Achievements	Measures and incentives in place based upon specific programs in place that are under the utility's control
	Energy Use	Electric Usage Intensity	Metric tied to system-wide usage intensity

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.35:

Reference(s): 1B-SEC-19

Referring to 1B-SEC-19a, to inquire with ScottMadden and provide additional information about the components of the respective rate and regulatory frameworks in their jurisdiction review; to clarify their definition of IRM.

RESPONSE (PREPARED BY TORONTO HYDRO):

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request made by the School Energy Coalition. The scope of the undertaking is to update the chart in 1B-SEC-19, to include information about the general rate framework for each Utility/Jurisdiction.

RESPONSE (PREPARED BY SCOTTMADDEN):

There are four general types of rate frameworks:

A. Rates based on projected/ historical cost of service
B. Rates based on cost of service but supplemented with alternative cost recovery mechanisms, such as trackers or riders
C. Rates based originally on cost of service and adjusted over time to reflect cost forecasts, indexed trends in utility costs, or a combination of the two
D. Rates established based on achieving certain performance metrics

Rate frameworks have evolved over time to be complements to cost-of-service regulation, rather than complete substitutes. Therefore, the regulatory frameworks listed in the table below represent hybrid approaches that share features of the four general types of rate frameworks listed above.

Utility (Jurisdiction)	Framework Overview
ATCO Electric (Alberta)	**Regulatory Framework:** B,C **ARM:** Formulaic approach linked to average historical capex; indexed O&M **Cost Recovery**: Capital trackers for costs related to extraordinary events or net-zero laws **PIM:** None **Innovation Funding:** None
SDG&E (CA)	**Regulatory Framework:** B,C **ARM:** Uses utility-specific cost index for O&M rather than general inflation; capital investments based on an escalated seven-year historic and forecast average of capital additions **Cost Recovery**: Various two-way balancing accounts and riders, such as AMI balancing account **PIM:** IDER Pilot **Innovation Funding:** Rate Rider (Public Purpose Programs)
PG&E (CA)	**Regulatory Framework:** B,C **ARM:** Uses utility-specific cost index for O&M rather than general inflation; most capital costs escalated using utility specific cost index ; certain capital costs (that are "unique and not appropriately projected with any available index mechanism") forecasted in post-test years **Cost Recovery**: Various two-way balancing accounts and riders **PIM:** IDER Pilot **Innovation Funding:** Rate Rider (Public Purpose Programs)
Hawaiian Electric (HI)	**Regulatory Framework:** B,C,D **ARM:** Annual revenues adjusted using indexed formula **Cost Recovery**: EPRM and various riders **PIM:** 3 reward only performance incentives; 2 symmetrical performance incentives **Innovation Funding:** "Pilot Process" recovers innovative pilot costs through annual target revenues
Ameren (IL)	**Regulatory Framework:** A, D **ARM:** To be determined (MYRP rate case decision pending) **Cost Recovery**: To be determined (MYRP rate case decision pending) **PIM:** 8 symmetrical performance incentives **Innovation Funding:** "Pilot Process" recovers innovative pilot costs through annual target revenues
Central Maine Power (ME)	**Regulatory Framework:** A,D **ARM:** Forecast O&M and capital **Cost Recovery**: No alternative cost recovery mechanisms **PIM:** 6 penalty-only service quality metrics

Utility (Jurisdiction)	Framework Overview
	Innovation Funding: None
Eversource (MA)	**Regulatory Framework:** B,C,D **ARM:** O&M adjusted annually by I-X ; K-bar for supplement capital funding based on average historical capex **Cost Recovery**: 10% variance allowed for forecasted capital budget; Forecast excludes certain capital projects, such as solar investments, meter-related capital, and grid mod, eligible for recovery through other rate mechanisms outside of base rates **PIM:** 7 penalty-only service quality metrics; reward-only energy efficiency metric **Innovation Funding:** None
Xcel (MN)	**Regulatory Framework**: A,B **ARM:** Forecast O&M and capital **Cost Recovery**: Various riders/trackers to recover various pass-through costs, related to energy efficiency, services for specific customer classes, and environmental improvement, among other areas. **PIM:** None (tracking-only metrics) **Innovation Funding:** None
PSE&G (NJ)	**Regulatory Framework:** A,B **ARM:** N/A – no MYRP **Cost Recovery**: Multiple trackers, including Energy Strong **PIM:** None **Innovation Funding:** None
Con Edison (NY)	**Regulatory Framework:** B,C,D **ARM:** Forecast O&M and capital (used in settlements) **Cost Recovery**: Multiple riders, such as the Systems Beneift Charge **PIM:** 7 reward-only incentives (based on 2020 rate case) **Innovation Funding:** Rate Rider for REV demonstration projects
National Grid (NY)	**Regulatory Framework:** B,C,D **ARM:** Forecast O&M and capital (used in settlements) **Cost Recovery**: Multiple riders, such as the Systems Beneift Charge **PIM:** 9 reward-only incentives **Innovation Funding:** Rate Rider for REV demonstration projects
Duke Energy (NC)	**Regulatory Framework:** B,C,D **ARM:** Commission-authorized "step-ups" in revenue requirements for incremental capital spending projects and associated O&M for each year of the MYRP **Cost Recovery**: Multiple riders, such as the Systems Beneift Charge **PIM:** 1 penalty-only metric; 2 reward-only metric **Innovation Funding:** Rate Rider for REV demonstration projects
Nova Scotia Power (NS)	**Regulatory Framework:** A, B **ARM:** Forecast O&M and capital **Cost Recovery**: Various riders

Utility (Jurisdiction)	Framework Overview
	PIM: None **Innovation Funding:** Rate Rider
AEP (OH)	**Regulatory Framework:** A,B **ARM:** N/A – no MYRP **Cost Recovery**: Various riders, such as the Enhanced Service Reliability Rider **PIM:** None **Innovation Funding:** None
PECO (PA)	**Regulatory Framework:** A,B **ARM:** N/A – no MYRP **Cost Recovery**: Various riders, such as the Distribution System Improvement Charge **PIM:** None **Innovation Funding:** None
Rhode Island Energy (RI)	**Regulatory Framework:** B,D **ARM:** Forecast O&M and capital **Cost Recovery**: Various adjustment provisions, such as the Infrastructure, Safety, and Reliability Provision **PIM:** 4 service quality penalty-only metrics; 1 demand reduction reward-only metric **Innovation Funding:** None
UK RIIO	**Regulatory Framework:** B,C,D **ARM:** Forecast O&M and capital (building blocks method) **Cost Recovery**: Uncertainty mechanisms **PIM:** 10 symmetrical performance incentives **Innovation Funding:** Multiple funding mechanisms, including the Strategic Innovation Fund and the Network Innovation Allowance
Green Mountain Power (VT)	**Regulatory Framework:** B,C **ARM:** Hybrid ARM approach with forecasted CAPEX capped over the plan period and OPEX treated in one of three ways: forecasted and capped, capped and tied to an external inflation index, or reforecast annually **Cost Recovery**: Various riders **PIM:** None (tracking-only metrics) **Innovation Funding:** Recovers innovative pilot costs through annual target revenues

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.36:

Reference(s): **1B-PP-19**

Referring to 1-PP-19B, the table showing innovation funds, to in each jurisdiction who within the regulatory process determines what projects or initiative gets funding, and if there's specific approval criteria and, if there are, what are they.

RESPONSE:

Please refer to the table below.

Innovation Fund	Eligibility Criteria	Governing Body
UK RIIO	**Strategic Innovation Fund** 1) Address the Innovation Challenge set by Ofgem; 2) Clearly identify potential to deliver a net benefit to customers; 3) Involve network innovation; 4) Must not undermine the development of competitive markets; 5) Be innovative, novel, and/or risky; 6) Include participation from stakeholders; 7) Provide value for money and be cost competitively; 8) Have a robust methodology to progress in a timely manner **Network Innovation Allowance** 1) Facilitate energy system transition and/or benefit consumers in vulnerable situations; 2) Potential to deliver a net benefit to consumers; 3) Involve research, development, and demonstration; 4) Develop new learnings; 5) Be innovative; 6) Not lead to unnecessary duplication	Ofgem determines project funding for SIF and network innovation allowances (NIA)
New York REV	REV Demonstration Projects should do the following: 1) Include partnerships between utilities and third-party service providers; 2) Identify questions/problems it hopes to answer, and the market should respond with solutions; 3) Delineate how the economic value is divided between the customer, utility, and third-party provider; 4) The market for grid services should be competitive; 5) Propose rules to create competitive markets; 6) Inform pricing and rate modifications; 7) Consider deploying advanced distribution systems; 8) Explore opportunities to work with various types of customers	NY DPS

Nova Scotia	Criteria is justified based on the expectation the projects will provide customer value in some or all of the following areas: 1) Reduce upward pressure on revenue requirement; 2) Provide reliability and grid stability; 3) Support environmental and other government policy compliance; 4) Improve customer experience In addition, innovation capital investments may be justified on the basis that they are reasonably expected to allow for testing before deploying at scale, provide valuable data and learnings, or aid in the development of business cases where applicable	Nova Scotia Utility and Review Board
California EPIC	Projects that support one or more of the following goals: 1) Transportation electrification; 2) Distributed energy resource integration; 3) Building decarbonization; 4) Achievement of 100% net-zero carbon emissions and coordination of the role of natural gas; 5) Climate Adaptation	CPUC

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.37:

Reference(s): **4-AMPCO-84**
4-SEC-116

To provide a revised version of those tables that show the total number of employees in each of the four categories from the AMPCO-84a management, executive, union and non-union, and the total amounts that are benchmarked; and then the total amount of compensation that was part of the benchmarked amounts in those categories.

RESPONSE (PREPARED BY TORONTO HYDRO):

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request made by the School Energy Coalition. The scope of the undertaking is to provide revised versions of tables 1 and 2 in 4-SEC-116 that show the total number of employees in the categories used in 4-AMPCO-84: management, executive, union and non-union, and the total amounts that are benchmarked. In addition, to provide the total amount of compensation that was part of the benchmarked amounts in those categories.

RESPONSE (PREPARED BY MERCER):

The table below reflects a revised version of the information provided by Mercer, in the response to question A in 4-SEC-116, across Toronto Hydro’s defined Non-Executive Management, Union and Non-Union Non-Management categories (consistent with the above categories in response to 4-AMPCO-84(A)). We note that the scope of the Mercer Study only included benchmark jobs in PWU, Society and Non-Union – Executive jobs were not within the scope of the Study.

Employee Group	Total Employees	Total Employees in Benchmarked Jobs
Union	634	529
Non-Executive Management	70	17
Non-Union Non-Management	477	257

Regarding actual total compensation, the Mercer Study captured total remuneration/ compensation which included base salary (reflects Toronto Hydro's salary structure job rates), target short-term incentive, pension and benefits. Actual payments made to employees were not the basis of the Mercer Study, and so Mercer is not able to respond to the request regarding actual total compensation.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.38:

Reference(s): 4-SEC-116

To respond with more detail to AMPCO-34C, including the methodology and results.

RESPONSE (PREPARED BY TORONTO HYDRO):

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request made by the School Energy Coalition. The scope of the undertaking is, in reference to 4-SEC-116(c), to provide a step-by-step explanation of how estimates were reached and all supporting calculations (including numbers).

RESPONSE (PREPARED BY MERCER):

Below is a detailed description of the steps used to calculate Toronto Hydro's estimated 2022 total dollar difference.

- **Step 1:** Leveraging the findings in the Mercer Study, the dollar difference between Toronto Hydro and the market median for the Energy peer group, for each grade, was determined.
  For illustrative purposes, if Toronto Hydro's total remuneration/compensation for benchmark jobs in grade 5 was \$50K and the average market 50th percentile was \$45K, then the dollar difference between Toronto Hydro's grade 5 and the market median is \$5K.
- **Step 2:** Calculate the total dollar difference for each grade by multiplying by the total number of employees, in each grade, in the Study. Note that,

as outlined in the Mercer Study, Society and PWU were not broken down by grades.

Continuing with the illustration above, if Toronto Hydro has 10 employees in grade 5, the total dollar differential for grade 5 would [$5K x 10] = $50K

- **Step 3:** The total dollar differential for each grade was calculated and summed up to determine Toronto Hydro's estimated total dollar difference for 2022.

The approach for calculating Toronto Hydro's total dollar difference to the market competitive range is similar to the steps outlined above. However, there is a slight difference in approach, as outlined below:

- In Step 1 above, Mercer calculated the upper end of the market competitive range by increasing the market 50th percentile by 5%.
- The upper end of the market competitive range was then used to calculate the total dollar difference, by grade, as outlined in the subsequent steps above.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.39:

Reference(s): 4-SEC-116

To ask Mercer why they were able to make a compensation study in the JRAP proceeding, and why they can't do a similar compensation study in this case.

RESPONSE (PREPARED BY TORONTO HYDRO):

In reviewing the transcript, Toronto Hydro notes that this undertaking does not fully capture the request made by the School Energy Coalition. The scope of the undertaking is to explain why Mercer was able to provide a similar analysis in the JRAP proceeding (with reference to E-SEC-212 and JT5.10.20), but cannot provide a similar analysis here up to 2029 (as requested in 4-SEC-116).

RESPONSE (PREPARED BY MERCER):

The referenced information for HONI relates to a Mercer Study addendum based on a specific request by the Ontario Energy Board in that case for a forecast Study to assess the utility's likely benchmark positioning as of the end of the future rate period. As such, the addendum Study was separate from the Compensation Review Study and specifically focused on future compensation forecasts. Mercer has not conducted a similar forecast Study for Toronto Hydro, as mentioned in our response to 4-SEC-116. We are therefore unable to provide an estimated dollar difference beyond the current year of the Study. The Mercer Study conducted for Toronto Hydro was not designed to be forward looking – its purpose was to assess the competitive positioning of Toronto Hydro, on an overall basis, as of the time of the study.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.40:

Reference(s): **Exhibit 2B, Tab 4, Schedule 4**

To inquire of Mercer, for the PWU positions specifically, the total employees in those positions of Toronto Hydro compared to total employees that are benchmarked for those positions.

RESPONSE (PREPARED BY MERCER):

The table below presents the list of PWU jobs included in the Mercer Study as well as the number of Toronto Hydro employees in each of the jobs:

THESL Position	Union	Total # of Employees
Engineering Technologist Level 1	PWU	56
Engineering Technologist Level 2	PWU	32
Customer Relations Representative	PWU	30
Cert Meter Mechanic - ALL	PWU	8
Programmer/Analyst	PWU	6
Power Line Technician - ALL	PWU	134
Cert Crew Leader, Power Line Tech - ALL	PWU	21
Distribution System Technologist - ALL	PWU	52
Power System Controller - ALL	PWU	52
Fleet Mechanic	PWU	9

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.41:

Reference(s): 4-CCMBC-20

To ask Mercer to provide a list of the 90 organizations.

RESPONSE (PREPARED BY MERCER):

As outlined in the Mercer study, the General Industry peer group represents organizations within ½ to 2x the size of Toronto Hydro on the basis of annual revenue. Where data was not available, the peer group was expanded to include organizations within 1/3 to 3x the size of Toronto Hydro - this was only done for one of the benchmark jobs. We note that, as outlined in our response to interrogatory 4-CCMBC-20, there were over 90 organizations included in the General Industry peer group. The table below presents the list of 95 organizations within ½ to 2x the size of Toronto Hydro:

General Industry Peer Group	
Aecon Group, Inc.	Kuehne + Nagel - Canada
Agnico Eagle Mines Limited	Labatt Breweries of Canada
Air Canada	Lassonde Industries, Inc.
Alberta Electric System Operator	Ledcor Industries Inc.
Algonquin Power & Utilities Corp.	Linamar Corporation
AltaGas, Ltd.	Lundin Mining Corporation
Americold	Maple Leaf Foods, Inc.
Apotex, Inc.	Mattamy Homes Limited

General Industry Peer Group	
ATB Financial	McDonald's Restaurants of Canada Limited
ATCO, Ltd.	Mercedes-Benz Canada, Inc.
Business Development Bank of Canada	Nestlé Canada
Cadillac Fairview Corporation Limited	Ocado Solutions Canada, Inc.
Canada Post Corporation - Purolator	Oceaneering Canada, Ltd.
Canadelle Limited Partnership	PwC Management Services LP
Capital Power Corporation	Quest Diagnostics
CI Financial Corp.	Resolute Forest Products, Inc.
Coca-Cola Canada Bottling Limited	Rio Tinto Canada Inc.
Colas Canada, Inc.	Samuel, Son & Co., Limited
Crescent Point Energy Corp.	SaskPower
Deschênes Group Inc.	Secure Energy Services, Inc.
Emera, Inc.	Shutterfly, Inc.
ENMAX Corporation	Signature Aviation
EPCOR Utilities, Inc.	Sonepar Canada Inc.
Export Development Canada	Spectrum Brands Holdings, Inc. - Pet Home & Garden
Finning Canada, Inc.	Spectrum Brands Holdings, Inc. - Spectrum Brands Canada, Inc.
Fluor Canada, Ltd.	Spin Master
Fortis, Inc. - FortisBC, Inc.	Sport Chek
Fossil Canada, Inc.	StandardAero Limited
Generac Power Systems	Stantec, Inc.
Giant Tiger Stores Limited	Starbucks Coffee Canada, Inc.
Gildan Activewear	Sysco Canada, Inc.
Gordon Food Service Canada, Ltd.	Tailored Brands Inc.

General Industry Peer Group	
Hudbay Minerals Inc	TC Transcontinental
Hydro One, Inc.	The Boyd Group
Hydro-Québec	The Co-operators Group Limited
Hyundai Auto Canada	The Mosaic Company - Potash
IGM Financial Inc.	The Wawanesa Mutual Insurance Company
IKEA Canada	Tourmaline Oil Corp.
Insurance Corporation of British Columbia	TransAlta
Inter Pipeline, Ltd.	TreeHouse Foods, Inc.
Invesco - Invesco Canada	University Health Network
John Deere Canada ULC	Vale Canada Limited
Johnson & Johnson, Inc.	Valero Energy, Inc.
Johnson & Johnson, Inc. - Janssen, Inc.	Vermilion Energy, Inc.
Keyera Corp.	WestJet, An Alberta Partnership
Kinross Gold Corporation	Workers' Compensation Board - Alberta
KPMG, LLP	Yamana Gold, Inc.
Kraft Heinz Canada	

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.42:

Reference(s): 5-VECC-77

For each of the issuances during this current rate term, so beginning in 2020, so for each of them, the actual administration cost that Toronto Hydro incurred as compared to the impact of the 5 percent basis points that you're collecting.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request made by School Energy Coalition. The scope of the undertaking is to provide the impact of 5 basis point which equates to 0.05 percent.

Table 1 below shows the administration fees related to debt issuances whereas the administration costs related to debt issuances is summarized in Table 2.

1 **Table 1: 2020-2024 Administration Fees for Debt Issuance ($ Millions)[1]**

Description	Start Date	Principal	Administration Fees						Total
			Basis Point	Actual				Forecast	
				2020	2021	2022	2023	2024	
2010 Series 6	20-May-10	200.0	0.05%	0.1	0.1	0.1	0.1	0.1	**0.5**
2012 Prom Note #2	1-Jan-12	45.0	N/A	N/A	N/A	N/A	N/A	N/A	**N/A**
2013 Series 9	9-Apr-13	200.0	0.05%	0.1	0.1	0.1	0.1	0.1	**0.5**
2014 Series 10	16-Sep-14	200.0	0.05%	0.1	0.1	0.1	0.1	0.1	**0.5**
2015 Series 11	16-Mar-15	200.0	0.05%	0.1	0.1	0.1	0.1	0.1	**0.5**
2013 Series 9 re-opening	2-Sep-15	45.0	0.05%	0.0	0.0	0.0	0.0	0.0	**0.1**
2016 Series 12	14-Jun-16	200.0	0.05%	0.1	0.1	0.1	0.1	0.1	**0.5**
2017 Series 13	14-Nov-17	200.0	0.05%	0.1	0.1	0.1	0.1	0.1	**0.5**
2019 Series 14	12-Nov-19	200.0	0.05%	0.1	0.1	0.1	0.1	0.1	**0.5**
2019 Series 15	12-Nov-19	200.0	0.05%	0.1	0.1	0.1	0.1	0.1	**0.5**
Subtotal Administration Fees for issuance prior to 2020 (a)				**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**4.1**
2020 Series 16	15-Oct-20	200.0	0.05%	0.0	0.1	0.1	0.1	0.1	**0.4**
2021 Series 17	18-Oct-21	150.0	0.05%	-	0.0	0.1	0.1	0.1	**0.2**
2021 Series 18	18-Oct-21	200.0	0.05%	-	0.0	0.1	0.1	0.1	**0.3**
2022 Series 19	13-Oct-22	300.0	0.05%	-	-	0.0	0.2	0.2	**0.3**
2023 Series 20	14-Jun-23	250.0	0.05%	-	-	-	0.1	0.1	**0.2**
2023 Series 21	2-Oct-23	200.0	0.05%	-	-	-	0.0	0.1	**0.1**
2024 Series 22	1-Nov-24	200.0	0.05%	-	-	-	-	0.0	**0.0**
Subtotal Administration Fees for issuances 2020-2024 (b)				**0.0**	**0.1**	**0.3**	**0.5**	**0.7**	**1.7**
Total Administration Fees (c = a + b)				**0.8**	**1.0**	**1.1**	**1.3**	**1.5**	**5.8**

[1] Numbers may not sum due to rounding.

Table 2: 2020-2024 Administration Costs for Debt Issuance ($ Millions)[2]

Name of Company		Services Offered	Actual				Forecast	Total
From	To		2020	2021	2022	2023	2024	
THESL	THC	Finance - Debt Administration Costs (a)	0.1	0.2	0.2	0.3	0.3	1.1
THESL	THC	Legal and Regulatory - Debt Administration Costs (b)	0.1	0.1	0.2	0.2	0.3	0.9
Total Debt Administration Costs Allocated from THESL to THC through Shared Services (c = a + b)			**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**2.0**
Debt Issuance Cost Amortization (3rd party accounting, legal, bank, credit rating and public filing fees) (d)			2.1	2.2	2.2	2.0	2.1	10.7
Debt Administration Costs Incurred in THC (e)			0.1	0.1	0.1	0.1	0.1	0.5
Total Debt Administration costs (f = c + d + e)			**2.4**	**2.6**	**2.7**	**2.6**	**2.8**	**13.2**

[2] Numbers may not sum due to rounding.

Toronto Hydro notes that in the course of preparing this undertaking response, the utility identified an error with respect to how debt issuance cost amortization costs (row d) have been mapped in OM&A through corporate cost allocations. These costs should not form part of the utility's OM&A since they are being recovered through the administrative fee. Toronto is evaluating the impact of this correction and the implications for the forecasts in the application.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.43:

Reference(s): 9-Staff-344

Referring to 9-Staff-344C: to provide a similar table that shows how you get to the ROE, the adjustment, for 2023, and then provide an explanation of the drivers of the under-earning in 2023.

RESPONSE:

Please refer below for the 2023 ROE calculations using the ESM methodology as approved in EB-2018-0165 with an explanation of drivers when compared to the approved ROE:

Table 1: 2023 ROE breakdown

2023 RRR 2.1.5.6 ROE		($m)
Regulatory Net Income from RRR	**A**	**161.3**
Adjustments for non-rate regulated donations and expenses	B	0.7
Deduction for other out-of-period (revenue) / expense	C	-
Interest expense adjustments to deemed interest expense	D	(14.3)
Payments-in-lieu of taxes adjustments	E	(6.9)
Total Adjustment to RRR net Income	**F (B+C+D+E)**	**(20.5)**
2.1.5.6 Adjusted Net Income	G=(A+F)	140.8
2.1.5.6 Adjusted Deemed Equity	H	2,070.7
2.1.5.6 ROE	**I=G/H**	**6.80%**
ROE Approved	J	8.52%
ROE Over (Under)	**I Compared to J**	**(1.72%)**

1 **Table 2: Approved ROE to Achieved ROE for 2023**

	%	($m)
ROE Approved	**8.52%**	**173.6**
Decrease due to lower volumes	(0.83%)	(17.1)
Increase due to amounts deferred into specified DVAs	0.08%	1.6
Decrease due to lower other income	(3.12%)	(64.7)
Decrease due to higher operating expense	(0.35%)	(7.3)
Increase due to lower depreciation expense	2.04%	42.3
Increase due to lower payments-in-lieu of taxes	0.68%	14.1
Decrease due to higher deemed interest	(0.08%)	(1.7)
Decrease due to other stretch in approved ROE[i]	(0.14%)	-
ROE Achieved	**6.80%**	**140.8**

[i] This line includes stretch in the approved ROE rate and the impact of variances between the achieved rate base and the approved rate base. Both impact the ROE rate only with no dollar value impact.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.44:

Reference(s): **6-SEC-120**

To provide a revised version of the table in 6-SEC-120 showing deficiency as compared to the 2024 rates at the forecast load.

RESPONSE:

The table below shows the requested information in accordance with the latest revenue requirement and distribution load forecast.

	2020 OEB Approved	2025 Forecast	2026 Forecast	2027 Forecast	2028 Forecast	2029 Forecast
Rate Base	4,514.8	5,899.1	6,279.3	6,703.2	7,162.0	7,590.1
ROE	8.52%	9.36%	9.36%	9.36%	9.36%	9.36%
Debt Rate	3.64%	4.04%	4.04%	4.04%	4.04%	4.04%
DRIVERS OF DEFICIENCY						
OM&A	266.7	343.0	355.4	364.8	377.2	388.2
Depreciation	263.7	290.4	301.7	318.2	336.7	346.9
Deemed Interest Expense	98.5	142.9	151.0	160.1	169.8	178.7
Return on Equity	153.9	220.9	233.4	247.4	262.5	276.2
PILS	9.7	28.9	30.9	20.3	55.4	47.0
Total Service Revenue Requirement	**792.5**	**1,026.0**	**1,072.5**	**1,110.8**	**1,201.7**	**1,237.0**
Distribution Revenue at previous years approved/ 2024 rates	771.4	866.6	867.6	866.9	867.6	864.1
Revenue Offsets	42.3	48.2	48.8	49.4	50.1	50.7
Total Operating Revenue	**813.7**	**914.8**	**916.4**	**916.3**	**917.7**	**914.8**
Total Deficiency		**111.2**	**156.0**	**194.4**	**284.0**	**322.2**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.45:

Reference(s): 8-SEC-125

To revisit the response to 8-SEC-125 and to include actual rates.

RESPONSE:

Appendix A shows the rates broken down by customer class.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO COALITION OF CONCERNED MANUFACTURERS AND BUSINESSES OF CANADA

UNDERTAKING NO. JT3.46:

Reference(s): **4-CCMBC-20**

To ask Mercer whether the compensation and benefits for employees, which is non-executive compensation and benefits for employees, are higher in Alberta than in Ontario or lower in Alberta than in Ontario.

RESPONSE (PREPARED BY MERCER):

The scope of the Mercer Study was to review total remuneration within a General Industry Peer Group and an Energy Peer Group across Canada. As such, the Mercer Study did not review compensation levels for specific geographical locations including Alberta.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ENERGY PROBE RESEARCH FOUNDATION

UNDERTAKING NO. JT4.1:

Reference(s): **1B-EP-2**
Appendix B of the DSC

To explain how THESL applies Appendix B of the Distribution System Code to evaluating multi-storey developments; how they would apply it in assessing developer contribution to the costs, within a general definition of costs.

RESPONSE:

Toronto Hydro recovers costs from load customers connecting to its distribution system in accordance with the connection and expansion rules of the Distribution System Code ("DSC"),[1] independent of building type or size features such as square footage or storeys.

For connections,[2] Toronto Hydro applies a basic connection allowance to the connection costs of all residential and non-residential customers.[3] Where the costs associated with the installation of connection assets exceeds the basic connection allowance, Toronto Hydro collects the balance through a variable connection charge from all customer classes.[4]

[1] Distribution System Code ("DSC", last revised March 27, 2024), ss. 3.1 and 3.2, respectively.
[2] In this context, "connection" refers to the process of installing and activating assets between the main distribution system and the ownership demarcation point with the customer, in accordance with DSC s. 1.2.
[3] Except micro-embedded generation facility customers, who are required to pay a basic connection charge. See DSC s. 3.1.5A.
[4] DSC s. 3.1.6

Where Toronto Hydro has to make modifications or additions to the main distribution system (defined as an "expansion" in the DSC)[5] to connect a customer to its distribution system, the utility performs an economic evaluation in accordance with Appendix B of the DSC.

An economic evaluation is a prescribed discounted cash flow model, which evaluates revenues and expenses generated by the customer connection over a twenty-five year revenue horizon. The revenue inputs include the net present values of revenues expected that from the load connection (e.g. billing revenue) and capital cost allowance ("CCA") tax shield contributions. The expense inputs include the net present values of the capital cost of the expansion work, attributable incremental operating and maintenance costs, and taxes associated with the expansion. Where the expenses exceed revenues, Toronto Hydro collects a capital contribution from the customer.[6] For expansions that require a capital contribution, Toronto Hydro also requires customers to provide an expansion deposit for up to 100% of the present value of forecasted revenues, in accordance with the DSC[7] and Appendix B. The purpose of the expansion deposit is to cover the forecast risk, i.e. the risk of a customer overestimating their load and therefore the capacity of the assets required for their connection.[8] As the forecasted load materializes over the applicable connection horizon (typically five years), Toronto Hydro returns the expansion deposit with interest.[9] If new customers connect to the newly built expansion assets during the applicable connection horizon, Toronto Hydro proportionally rebates the initial customer their original contribution and collects capital contributions from the new customers.[10]

[5] S. 1.2.
[6] DSC s. 3.2.6.
[7] DSC s. 3.2.20.
[8] DSC s. 3.2.21.
[9] DSC s. 3.2.23.
[10] DSC s. 3.2.27.

Toronto Hydro transparently identifies all inputs and outputs of calculations for connection charges, the economic evaluation, and expansion deposits within its offer to connect.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ENERGY PROBE RESEARCH FOUNDATION

UNDERTAKING NO. JT4.2:

Reference(s): **Response to 1B-EP-23, Part C**

To clarify X-factor impact on the Revenue Growth Factor (Ref: Response to 1B-EP-23C).

RESPONSE:

If the X Factor in Toronto Hydro's Custom Revenue Cap Index had a total value of 0%, the revenue growth factor would fund annual increases from 2026 to 2029 equal to the difference between the current year's forecast revenue requirement, and the prior year's revenue requirement.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT4.3:

Reference(s): **Exhibit 3, Tab 1, Schedule 1, Appendix C, Updated April 2, 2024**

To confirm whether the updated CDM annual savings value in the April 2 update is an actual savings number or a forecast number.

RESPONSE:

Toronto Hydro confirms that the savings for 2023 are forecasted CDM savings based on the 2021-2024 CDM Framework targets.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT4.4:

Reference(s): Exhibit 3, Tab 1, Schedule 1, Updated April 2, 2024

To describe the impact on the load forecast of the new definition of "Weather Normal".

RESPONSE:

Toronto Hydro updated its 10-year weather average from 2013-2022 to 2014-2023, leading to slightly lower weather normalized loads.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT4.5:

Reference(s): **Exhibit 6, Tab 1, Schedule 2**

To provide, on a customer-class basis, a calculation of revenue at current rates versus the updated load forecast.

RESPONSE:

In reviewing transcript, Toronto Hydro notes that this undertaking does not capture the request made by the Vulnerable Energy Consumers Coalition. The scope of the undertaking is to provide the calculation of what the revenue would be at current rates, based on the updated load forecast, and to provide that calculation on a customer class basis.

See the table below for revenue by rate class at current rates and updated load forecast for 2025.

	Residential	CSMUR	GS <50	GS 50-999 kW	GS 1,000-4,999 kW	Large Use >5MW	Street Light	USL	Total
Revenue ($M)	341.0	44.1	134.2	221.9	68.9	33.8	19.0	4.0	867.0

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT4.6:

Reference(s): 3-SEC-79, Appendix A

(A) To explain the difference between 3-SEC-79 and evidence Appendix 2-IB, the impacts of EVs and DERs on the load forecast; (B) to provide two schedules: (1) showing figures that align with the original load forecast values; (2) showing figures that align with the updated load forecast.

RESPONSE:

The GWh values provided in 3-SEC-79 Appendix A were at the purchased level and are aligned with Table 1 in Exhibit 3, Schedule 1, Tab 1.

Please refer to Appendix A for a revised version of the original load forecast with GWh values at the distribution level, which aligns with the original Appendix 2-IB. A version aligned with the application update has also been provided in Appendix A.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT4.7:

Reference(s): 3-SEC-79, Appendix A

(1) To explain the change in the light duty electric vehicle forecast between the original application and the update; (2) to explain the change in the medium duty and heavy-duty electric vehicle forecast between the original application and the update.

RESPONSE:

There were two changes which drove the need to update the EV forecasts: (i) changes to EV targets, resulting from policy updates; and (ii) 2022 actuals. **Error! Reference source not found.** shows the two EV targets considered (Registrations and Sales) to produce the EV forecasts.

Table 1: Modelled Targets for EV Forecasts

Target Type	Original Application	April 2nd Update
EV Registrations	From City of Toronto Electric Vehicle Strategy (2019): • 2025 – 5% of total light-duty vehicles • 2030 – 20% of light-duty vehicles Assumed Adoption Rates: • 2025 – 13% of medium-duty and heavy-duty vehicles • 2030 – 31% of medium-duty and heavy-duty vehicles	From City of Toronto TransformTO Net Zero Strategy (2021): • 2030 – 30% of total vehicles (light, medium, and heavy)
EV Sales	From City of Toronto Electric Vehicle Strategy (2019): • 2025 – 15% of light-duty vehicle sales • 2030 – 40% of light-duty vehicle sales	From Canada's 2030 Emissions Reduction Plan: • 2026 – 20% of light-duty vehicle sales • 2030 – 60% of light-duty vehicle sales

		• 2030 – 30% of medium-duty and heavy-duty vehicle sales

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT4.8:

Reference(s): 7-VECC-88

To clarify the response to 7-VECC-88, Part B, with a spreadsheet calculation showing the change from status quo ratios for the cost allocation model to the revenue-to-cost ratios in the original application.

RESPONSE:

Please refer to Appendix A (JT4.8 App A – Rate Design) for the calculation of the proposed revenue to cost ratios.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT4.9:

Reference(s): **N/A**

To describe how EV charges in parking garages would be linked back and included as part of the suite metered load, or whether the charges would show up as part of the common load for the building, more appropriately attributable to one of the GS classes.

RESPONSE:

The billing of energy used by electric vehicle ("EV") chargers depends upon the metering arrangement chosen by the customer. Where EV chargers are behind and part of the common elements load of a Toronto Hydro suite metered building, the applicable charges would show up on the bill for the common elements load account. Where Toronto Hydro is individually metering EV chargers associated with a particular suite, the applicable charges would show up on the bill for the individual suite only. Where the customer has engaged a unit sub-metering provider ("USMP") to meter and bill suites and Toronto Hydro only bills the aggregate load of the building through a bulk meter, the applicable charges would show up on the bill for the bulk account.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO

UNDERTAKING NO. JT4.10:

Reference(s): 4-VECC-71
4-VECC-72

Referring to 4-VECC-71 and 4-VECC-72, to identify drivers of increase in customer relationship costs.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request made by the Vulnerable Energy Consumers Coalition ("VECC"). The scope of the undertaking is, for the Customer Relationship Management segment, aside from human resources related increases, to provide the other major drivers of the increase in the segment. In addition, for the Human Resources and Safety Segment, to provide the drivers of the increase including the proportion being driven by labour as well as other cost drivers.

With reference to 4-VECC-71(a), Toronto Hydro notes that the compensation costs listed for the Customer Relationship Management ("CRM") segment include payroll costs for internal staff only and do not constitute the entirety of human resources costs for that segment. In fact, in addition to internal staff, this segment relies heavily on external third-party call centre and business processing staff to handle customer contacts over the phone, via email or live chat, as well as administrative activities related to customer moves. External staffing costs make up the majority of the difference between the compensation costs outlined in 4-VECC-71 and the total costs for the segment.

Other cost impacts in the 2020 to 2024 rate period include consulting costs related to the customer information system ("CIS") upgrade project, payroll compensation savings due to full time staff capitalized to the CIS upgrade project, and temporary staff costs to backfill for full time staff on the project. None of these costs or labour capitalization savings will persist into the 2025-2029 rate period.

In reference to 4-VECC-72, the two major cost drivers are increases to:

1. Human resources cost of $8.7M or 80% of the total $10.8M incremental spend from 2020 to 2029. The average annual incremental cost of human resources has increased by 6.6% over this 10-year timeframe which includes inflationary costs and incremental headcount.
2. Training costs/programs have increased by $2M or 20% of the total incremental $10.8M.

These main areas have increased to support both the growing employee population and Toronto Hydro's investment plan. Details by segment are outlined in Exhibit 4, Tab 2, Schedule 15, starting from page 14 to 28.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO

UNDERTAKING NO. JT4.11:

Reference(s): 1B-SEC-03

To clarify whether under the cause code of "Defective Equipment", Major Event Days are excluded.

RESPONSE:

On Toronto Hydro's corporate scorecard, the key performance indicators for SAIFI and SAIDI measure interruptions recorded with the cause code of Defective Equipment, which does not include Major Event Days ("MEDs").[1]

[1] Major Event Days (MEDs) as defined by the threshold computed by IEEE 1366 2.5 Beta

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO

UNDERTAKING NO. JT4.12:

Reference(s): 4-AMPCO-80
1B-SEC-7

To consider whether to provide the requested audit documents, and/or audits attached to 1B-SEC-7.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the full scope of the request made by AMPCO. The scope of the undertaking was to provide a) two audits referred to in interrogatory response 4-AMPCO-80(b) and b) four items referred to in the appendix to interrogatory response 1B-SEC-7.

For the two external audits referred to in interrogatory response 4-AMPCO-80(b), please refer to appendices A and B to this undertaking response.

The question with respect to 1B-SEC-7 referenced four specific observations from the internal audit summary provided in the appendix to that interrogatory response. Please refer to Appendix C to this undertaking response for more information about the referenced observations and the completed management action plans.

FINAL SUMMARY REPORT

PMO BEST PRACTICES ASSESSMENT

PURCHASE ORDER
4500064590

SUBMITTED BY:
Comtech Group Inc.

DATE SUBMITTED:
Feb 17th. 2022

Table of Contents

1 Executive Summary

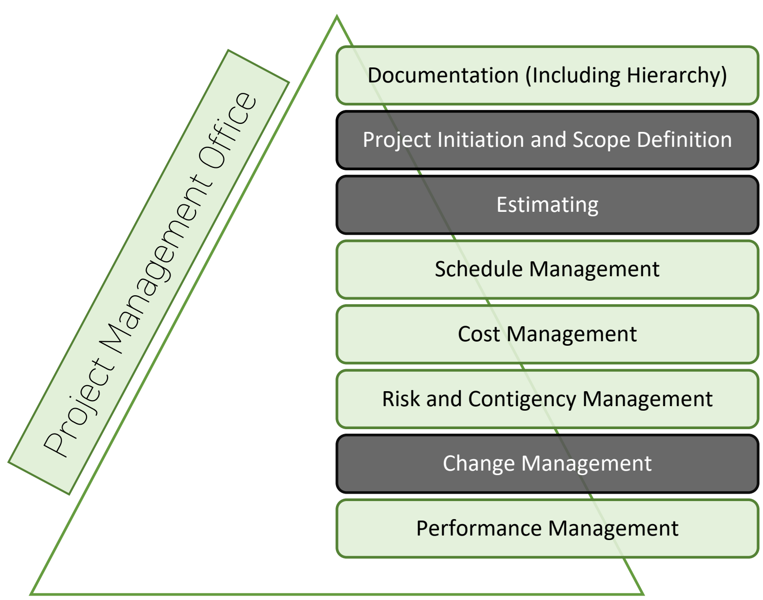
Toronto Hydro is seeking to enhance its current Project Management Office (PMO) capabilities and practices through the development, documentation, and implementation of an integrated set of program and project management processes governance, and procedures leveraging current lessons learned and best practices from industry sectors.

To support this goal, Toronto Hydro has engaged Comtech Group Inc. (Comtech) to perform an initial assessment of the PMO practices currently in place within the organization and to provide recommendations based on broad industry experience and best practices as well as share lessons learned from previous experience establishing and overseeing enterprise-level PMOs for large power generation and distribution companies within the energy and utilities sector.
It should be noted that the findings and associated recommendations of this assessment are based on information collected through interviews with key members of the Project Management Organization which is comprised primarily of Program Managers responsible for ensuring overall program delivery and not Project Managers responsible for individual projects.

1.1 Assessment Objective

This assessment is intended to provide practical recommendations that Toronto Hydro can apply in the short, medium, and long term to enhance its project management approach enabling the organization to better plan, organize, track, and manage its projects and programs through to successful completion. By evaluating current practices and ultimately providing key recommendations for enhancement, this assessment will help Toronto Hydro to enhance accountability and project success. The assessment focuses on benchmarking Toronto Hydro's current project management approach against industry-recognized practices as summarized in Figure 1.1 below:

Figure 1.1 – Scope of Assessment



**Subject matter areas shown in grey do not currently fall within the scope of the Toronto Hydro PMO but have been evaluated as part of the assessment.

1.2 Assessment Approach (Collecting Data)

To assess each of the subject matter areas identified in Figure 1.1 above, our team utilized a combination of:

- Review of key documentation
- Predetermined questionnaires
- Interactive sessions/interviews with key PMO staff

The assessment focused on the review of documentation (governance, job aids, flow charts, forms, and formats), people and practices, and tools and applications.

Please refer to Appendix N of this report for a summary of all the reference documentation provided by Toronto Hydro as part of this assessment.

The first step in the assessment process was to gather key documents, governance, policies, procedures, and other relevant background information necessary to adequately assess the current project management systems, processes, and overall capabilities. To support this assessment, the Toronto Hydro team shared a significant amount of typical program and project documents immediately following the kickoff meeting.

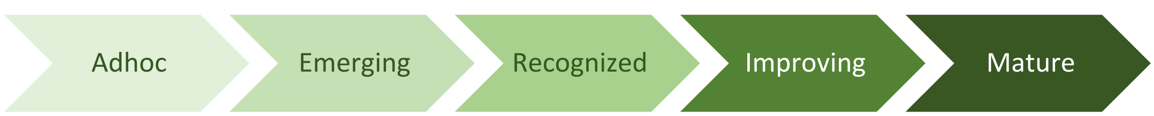
Virtual interviews were performed with key staff within the Toronto Hydro PMO to:

- Define key focus areas for the assessment
- Obtain first-hand feedback from the PMO team
- Identify additional documentation to be reviewed

1.3 Assessment Framework (Evaluation & Benchmarking)

The Project Management Maturity Model (OPM3) was used as a guideline for the framework against which the Toronto Hydro PMO practices were assessed. The framework presents pre-defined criteria to be used in the evaluation of each of the key subject matter areas (as listed in Figure 1.1) ranging in maturity as shown below in Figure 1.2:

Figure 1.2 – OPM3 Maturity Scale



Details relating to each level of maturity are summarized in Figure 1.3 below:

Figure 1.3 – Maturity Criteria

Maturity Level	Details
Mature	• Industry best practices are adopted and are being executed following a consistent, predefined, and documented process. PMO continues to actively look for process improvement and promotes responsibility, detracts poor procedural performance, and develops/adopts corrective actions. • PMO is staffed with resources who are trained and adopting routine practices which are aligned with the internal governance. • Project Management Information Systems (PMIS) are adopted, configured properly, and integrated within the organization. There are very few (if any) discrepancies between business processes within the tools and corporate strategic and tactical guidelines. • The tools are well configured, administrated, and allow for transparency of information and advanced data analysis. Usable dashboards are developed as standard deliverables for project meetings and forecasted trends can be identified and mitigated in short periods. • Single source of project "Truth" exists for all the stakeholders and is used as a basis for all strategic and project-level decision making. • Organization can efficiently plan, manage, and control multiple projects simultaneously.
Improving	• PMO has robust integration across governance, processes, practices, and systems. There is a strong corporate philosophy that drives the execution of programs/projects and sufficient resourcing is provided to guarantee that programs/projects will be delivered to the expected standards which have been in place for an extended period. • The PMO team knowledge and their routine practices are in alignment with the organization's guidelines with little to no deviations. • Dashboards and other program/project-related deliverables are utilized to monitor the health of certain procedures and to perform self-assessments (at a predefined frequency) to ensure procedures are implemented and followed. • Project information and performance measurement tools are developed on a routine basis and any observed deviations are identified and addressed in a timely manner. • Training programs are identified, developed, and delivered to maintain and improve the collective knowledge and skills of the PMO overall.
Recognized	• Methodologies are defined through guidelines, standards, job aids, and other related standard formats. Experienced personnel are responsible for the PMO's day-to-day practices and there is a widespread understanding of the PMO scope and level of responsibilities as well as scalability to the PMO services. • There are opportunities for improvement that can be identified as the organization develops and internal processes are rationalized. • Self-assessment checks are occasionally performed to ensure defined methodologies are being followed and PMO requirements are being met. • Reporting is performed periodically but not at the level of the corporate-wide reporting plan, while dashboards and regular project updates provide some trends to satisfy the forecasting needs. • PMO team's knowledge and routine practices are in alignment (with limited deviations) with the organizational guidelines. • PMIS are adopted, properly configured, and integrated. There are no (or very limited) discrepancies between business processes with the tools and corporate strategic and project level guidelines.

Maturity Level	Details
Emerging	• There are some governance and methodologies, but there is no evidence that they are consistently followed and are not fully meeting the requirements of the PMO, accordingly some PMO practices are not yet planned and developed. • PMO staff roles are clearly defined, but responsibilities are not defined and documented. • There are sufficient resources available to meet the program/project requirements, with training and skill improvement exercises provided. • PMIS are available, but with limited capacity and a lack of integration, often requiring significant amounts of manual data management. • Business processes and PMIS integration are maintained manually, and some business processes are simulated in the tools. • Dashboards and performance KPIs are at the early stages of development and not commonly used.
Ad-Hoc	• PMO processes are not documented and are implemented at a very basic level. Most of the practices are based on a predefined basis or an enterprise standard. • PMO team's roles and responsibilities are not defined clearly which results in redundant work or miscommunication with regards to responsibilities of individuals. Standard/predeveloped and easy to access forms and formats are missing or not fully developed/supported. • Training and skill enhancement programs (such as integrated training programs) are missing, and staff are not familiar with innovative methods of program/project management. • Project data is not centralized and exists in multiple sources requiring the PMO team to spend extensive effort to consolidate and verify the information.

1.4 Overall Observations

After completing the interviews, reviewing questionnaire responses, and supplied documentation, our team observed the overall maturity rating of the Toronto Hydro PMO to be at the "Emerging" level, typical of an organization that is actively executing projects but in the early stages of implementing formal and defined PMO practices. As shown in Figure 1.4 below, this report will outline key recommendations to enable Toronto Hydro to transition from Emerging to Improving on the maturity scale.

Figure 1.4 – Current and Future State

The detailed breakdown of the maturity assessment for each key subject matter area is provided in Figure 1.5 along with a summary of the key observations in Section 1.4.1.

Figure 1.5 – Current and Future State

Subject Mater Area	Ad-Hoc	Emerging	Recognized	Improving	Mature
Overall		◆			
Documentation (Governance, Guides, Formats, Including Hierarchy)	◆				
Project Initiation and Scope Definition		◆			
Estimating			◆		
Schedule Management	◆				
Cost Management (Budget, Cost Control, Forecasting)		◆			
Risk and Contingency Management			◆		
Change Management		◆			
Performance Management and Reporting		◆			

Given the planned capital expansion and investments that Toronto Hydro will pursue in the future, we highly recommend a step-by-step plan towards integrating our recommendations outlined in this report. Section 1.4.1 provides a high-level of all the key observations and recommendations for Toronto Hydro's consideration.

1.4.1 Key Observations / Recommendations

The observations and recommendations identified by the team have been grouped into four categories as shown in Figure 1.6 below:

Figure 1.6 – Classification of Observations and Recommendations

Well Established

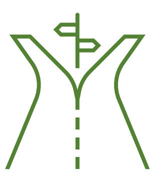
Actions Toronto Hydro is doing well right now to support an integrated PMO and effective project delivery.

Short Term

Quick wins Toronto Hydro can implement to begin progressing towards its desired future state immediately.

Medium Term

Additional improvements which can be implemented, building on top of the short-term goals to further improve project organization and delivery.



Long Term

Longer-term actions to provide Toronto Hydro with a framework to support future expansion of its PMO capabilities and integration of other corporate functions.

Well Established

- Personnel interviewed showed a common and thorough understanding of PMO principles and guidelines already in place within Toronto Hydro and were aware of the importance of these standards to effective and efficient program/project management.
- Existing and documented process flows are stored under a centralized document repository which is readily accessible to all Toronto Hydro employees, providing an integrated and easy to access platform for additional PMO-related documentation and communications (please refer to Long Term Actions for more information).
- Project cost estimates are developed based on historical data (including actual costs incurred) from past projects of similar scope and complexity which provides a robust and integrated approach to estimate development.
- Projects finishing with delays or cost overruns are required to develop Project Variance Analysis (PVA) reports which will detail all the variances and their root causes (cost, scope, and schedule), lessons learned. This is a highly effective way of documenting critical information to contribute to future projects (i.e., incorporating lessons learned into the estimates, schedules, or risk logs for future projects).

- Toronto Hydro has been using SAP an Enterprise Resource Planning (ERP) tool for quite some time now. Some of the business processes, library data, and management information are stored within the ERP which can be used as inputs for future programs/projects as well as future expansions of the PMO functionality.

Observations and Short-Term Actions

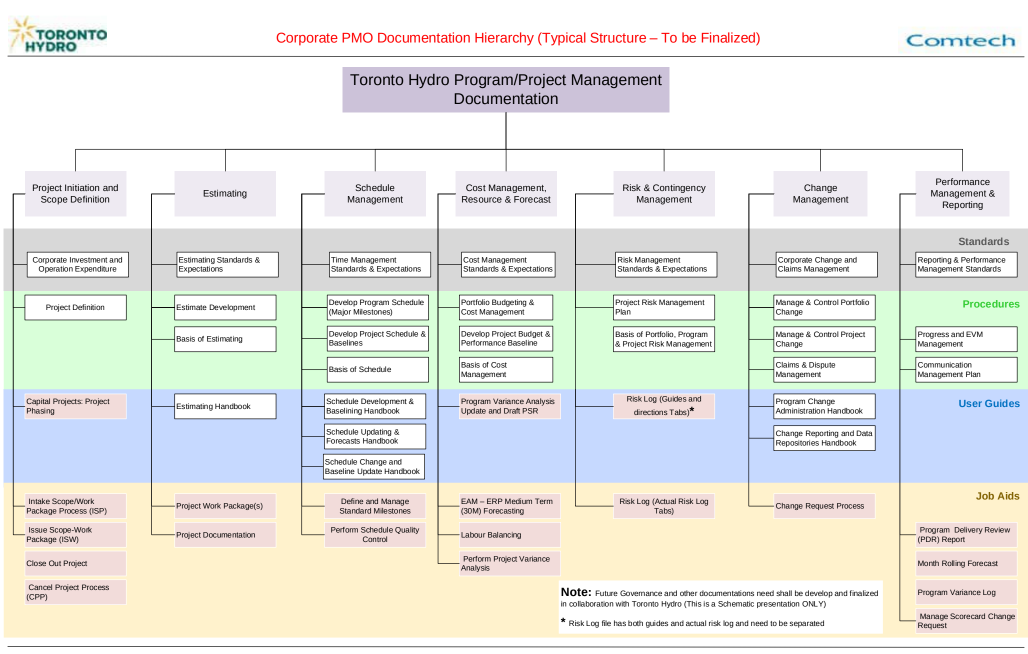
- Some of the PMO practices are documented as process flows, and we recommend Toronto Hydro prepare a singular overarching governance document (that comprehensively documents all expectations, guidelines, basis, references, and other background information regarding the PMO) and integrates and organizes all the individual emerging practices. Developing and keeping this document up to date should be a top priority for Toronto Hydro.
- Many of the PMO practices are still ad hoc and should be formally documented or integrated with each other. We recommend Toronto Hydro review the observations in this report and begin developing and implementing them within the PMO. An easy quick win would be to develop job-aids in the short term and then work on more formally documented procedures in the medium term. To achieve this goal, we recommend Toronto Hydro assign a dedicated team (with defined roles and responsibilities) to:
    - Develop, implement, and maintain a comprehensive set of PMO governance, processes, procedures, and supporting documentation.
    - Define the priorities for the required documentation, which will be driven by operations and capital plans as well as any long-term strategies Toronto Hydro has in place.
    - Establish a timeline for the development, review, approval, and roll-out of each set of documentation.
    - Ensure that each functional PMO discipline (i.e., scheduling, estimating, reporting, risk, etc.) has an organizational chart with defined roles and responsibilities.
    - Implement a training program to develop and monitor employee skills within their functional PMO disciplines.
- The majority of program and project schedules were just merely dates absent any logic connection/ties or calculated durations. In other instances, it was noted that some projects did not have any schedule at all, just an anticipated completion date. We recommend the adoption of a scheduling platform such as Microsoft Project or Primavera P6 for all projects being executed by Toronto Hydro to allow a more integrated and visual representation of all Responsibility Centers (RCs) and the Toronto Hydro program. Schedules can be developed at a high level, but with enough detail to keep the programs better organized. Scheduling is critical as it interlinks with cost management, performance measurement, and reporting practices. It should be noted that Toronto Hydro is performing time management on program levels and not projects.
- Physical percent complete progress/stages of work completion are not being used as a basis for calculating project and program progress. We recommend implementing a quick and simple methodology such as weighted milestones on a high-level schedule to be used as an initial basis of progress calculation. This will help organize the cashflows and required funding practices and overall help Toronto Hydro better track its incurred costs and upcoming funding requirements as well as to better understand the state of its projects at any given time.
- It is recommended to implement EVM practices on a project and phase level (initiation, estimating, engineering, procurement, construction, commissioning, and close out) to allow for more accurate performance tracking at the program and portfolio level as well.

- Forecasting should be enhanced by using % physical progress, EVM, weighted milestones, burn rates, contractual commitment, etc. which will also improve the consistency and accuracy of the Estimate at Completion (EAC) and Estimate to Complete (ETC) calculations. It is recommended that Toronto Hydro adopt one of the standard forecasting methods as a standard to apply to all projects.
- Presently, all program and project status update information and reports are developed using Microsoft Excel in a static tabular format. We recommend developing a standardized set of multi-layer reporting dashboards that summarize information from the project level and roll it up to the program level. Toronto Hydro could leverage existing tools already in use such as SAP BI and Tableau to develop the dashboards in question. While the development of the dashboards is a short-term action, automating that data retrieval to update the dashboards can be considered as a medium- or long-term action and is discussed further in the subsequent sections of this report.

Observations and Medium-Term Actions

- We recommend that Toronto Hydro develop a centralized list of all the required documents necessary to formally document all the governance, processes, and procedures in a central library. We recommend performing a study to identify missing items (such as schedule development practices, project performance metrics, EVM practices, etc.) and develop a comprehensive list. Figure 1.7 below illustrates the sample document hierarchy:

Figure 1.7 – Documentation Hierarchy



Please refer to Appendix A of this report for the full-size sample Document Hierarchy.

- A key best practice is to integrate cost and schedule to improve the quality and consistency of project execution and reporting. Integration of cost and schedule information will provide more effective project data to support better project decision-making. We recommend that Toronto Hydro implements a basic level of cost/schedule integration for all projects going forward. Refer to Sections 5 and 6 for more information.

- We recommend developing a centralized PMO training plan, including the development of training material, identifying critical, mandatory, and elective training, and tracking of resource qualifications. PMO/other related training is primarily provided to new hires at the time of their onboarding or on an Ad-Hoc basis as required.
- To better promote continuous improvement, we recommend that Toronto Hydro performs regular self-assessments (potentially with wider scope) to track progress on implementation of the improvements identified herein and to address new needs that may arise over time as the organization continues to grow and develop.
- We recommend that critical project management and project controls information be transitioned to a centralized "Single Source of Truth" system as opposed to storing and maintaining using local data management tools (i.e., Microsoft Excel). The use of Excel can pose multiple data-related risks (non-integrated data sources, cyber security, increased resource efforts to consolidate/validate data from multiple sources). For example, having estimating, cost, and schedule data integrated and organized in one database can allow for automated project reporting/dashboards or automated updates to project financials and schedules when Change Requests are processed, approved, and implemented.
- We recommend developing a centralized plan for a corporate-wide risk workshop as well as individual project risk workshops/brainstorming sessions (particularly for larger more complex projects) to ensure all risks are accounted for at the project and program levels. While the project risks are stored and managed under a centralized database, the risk identification process is performed in a somewhat isolated manner often involving a single or a limited number of participants.
- Project reporting is currently being performed using SAP BI and Tableau, which are very powerful tools. However, there is a lack of a central data repository. In the absence of a centralized library for reporting, project data is being handled locally through individuals' computers or emails. We recommend developing a transition plan to adopt a centralized project data source to contain all the project-related data necessary for reporting.
- We recommend continuing to enhance the program and project status tracking and reporting dashboards to incorporate additional features such as online/interactive Power BI reports which can be manipulated by the viewer to filter information as required. We also recommend establishing a centralized location for reporting data (reporting database). With a centralized set of data Toronto Hydro can then utilize automated data retrieval processes to populate the dashboards essentially enabling the dashboards to present live project information that is always up to date.

Observations and Long-Term Recommendations

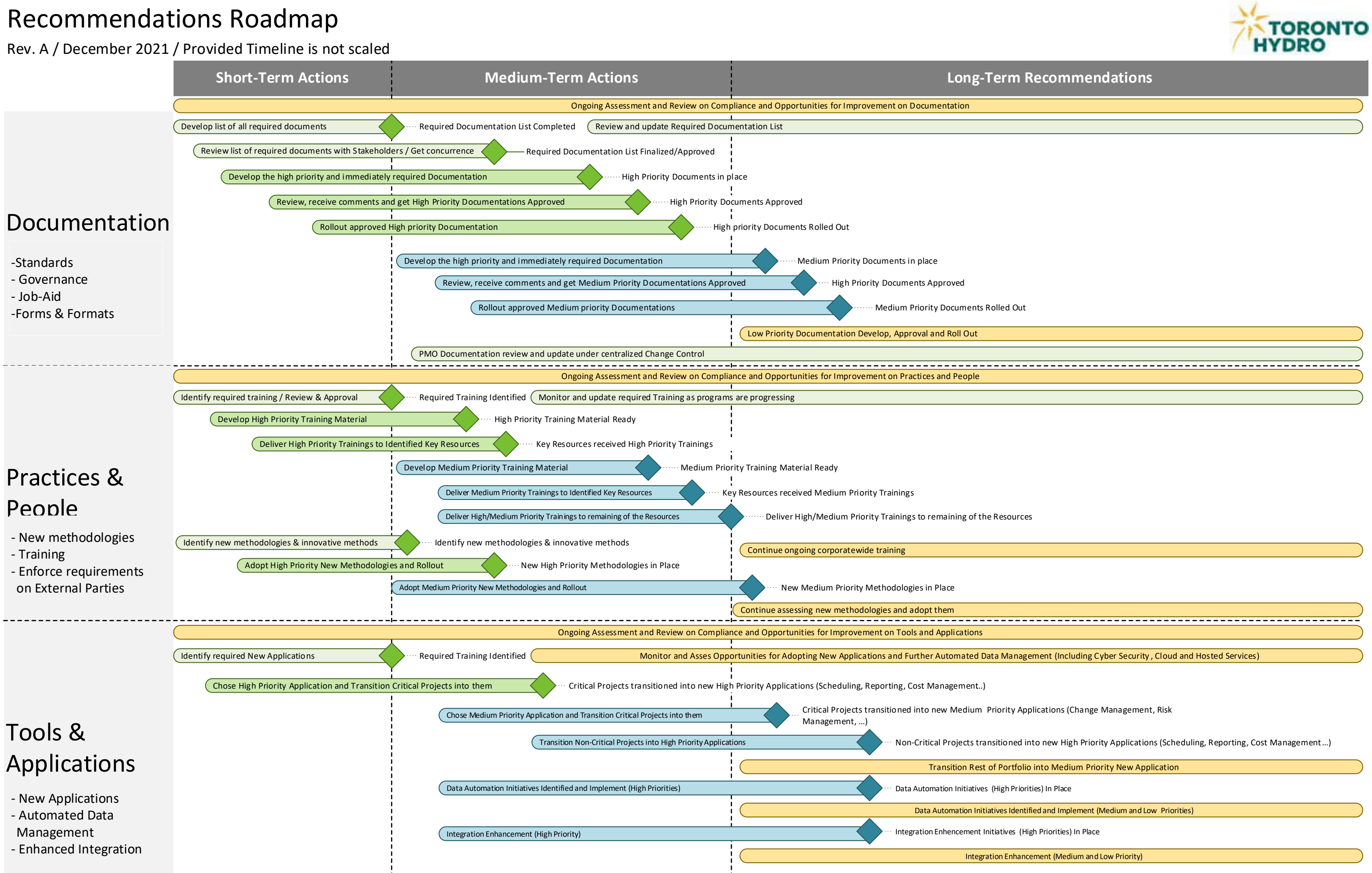
- Continue to identify, develop, document, and update processes as the organization grows and evolves. Ensure that all newly developed documentation is stored under a centralized and easily accessible repository.
- After achieving the basic level of schedule and cost integration, we recommend expanding the integration down to the major deliverables of the projects. This will allow for quick identification of risk areas or opportunities in terms of budget and schedule. A practical rule of thumb is to apply the 80/20 rule to integrate 20% of the major deliverables accounting for 80% of the cost and or schedule duration.
- We recommend transitioning away from single-user standalone scheduling platforms such as MS Project and leveraging enterprise planning tools such as Primavera P6 which can integrate

within Toronto Hydro's ERP system thus establishing an end-to-end program/project management PMIS.

- We recommend that Toronto Hydro investigate cloud-based project management tools that would be accessible by all project stakeholders remotely thus reducing the effort required to collect and aggregate data by providing real-time data to support the decision-making process.
- Continue to invest in corporate training programs relating to PMO functions, this would not only improve the overall PMO functionality but also promote professional and personal development within the Toronto Hydro team.
- Develop a plan to implement a fully integrated suite of PMIS (including "One Source of Truth") which would equip Toronto Hydro with the tools and infrastructure for any future expansion programs.
- By this stage, program and project dashboards should be fully developed, communicated, and implemented within the organization. We recommend integrating the centralized reporting database into the overall centralized project data repository (single source of truth) to complete the collection and organization of all project data into one source. We also recommend that Toronto Hydro perform regular reviews and assessments of its reporting requirements and adjust the parameters displayed in the dashboards as required.

Figure 1.8 provides a high-level roadmap summarizing the key improvement actions recommended for Toronto Hydro. Please note, the recommendation road map is preliminary, intended illustrative purposes only, and will require further input from Toronto Hydro.

Figure 1.8 – Recommendation Roadmap



2 Documentation (Governance, Guides, Formats, and Hierarchy)

In this section, we have detailed the team's findings relating to the documentation Toronto Hydro has in place to formalize its internal PMO governance, processes, procedures, guides, template formats as well as the overall organization of these documents in the form of a document hierarchy. Additional details and samples are included in the appendices of this report.

2.1 Process, Governance, and Standards

It was clear through the interview process that Toronto Hydro stakeholders understand the critical importance of documenting PMO governance, processes, and procedures and have invested in producing process maps. While the team is focused on completing the necessary documentation, a high-level plan for identifying, developing, and implementing all the necessary documentation should be established. Most processes, which have been documented, are in the form of process flows which provide the sequence of actions to be performed but can be supplemented by additional tactical details necessary to execute the process or procedure correctly and consistently. This could begin with the preparation of a top-down hierarchical structure that organizes all documentation relating to governance, processes, and procedures. This hierarchy is a critical component as it will function as the roadmap to help Toronto Hydro organize all its PMO documentation and processes. We have included a sample hierarchy within the appendices to this report. Organizational Change Management (OCM) is currently being performed on an ad hoc basis without having a standardized process/approach which can make it difficult to effectively develop, implement, communicate, and ensure adoption of any organizational changes.

2.2 Practices and Resources

The majority of program and project stakeholders and individuals are aware of the existing documentation in place but are not necessarily familiar with all the required guides, standards, governance forms, and or formats. Members of the PMO who are responsible for developing and maintaining the documentation are extremely knowledgeable and have a thorough understanding of the internal Toronto Hydro PMO requirements and would be great resources to expand the knowledge base across other program and project stakeholders. Roles and responsibilities within the PMO should be formally defined to reduce duplication of effort, inconsistency with responsibilities regarding deliverables, mis aligned approval workflows, etc.

Many internal and program/project practices we found to be well defined, but sometimes varied on a case-to-case basis for example from project to project or from one internal PMO initiative to another. Implementing the additional documentation-related recommendations in this section will help bolster an enterprise-level strategy to deliver programs and projects under a uniform and standardized approach.

2.3 Applications and Tools

Currently Toronto Hydro is using its internal intranet as the central hub for storing and sharing its PMO documentation which is a great platform for sharing centralized information. Our team did however observe that the responsibility of developing PMO processes and procedures can often fall on individuals who are not part of the PMO itself. In cases such as this, there needs to be a protocol in place to identify which parts of a procedure are the responsibility of the PMO and which are the responsibility of other functional groups within the organization to ensure continuity and that actions do not get lost in transition. Furthermore, it was noted that when individuals external to the PMO develop any PMO documentation, they did so without operating under the same PMO intranet site. This is an area of concern as data that isn't stored in a centralized location with proper revision control can often lead to duplication errors and conflicting information.

Some of the business processes were also found to be defined under SAP, Toronto Hydro's ERP, which contains some standard forms, formats, and library data. To properly apply the existing processes and standards forms within SAP, a documented set of processes and procedures need to be in place to reference this information and ensure the proper change control is applied when something is updated.

2.4 Conclusions and Recommendations

Figure 2.1 – Overall Documentation Rating

Based on the observations identified in the sections above, we recommend the following:

1. Develop and implement a corporate documentation plan which:
    a. Addresses requirements from corporate-wide standards down to individual template formats.
    b. Identifies roles and responsibilities of all parties involved.
    c. Established a timeline for the development, review, approval, and roll-out of each deliverable.
2. Define the priorities for the required documentation, which will be driven by operation and capital plans as well as any long-term strategies Toronto Hydro has in place.
3. Assign a team dedicated to the identification, development, and update/maintenance of PMO documentation.
4. Develop a plan to frequently review and update the documentation in place based on practical feedback collected (regularly) from engineering, procurement, construction, and other stakeholder teams.
5. Ensure that external stakeholders (i.e., contractors, suppliers, vendors, etc.) also comply with Toronto Hydro's program/project management standards and requirements (such as scheduling and reporting). This may require a transitionary period as Toronto Hydro's supply chain becomes familiar with the new requirements.

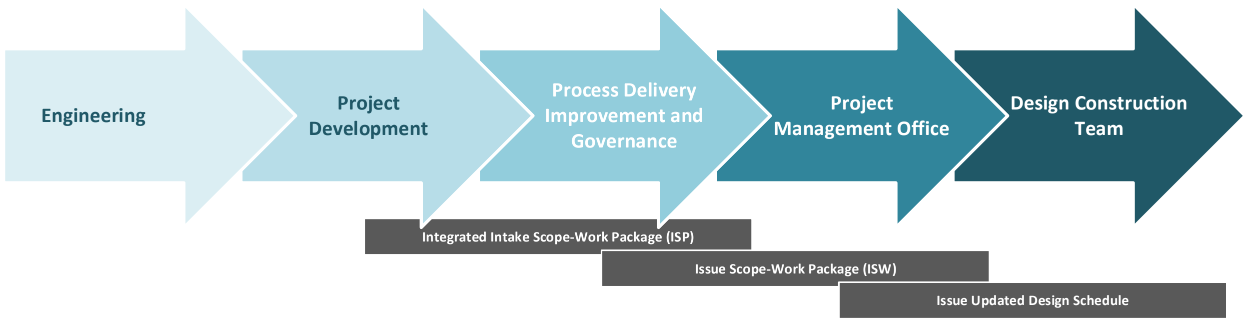
Please refer to Appendix A of this report for a proposed Document Hierarchy and Appendix C for a sample Integration Management Plan.

3 Project Initiation and Scope Definition

In this section, we have detailed the team's findings relating to the processes through which Toronto Hydro initiates its projects and defines the scope to be completed within each project. Although this responsibility falls to the individual project teams, the overall oversight of the process is performed by Toronto Hydro's PMO.

Figure 3.1 below illustrates the project initiation process flow which was observed during the assessment:

Figure 3.1 – Project Initiation Process



Project initiation begins with a high-level estimate being developed by the Engineering Team which is responsible for system planning and identifying various investment needs. The estimate gains more and more detail as it passes through the various work groups identified in Figure 3.1.

This process of project initiation is not currently standardized or documented in a singular integrated document such as governance that sets the guidelines around identifying how the need for projects is determined, stating the requirements to define a project, and the requirements for capitalization of the asset. We recommend a gated process be developed for the project initiation process which will define the requirements for information to be developed within each phase of the Project Delivery Report e as it progresses from engineering input through to the design construction team.

The following are currently available process flows that Toronto Hydro has in place to support scoping and project initiation:

1. Intake Scope/Work Page Process (ISP) – Owned by Process Delivery Improvement and Governance group (PDIG)
2. Issue Scope/Work Package (ISW) – Owned by the PMO
3. Issue Project – Owned by PMO

As evident in the list above, the responsibilities of project initiation are owned by two different working groups within Toronto Hydro and the individual steps are not linked together by an integrated document, which could lead to duplication of efforts or misalignment in terms of expectations concerning project initiation and definition.

3.1 Practices and Resources

Members of the PMO were aware of the process and were utilizing some prepopulated process flows and formats to oversee the project initiation process. However, they were not aware of the similar/duplicate efforts being performed in the Engineering and Project Development groups.

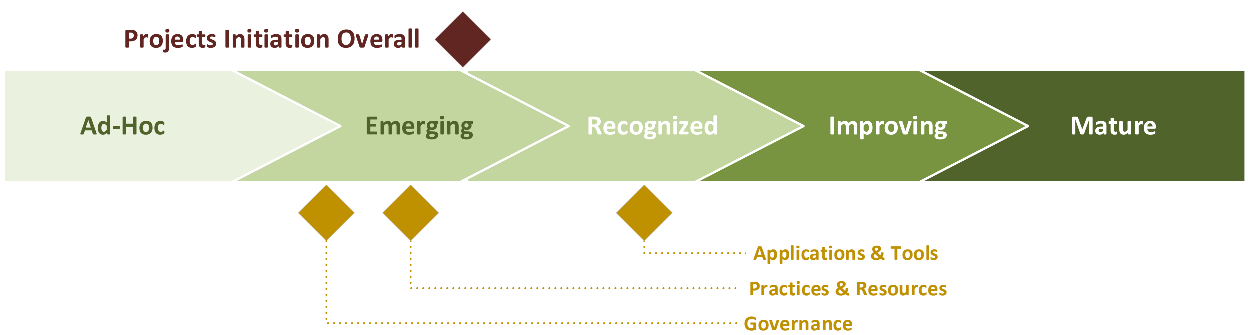
Although it was noted that the PDIG / PMO team members are required to collaborate on project initiation, there is no dedicated organizational chart or responsibility matrix developed for a formal Project Initiation Team and the roles and responsibilities of the individual team members have not been defined and documented. Furthermore, we did not observe any documented training and skill improvement plans for this subject matter area. Providing formal training on project initiation would help to align expectations between the PMO / PDIG and subsequent work groups and allow them to work together more coherently.

3.2 Applications and Tools

Project initiation is performed primarily using existing processes within SAP by the PDIG and through leveraging historical data from past projects into the development of new Scope of Work Packages, also stored under SAP. Within SAP, Toronto Hydro has mapped out the project lifecycle and associated business practices up to and including the design schedule development, however, processes beyond engineering have not developed.

3.3 Conclusions and Recommendations

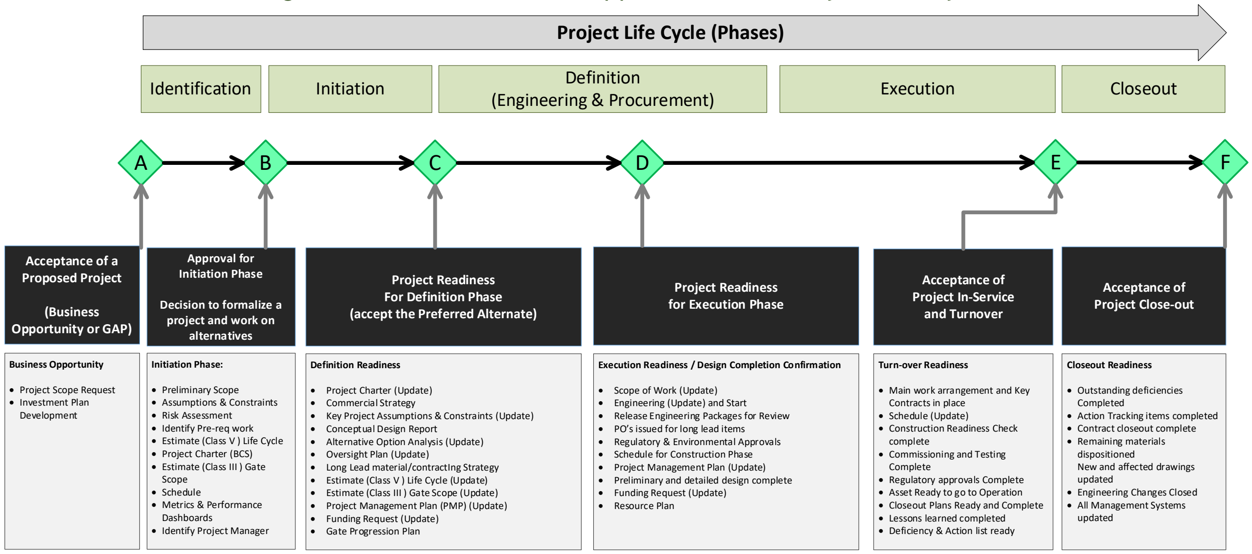
Figure 3.2 – Overall Project Initiation and Scope Defining Rating



Based on the observations identified in the sections above, we recommend the following:

1. Develop overarching governance for project initiation which covers the entire project lifecycle and integrates the responsibilities of the PMO / PDIG, and any other necessary work groups within Toronto Hydro.
2. Adopt a high-level gated process to enforce program/project management requirements across the complete project lifecycle. Figure 3.3 below illustrates a typical gated process which defines the necessary inputs to be defined at each stage of the project lifecycle from project initiation to closeout:

Figure 3.3 – Gated Process Approach to the Project Life Cycle



3. Develop and maintain dashboards to track and monitor projects across all points in their life cycle (active, yet to be initiated, in construction, in commissioning, capitalized/in-service, etc.) as this would provide an additional layer of portfolio management information to enable the team within the PMO to assign priorities to projects and better maintain the overall Toronto Hydro programs.

Please refer to Appendix B of this report for a generic sample Project Dashboard and Appendix D for a sample Scope Management Plan.

4 Estimating

In this section, we have detailed the team's findings relating to the estimating practices which Toronto Hydro uses to develop project and program budgets. As the estimating practices are not the responsibility of Toronto Hydro's PMO, a dedicated personnel interview relating to this subject matter area was not performed, however, it was included in the assessment as estimating is a critical process tied into other operations with the PMO.

4.1 Process, Governance, and Standards

It was observed that estimating practices are not documented under any Toronto Hydro governance currently in place. Typical estimate governance would include the following key subject matter areas to ensure consistency of this practice across the organization:

- Basis of Estimates
- Productivity Rates
- Units of Measures
- Standard Cost Breakdown Structure (CBS),
- Work Breakdown Structure (WBS)
- Work packaging
- Control accounts definition and levels
- Any other assumptions such as coding or library data.

4.2 Practices and Resources

As mentioned in Section 3, high-level estimates are primarily developed by the Engineering and Investment Planning team members, and more detailed input is typically provided by the Construction Team. Most of the estimating practices are performed and concentrated under SAP and the business processes relating to estimating are also already established under SAP. As a result, we found that the personnel was very familiar and aware of the expected processes and responsibilities relating to estimating further supporting the benefits of formally documenting processes and procedures to standardize project delivery across the organization.

Our team suggests that industry-accepted standards from the American Associated of Cost Engineers (AACE) or the Project Management Institute (PMI) be incorporated and referenced in estimating practices and to better leverage historical project data as a benchmark by collecting and organizing historical project data in a centralized database and using this data as a reference for planning and estimating future projects. Benchmarking against past projects (with actual incurred cost data) is a very effective way to improve the quality of estimates.

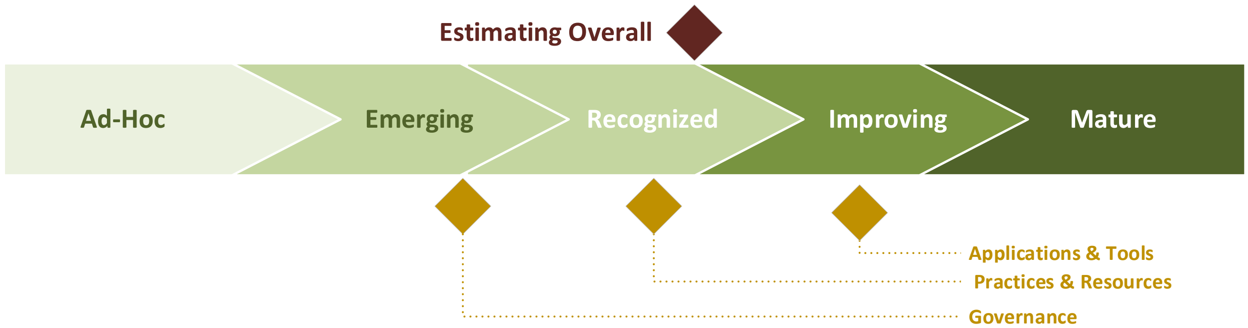
From an organizational perspective, a dedicated organizational chart and formalized estimating training plan could be instituted.

4.3 Applications and Tools

The estimating functions and associated business processes are largely performed and contained within SAP. Library data for past and ongoing projects is also contained within the SAP system including typical forms and templates which presents a great source of data to develop the centralized database of historical project data.

4.4 Conclusions and Recommendations

Figure 4.1 – Overall Estimating Rating



Based on the observations identified in the sections above, we recommend the following:

1. Perform a self-assessment to identify opportunities for further improvement to estimating practices such as increasing the reliance on benchmarking and historical project data as inputs into new estimates.
2. Investigate possible enhancements of the estimating tool within SAP for better performance.
3. Engage with industry organizations governing estimating practices (such as AACE) and develop a plan and adopt their best practices and standardized approaches.

5 Schedule Management

In this section, we have detailed the team's findings relating to the time management and scheduling practices within Toronto Hydro and how project schedules are developed, refined, maintained, and linked together on a macro scale (program level).

5.1 Process, Governance, and Standards

Integrated time and schedule management practices are not currently documented under any of Toronto Hydro's governance, and there are no related job-aids, process flows, forms or templates in place to support standardized scheduling practices at the program and or project levels. A typical well developed and comprehensive scheduling governance would include details regarding the following subject matter areas:

- Basis of Schedules
- Methodology for developing, updating, and maintaining schedules
- Scheduling library data such as calendars, codes, roles, resources, etc.
- Standard Work Breakdown Structure (WBS),
- Schedules quality management plans and practices
- Standard scheduling reporting

5.2 Practices and Resources

Our team observed that programs and projects were largely monitored based on significant target dates (i.e., completion of engineering, etc.) that are logged in a master table as opposed to physically developed schedules. A few of the project teams are using Microsoft Project to maintain and update schedules. However, schedule quality and reliability could be an area for enhancement to include logic ties between milestones, tracking of the critical path, resource management, tracking and calculation of percent physical completion, and EVM.

Lack of logic-tied schedules is preventing the teams from calculating their schedules and having a clear picture of all the dependencies within the tasks and forecasted completion dates. Cost flow (and effects of change) is performed at a very high level and could be better informed by using an integrated scheduling tool. Program and project milestones are not being identified and used in scheduling practices regularly. We believe that this is a simple corrective action that can be implemented relatively quickly. Having clearing milestones for each project will provide an improved level of accuracy for scheduling as well as progress measurement.

From an organizational perspective, a dedicated organizational chart with roles, and responsibilities and a formalized training plan in place for scheduling functions would be beneficial.

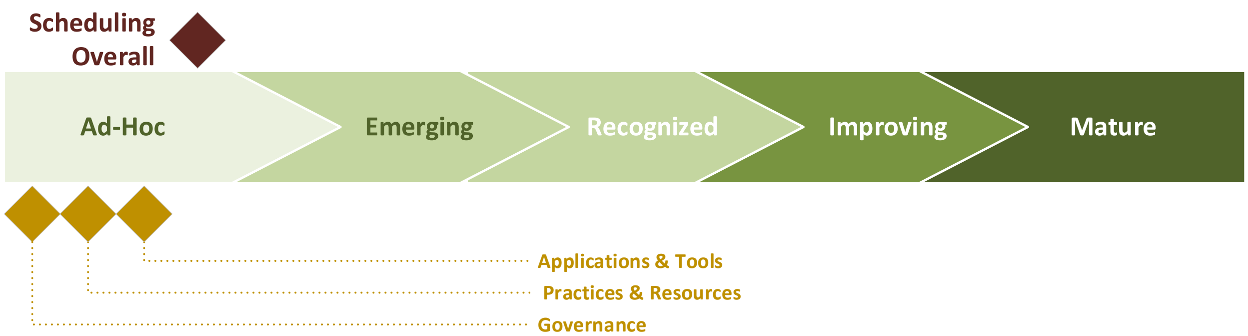
5.3 Applications and Tools

In summary, the time management and scheduling activities are performed in Microsoft Excel with a few cases (large more complex projects) being managed in Microsoft Project. Although these tools may be sufficient for Toronto Hydro's project delivery purpose there are many disadvantages to scheduling projects in this manner such as:

- A high level of manual effort is required to track and update schedules
- Inconsistent practices for time management
- Negative impact on forecasting accuracy and practices

5.4 Conclusions and Recommendations

Figure 5.1 – Overall Scheduling Rating

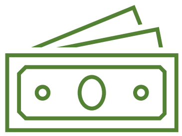


Based on the observations identified in the sections above, we recommend the following:

1. Adopt a scheduling tool to be used across the entire organization (i.e., Microsoft Project or Primavera P6) and provide training to all necessary staff. We recommend that Toronto Hydro take the following staged approach to implement an organization-wide scheduling platform:
    - Identify the scheduling requirements and document them
    - Identify critical projects (complex, long term, high investment, regulatory-related, etc.)
    - Phase 0 – Utilize Microsoft Project (standalone, non-enterprise solution)
    - Phase 1 – Move all schedules into a third-party enterprise scheduling environment
    - Phase 2 – Establish Toronto Hydro's Enterprise Scheduling Environment
    - Phase 3 – Transfer all the schedules into Toronto Hydro' Enterprise Scheduling Environment
2. Define and roll out a milestone management methodology to quickly develop a program/corporate time management system (providing internal, external, regulatory, strategic commitments clarity).
3. Investigate possible enhancement to the scheduling tool (for future phases) such as Primavera P6 for better performance and smother integration with the current SAP system.
4. Engage organizations responsible for standardized scheduling practices (such as AACE, PMI) and adopt their best practices on program and project time management.

Please refer to Appendix E of this report for a sample Schedule Management Plan.

6 Cost Management (Budgeting and Cost Control) & Resource Management



In this section, we have detailed the team's findings relating to Toronto Hydro's cost and resource management practices to assess how project costs are planned and tracked, when and how funds are released as well as how projects are staffed from a personnel perspective.

6.1 Process, Governance, and Standards

After a review of the provided documentation and interviewing of key relevant personnel, our team observed that Toronto Hydro would benefit from developing a standardized cost management plan/approach and or procedures to provide a standardized basis for how to perform cost management for both projects and programs. A typical set of cost management processes and procedures would include the following:

- Basis and methodology for developing and maintaining budgets
- Library of reference cost control data such as unit rates, escalation rates, cashflow functions roles, etc.
- Standardized WBS and CBS
- Standardized protocols for actual cost and accrual collection
- Standardized reporting formats for key cost indicators such as budget, forecast, actuals, etc.

The team did observe a degree of standardization amongst the practices concerning the cost management that was generally adopted amongst the teams, however, they were not formally documented or adopted across the entire organization. Currently, projects follow a simple process to track project costs against the planned budgets. If a project is over or under spent, the project teams need to submit a change request (typically performed every year) to reconcile the variance. The project teams develop the budgets and then track the actual incurred costs as per a typical WBS/CBS but like other elements, this process is not formalized under a controlled and documented process. There are process flow diagrams to summarize some of the cost management workflows, but they typically lack the detail necessary to standardize the approach to costing, scheduling, and cash flow, etc., which could lead to variance and discrepancies in how each project team performs these functions and as a result how the relevant project information is presented.

Resource management is performed on an enterprise or corporate level using a Project Resource Allocation Template (PRAT). The PRAT is populated by Program Management Consultants (PMC) and summarizes the inputs from each department within Toronto Hydro which is then combined into a Corporate Resource Plan. Similar to cost management, while there are certain processes and standards in place, Toronto Hydro would benefit from a central governing document that describes how resourcing is to be planned, tracked, and executed.

6.2 Practices and Resources

In general, the cost management processes being followed are considered general guidelines or practices by the project teams. In terms of documentation, the processes are logged as job aids or process flows containing minimal detail.

Any projects that exceed their budgets by 15% or more are flagged and required to go through a root cause analysis to determine the cause of the variance. PMCs are responsible for monitoring all the cost data for the projects within their portfolios. On an enterprise level, the PMO collects all the project cost data to track the portfolio performance against the annual budget.

Currently Toronto Hydro does not have a gated process through which to release funding to projects on a gradual level based on the project lifecycle. Furthermore, EVM and the tracking of physical completion progress are not employed. In general, the absence of formalized schedule practices, physical progress tracking, and EVM can result in deficiencies in the cost controlling of projects including:

- Improper cashflows that misrepresent the direct work planned to be executed
- Accurate communication and measurement of the accruals due to the lack of physical progress tracking
- Inconsistency in the alignment of cost forecasting with scheduled and planed work as well as EVM

Actual Costs are collected and administrated by Finance and logged under SAP (the same platform where estimated and budgets are stored however the invoicing is performed via email). Actual costs are monitored as Life to Date (LTD) and Year to Date (YTD). Currently Toronto Hydro is primarily tracking the cost incurred against the total project budget. This is a reactive approach as it does not provide enough detail to understand if a project is trending over budget to raise a flag before the budget is already exceeded. Similarly, with project schedules and dates, the projects are primarily tracked as either being complete or incomplete, with minimal focus on intermediate milestones to track progress. Tracking of actual costs against the budget and scheduled completion dates is logged in the Project Delivery Report (PDR) which is prepared by each PMC for their respective portfolio.

There is a monthly cash flow developed for all the projects which get reviewed against the budget. Typically, this review is performed for the top 10 most capitally intensive projects within the portfolio. For large-scale megaprojects (i.e., supporting mega-transit programs in Toronto), Toronto Hydro assigns each project its own dedicated PMO team which generally follows the same standards as the corporate PMO. As part of this audit, our team did not have access to any of the key personnel that was allocated to the mega projects, as such the team focused on the corporate PMO and its functions.

Overall, there are general guidelines to program and project cost management present within each of the project teams, there is no enterprise-level framework in place to ensure that cost management is being performed consistently across the entire organization.

From an organizational perspective, there is no dedicated organizational chart, defined set of roles and responsibilities, or formalized training plan in place for the cost controlling functions within Toronto Hydro.

In terms of resourcing, supply, and demand of resources, is managed through:

- Demand: Project Resource Allocation Template (PRAT), by developing the PRAT, projects identify and log their demand for resources. The PRAT provides information regarding the type and quantity of resources required and integrated the budget units, labour types, and scope as well.

- Supply: The Forecast Assumption Summary (FAS), comprised of inputs from each division, provides a summary of the available resources at any given moment.

Both of the above documents as well as resource management assumptions such as calendars, holidays, vacation, and sick leave are all logged as Microsoft Excel files. Currently, Toronto Hydro is in the process of transitioning to Business Planning and Consolidation (BPC) which is a module within SAP that provides more automated resource tracking, normalization, and balancing activities. Using the BPC functionality within SAP is a great step towards more effective resource planning as well as enabling more enterprise-wide functionality by levering the integration of SAP within other project management practices.

6.3 Applications and Tools

Currently Toronto Hydro stores both estimates and actual incurred costs within the SAP system, which is a very effective practice promoting enterprise-wide integration. However, budgets and all comparisons against planned, forecast, and actual values are maintained and managed through Microsoft Excel which requires a lot of effort to keep up to date and presents the potential risk for data errors.

Projects and their associated budgets are initiated as per the following steps:

- Engineering defines the project based on technical, regulatory, or capital investment need
- Engineering develops a high-level estimate of the major equipment, required labour, and durations (similar to a top-down approach)
- The estimate is then provided to the Planning Team who breaks the work up into sub scopes and provides additional detail into the estimate by using "Units of Work"
- The estimates are logged under SAP and will be used as the basis for material procurement
- The PMO receives the Work Packages and adds any required equipment information and additional resource requirements into them
- The PMO is then responsible for finding the available team to execute the project
- Work Packages will be transferred to execution Responsibility/Resource Centres (RC) to develop a detailed design estimate using a bottom-up approach.

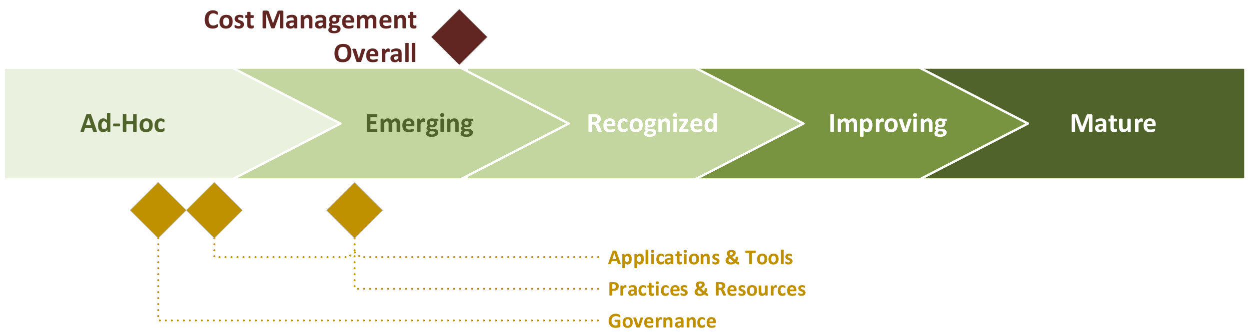
The budgets and forecasts are reviewed and approved by RC leaders, and there is a standard change request tool (SAP module), where projects can enter their last approved budget as well as their current change request.

Process and approval routes for the change requests are defined to go to different approving individuals based on the project and dollar value before it can be incorporated into the final project budget (50K$ for OPEX and 100K$ CAPEX triggers the change process). Change requests below the OPEX and CAPEX thresholds do not require a change request and can be processed through the project team directly.

All resource management-related activities are managed under Excel at this time, but Toronto Hydro is progressing towards implementing the BPC module with SAP in the near future.

6.4 Conclusions and Recommendations

Figure 6.1 – Overall Cost Management Rating



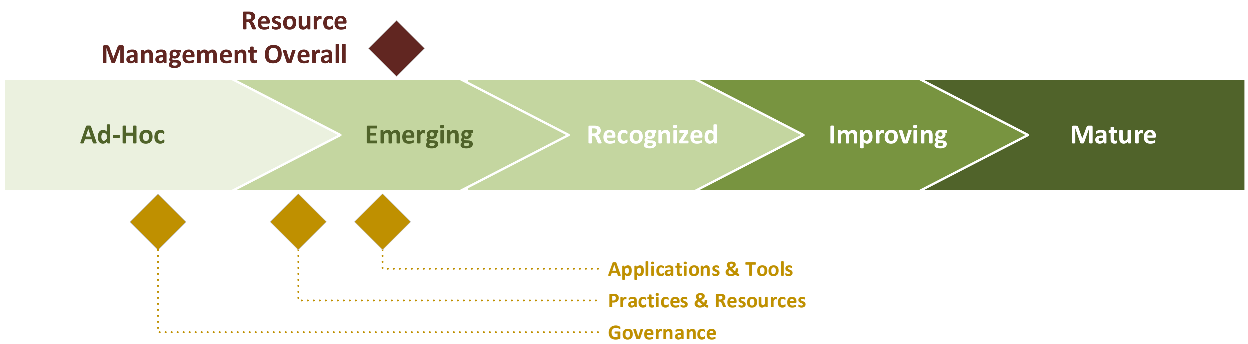
Based on the observations identified in the sections above, we recommend the following:

1. Adopt project-level cost and performance tracking methodology which can be implemented for each project lifecycle phase. Begin tracking progress against each phase in a binary manner (i.e., has the phase been completed yes, or no?) This will improve the accuracy and quality of forecasting and cost control with the Toronto Hydro portfolios.
2. Develop, implement, and provide training for a set of standard program and project dashboards which would provide cost control related information across different levels within the portfolio.
3. Plan for adopting an automated invoicing and cost collection application, there are several cloud-based options available that would get stakeholders (Vendors to enter the information into the system and follow predefined business rules and data quality).

Please refer to Appendix F of this report for a sample Cost Management Plan.

The assessment on resource Management and recommendations are as follows:

Figure 6.2 – Overall Resource Management Rating



Based on the observations identified in the sections above, we recommend the following:

1. Replace the current resource management excel spreadsheets with an enterprise resource management tool (as per the PMO team some planning is in place toward this requirement).
2. Develop and maintain a level of integration between resource planning and scheduling/budgeting for a higher level of efficiency and productivity.

3. Identify high-demand resources (overall or on some special period of year or projects) which can potentially create bottlenecks concerning staffing of projects. Develop a strategic plan to secure these types of resources.

7 Risk and Contingency Management

In this section, we have detailed the team's findings relating to Toronto Hydro's risk and contingency management practices to assess how project risks are identified and quantified, how mitigation strategies are developed as well as how contingency is quantified, allocated and released to projects.

7.1 Process, Governance, and Standards

Risk management practices within Toronto Hydro are performed by various teams depending on the stage of the project lifecycle. While there are generally accepted approaches to risk management within the organization, they have not been documented in the form of a Risk Management Plan to set the standard for this practice across the entire organization. The following common documentation is required to standardize risk management practices within a project, program, or across an entire organization:

- Risk identification, classification, mitigation, and response plans
- Documented quantitative and qualitative risk analysis methodologies and guidelines
- Standard Risk Breakdown Structure (RBS) and integration with WBS/CBS
- Documented contingency development and management methodologies

Toronto Hydro has standard practices developed and logged under a Microsoft Access database which is used as the organization's centralized risk management tool. When a project is initiated under the program, all identified risks will be logged under the risk management tool.

Currently, Toronto Hydro is grouping risks in two categories:

- Program Variance Log (PVL): Risks that have already occurred or have a probability of occurring that is greater than 70% (logged in an Excel spreadsheet)
- Enterprise Risk Log (ERL): Risks whose probability of occurrence is less than 70% (logged in an Access database)

All the risks are qualified and review regularly to quantify pre- and post-mitigation risk exposure. Once risks are closed out, they are no longer tracked for the project, but they are used as historical input on future projects. Considering that Toronto Hydro's current risk practices are fairly mature we believe that the organization would benefit the most from documenting this process formally as a procedure to ensure consistency and accuracy of the practice across the organization.

7.2 Practices and Resources

As mentioned above, Toronto Hydro has standard risk management practices developed and logged in a Microsoft Access database which services as the organization's centralized risk management tool. Project risks are defined during the project initiation stage and are logged with the PVL or the ERL depending on their probability of occurrence. Project risks are reviewed regularly until they are realized or closed out. Historical risk information is used as feedback and input into future project planning.

From an organizational perspective, Toronto Hydro does not have a dedicated team to manage risks on an enterprise level and to lead risk workshops to identify and quantify project risks and mitigation strategies.

Contingency development and tracking are performed by PMCs when they are developing the project budgets but there are no specific documented guidelines or defined roles and responsibilities to ensure contingency is allocated consistently.

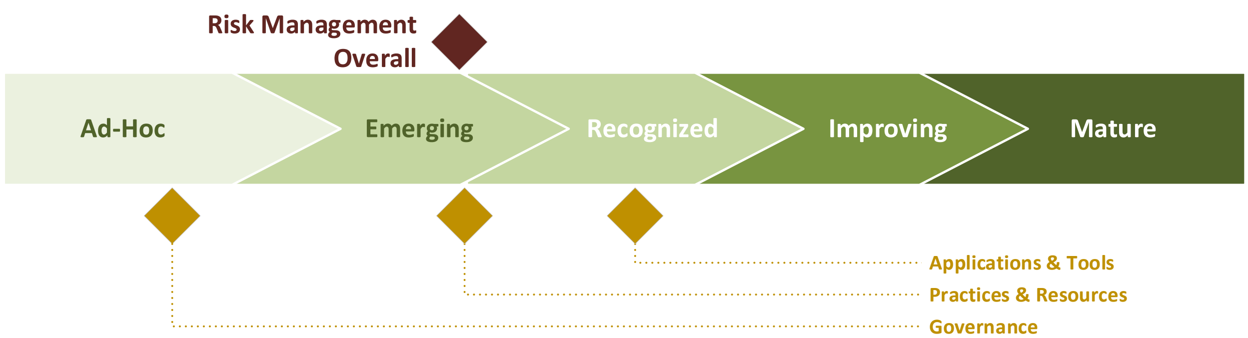
7.3 Applications and Tools

Risks, depending on their probability of the occurrence are logged either in Microsoft Excel (PVL) or within a Microsoft Access Database (ERL)

Toronto Hydro is aware of the need for adopting an integrated application for identifying, managing, and mitigating the risk on both the project and program levels. Although the two current platforms (Excel and Access Database) are sufficient to meet Toronto Hydro's needs, an Enterprise Risk Management platform could be considered if the project load is expected to grow in the future.

7.4 Conclusions and Recommendations

Figure 7.1 – Overall Risk and Contingency Management Rating



Based on the observations identified in the sections above, we recommend the following:

1. Develop and implement an Enterprise Risk Management (corporate-wide) strategy for all the Toronto Hydro divisions and stakeholders in charge of executing different phases of the projects.
2. Assure that Risk Management is covered under program and project dashboards including pre and post mitigated impacts, probabilities, and contingencies.
3. Plan for transitioning from current stand-alone MS-Access database and Excel spreadsheets into an Enterprise Risk Management tool (which could be hosted as a cloud service and accessible from different stations and construction sites).
4. Manage a multi-Layer contingency strategy by assigning and tracking the contingencies separately from project and program budgets, so that the management team would always have a clear picture of how much has been withdrawn from project contingencies or program reserve. Similar steps should be taken with regards to project schedule float or management reserves when it comes to program target dates.

8 Change Management

In this section, we have detailed the team's findings relating to Toronto Hydro's change management practices to assess how changes to project scope, schedule, and cost are communicated by the project teams, reviewed, assessed, approved, and implemented.

8.1 Process, Governance, and Standards

Currently, any potential changes to projects (scope, cost, schedule) are initiated, tracked, and managed using Toronto Hydro's SAP system as a centralized and integrated database system. While the use of SAP to manage project change is a generally accepted practice across the organization, Toronto Hydro would benefit from a documented change management process. A documented and standardized change management process would benefit Toronto Hydro through the following areas:

- All change-related information (requests, approval status, etc.,) will be logged in a standardized manner for ongoing and completed projects which will make project closeout easier.
- Project-level change information can be rolled up to the program and portfolio level to allow senior management to track high-level change trends to help inform strategic decisions.
- Having all the change information logged and organized will greatly support Toronto Hydro's abilities to mitigate any project claims should they arise.

The following common documentation is typically required to standardize change management practices within a project, program, or across an entire organization:

- Change management plan (Including forms, formats, level of authorities)
- Change initiation, assessment, and approval processes
- Change management roles and responsibilities (Authorized individuals for raising a change request to personnel with approval authority)
- Historical change management Information
- Claims and disputes mitigation and management plan

Currently, Toronto Hydro manages project change through a Change Request (CR) which, as mentioned above, is processed through SAP using standardized templates and formats. The level of authority required to approve a CR is determined by the financial impact of each change requested. The standard CR process under SAP covers various types of changes (scope, schedule, cost, etc.), comes with a pre-defined request/approval workflow already built-in, and allows for access to historical CRs on any given project all within the same module under SAP. Using SAP for change management is a great way for Toronto Hydro to keep all change data centralized and easily accessible and to ensure consistency in the change management process.

Internally to Toronto Hydro, if a certain project is nearing the limit of its budget and trending towards exceeding it, conditional approval to proceed is granted until the change request is approved for additional budget. Typically, the project will be instructed to proceed at a slower place under the CR is approved.

Externally, contractors, suppliers, and vendors are not authorized to proceed with any work at risk (beyond the approved budget) and must obtain an approved CR before continuing any further work.

The CR process has the following requirements and predefined thresholds:

- CAPEX projects: A change request is required if the total variance value is more than 100K$
- OPEX project: The threshold for the OPEX project is 50K$.
- Exemption: Changes less than the set threshold above don't need a change request.

The PMO actively monitors project budgets, actual costs, and forecasts frequently to track projects and flag potential upcoming change requests.

8.2 Practices and Resources

Internal project stakeholders submitting a CR are responsible for performing all the necessary follow-up activities to ensure the change request is processed, while the PMO is responsible to provide oversight over the process, making sure that it is followed. Any pending, in progress, or completed actions related to change requests are logged and tracked from initiation through to completion. An impact analysis is performed for the change request using the CLM 1/2/3 module within SAP to evaluate the potential effects of the CR on the given project before it is approved.

External project stakeholders (suppliers, vendors, contractors) change requests are managed by the Toronto Hydro contract administrators. The contract administrators receive change requests from the external party, log it under SAP, perform the necessary follow-up actions until the request is approved or rejected, and then communicate back to the external party.

While the change process itself is in place and functioning, Toronto Hydro has not implemented an organizational chart with roles and responsibilities to identify the individuals responsible for change management and has not provided any formal training to those responsible for this process.

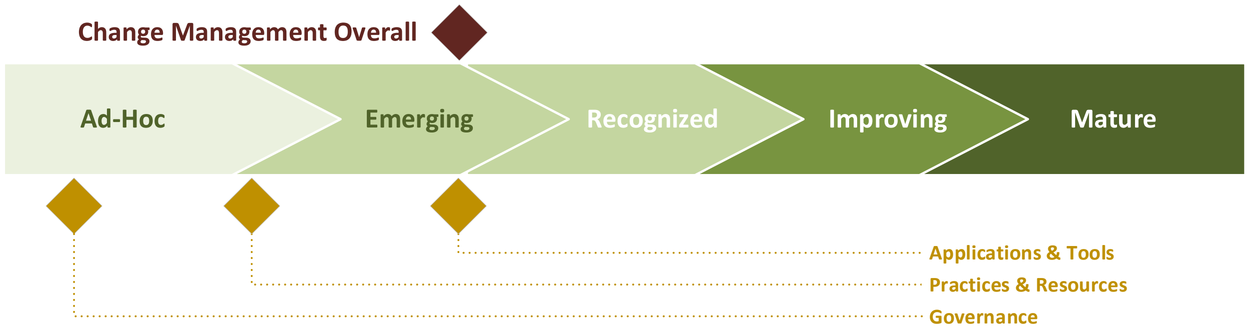
8.3 Applications and Tools

Toronto Hydro's CR process is entirely embedded within SAP and all internal stakeholders have access to change information (varying depending on their level of authority). All the historical change request information and data are easily accessible through the SAP system which presents a great opportunity to use this information for benchmarking and lessons learned initiatives for future projects. External change requests are communicated through Contract Administrators and processed through SAP as well, however, this process can create additional workload for Toronto Hydro to process the external requests.

Given that project data such as schedules, budgets and scopes are not stored under the same platform (centralized database) updating this data to reflect an approved change request is often a manual process that presents the risk of error during data entry.

8.4 Conclusions and Recommendations

Figure 8.1 – Change Management Rating



Based on the observations identified in the sections above, we recommend the following:

1. At this time, the PMO is just overseeing the change management process while it is performed by Contract Administrators (outside of the PMO). The disconnect between the PMO and the Contract Administrators could pose risks of not having the impacts of the change requests communicated up to the PMO for consideration from a portfolio perspective. We recommend that the change management process be brought entirely within the scope of the PMO.
2. PMO needs to add and update all the change-related information (at least the major ones) into program and projects performance management dashboards.
3. CRs are well maintained as a single element with SAP at this time, however, the PMO should consider further integration with scope, schedule, and cost to minimize the efforts and risk associated with manually updating project information every time a change is approved.

9 Performance Management and Reporting

In this section, we have detailed the team's findings relating to Toronto Hydro's performance management and reporting practices to assess how project performance is measured, assessed, and communicated throughout the various levels of the organization.

9.1 Process, Governance, and Standards

Currently, Toronto Hydro's performance management and reporting practices are not governed by a documented set of processes and procedures. Having this process formally documented and standardized would help better communicate the status of the corporate, program, and project goals concerning performance measurement and reporting. Comprehensive performance management and reporting framework typically include details relating to:

- Setting reporting requirements to provide management with the necessary strategic information.
- Performance calculation methods such as physical progress calculations, EVM, forecasting of the expected finish/required budget to complete/final cost of deliverables.
- Standard central data repository ("Single Source of Truth") provides all stakeholders with the necessary information for informed decision-making.
- Requirements for the project, program, portfolio, and enterprise-level dashboards (one-page report developed for different levels within Toronto Hydro) to provide a brief and up-to-date status of completed ongoing, and planned work.

9.2 Practices and Resources

Project and program performance management and reporting within Toronto Hydro is not performed by a centralized reporting team, rather different groups within the organization have responsibilities for different reporting functions as outlined below.

Toronto Hydro Supervisors are responsible for developing and maintaining the Management Controls and Reporting System (MCRS) which is a guideline providing details around reporting such as information to report, level of details, reporting frequency, etc. This is typically information that would be communicated through a reporting governance or procedure document. The team observed that the MCRS has been adopted across the entire organization which ensures a standardized approach to reporting. The MCRS covers reporting at the project level up to the program level and provides templates for generic reports. MCRS data is stored under a centralized library which includes historical action logs dating back up to five years, depending on project size. It was observed that Toronto Hydro also has an MCRS report, but it is not issued regularly, rather more on an as-required basis. The MCRS reports provide details at the project level, this information is then summarized in higher-level reports, discussed below.

PMCs are responsible for developing the Program Delivery Report (PDR) which essentially places them as the primary stakeholders in charge of developing reports for the PMO. PDR reports are developed by PMCs for their associated RCs (These reports are developed after the release of capital expense reports monthly), and PMO gathers these reports and consolidates all the results under one package. The PDRs provide a summary of all projects with a particular RC portfolio.

Other reporting within Toronto Hydro includes:

- Design Readiness Reports – developed by Engineering
- Maintenance Summary Reports – developed by the Construction Team
- External stakeholder (suppliers, contractors, vendors) updates – provided through regular communication with the Contract Administrators who manually communicate any important details to the internal stakeholders within Toronto Hydro

From an organizational perspective, Toronto Hydro has not implemented an organization chart with roles and responsibilities to identify the individuals responsible for performance monitoring and reporting.

9.3 Applications and Tools

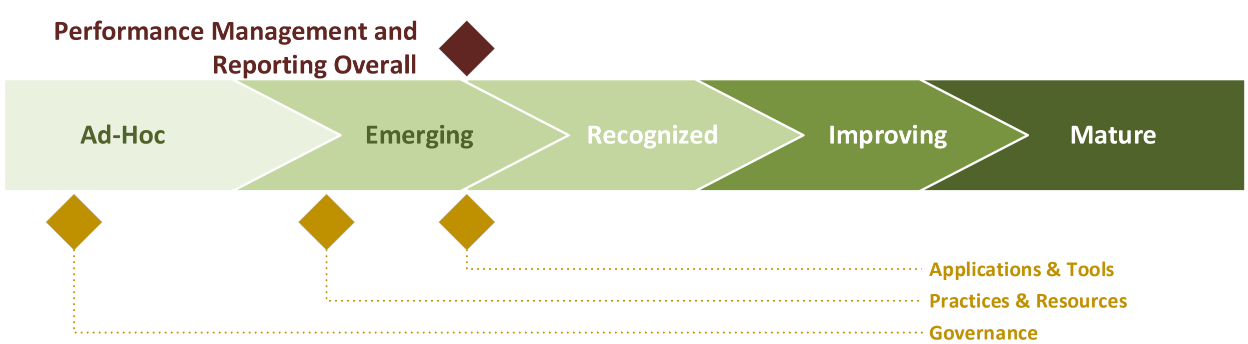
SAP and open TEXT are the primary data sources for reporting along with additional information which is extracted from various Excel spreadsheets and Access Databases. The data is then communicated through reports which are developed in SAP BI, Tableau, or Excel (primarily through Excel).

PMO-related reports are sometimes multi-layer (such as Planned Capital Project Completion Report or Design Readiness report). There are some additional dedicated reports for senior management which provide summarized data rolled up from the project level. In general, it was observed that the Toronto Hydro has formally documented any assumptions required for its PMO reporting requirements, and whenever ad-hoc reports are developed, assumptions for each report as also documented within the report so that whoever reads the report can understand how the information is being presented.

Toronto Hydro is currently transitioning the team (i.e., PMCs) from current manual reporting to using Tableau which allows them to leverage a lot of prepopulated/existing information.

9.4 Conclusions and Recommendations

Figure 9.1 – Performance Management and Reporting



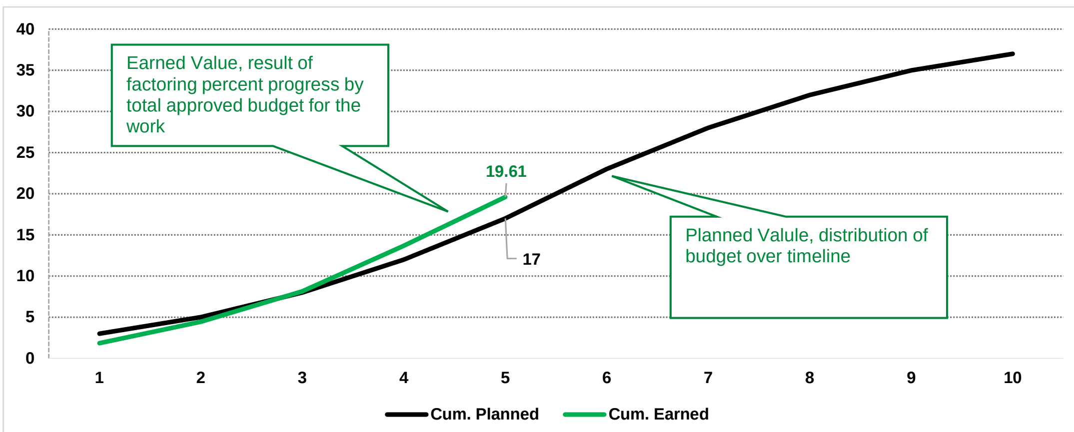
Based on the observations identified in the sections above, we recommend the following:

1. Adopt standardized performance measurement practices (even on a high-level basis) such as:
   a. Cost and schedule integration would result in alignment between budgets time spreads and work planned to be completed

b. Earned Value Management (for each phase of the project would be sufficient at this time) to support the status assessment, forecasting, and overall portfolio management.
c. Rule of Credit (It could be as simple as weighted milestones) to calculate project progress and roll it up into program levels.
d. Physical percent progress where progress is based on predefined rules of credit (such as tracking completed units against total quantities) as shown in the example in Figure 9.2 below:

Figure 9.2 – Performance Management (Physical % Progress)

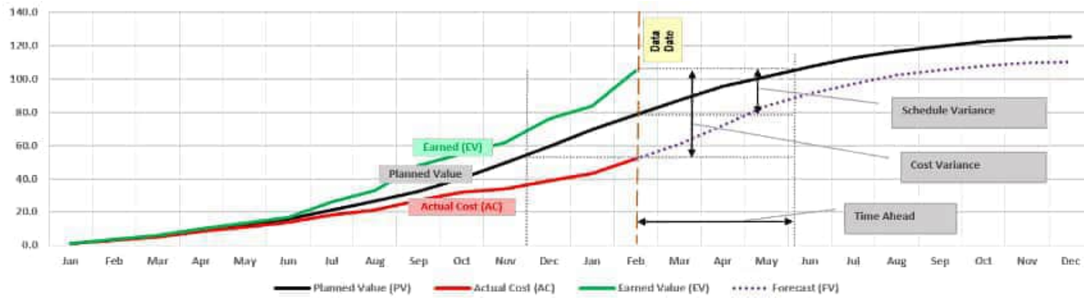
	Months									
	1	2	3	4	5	6	7	8	9	10
Planned Value	3	2	3	4	5	6	5	4	3	2
Progress	5%	7%	10%	15%	16%					
Earned Value	1.85	2.59	3.7	5.55	5.92					
Cum. Planned	3	5	8	12	17	23	28	32	35	37
Cum. Earned	1.85	4.44	8.14	13.69	19.61					



2. Include Cost Performance Index (CPI) and Schedule Performance Index (SPI) as key metrics for tracking the performance for projects (at least major/critical projects) and combine these KPIs into summaries for the program level dashboards. Implementing CPI and SPI will support the schedule variance calculations and great improve forecasting and recovery plan developments, see Figure 9.3 below:

Figure 9.3 – Performance Management (Physical % Progress)

	Year 1												Year 2											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Planned Value (PV)	1.0	3.0	5.5	8.5	12.0	16.0	21.0	26.5	32.5	40.5	49.5	59.5	69.5	78.5	87.5	95.5	101.5	107.5	112.5	116.5	119.5	122.5	124.5	125.5
Actual Cost (AC)	0.9	2.9	5.1	8.4	11.0	14.0	18.0	21.0	27.0	32.0	34.0	39.0	43.0	52.0										
Earned Value (EV)	1.1	3.5	6.1	10.1	13.2	16.8	26.0	33.0	48.0	55.0	62.0	76.0	84.0	105.0										
Forecast (FV)														52.0	61.0	72.0	84.0	91.0	97.0	102.5	105.2	107.8	109.6	110.4
Schedule Variance (SV=EV-PV)	0.1	0.5	0.6	1.6	1.2	0.8	5.0	6.5	15.5	14.5	12.5	16.5	14.5	26.5										
Cost Variance (CV=EV-AC)	0.2	0.6	1.0	1.7	2.2	2.8	8.0	12.0	21.0	23.0	28.0	37.0	41.0	53.0										
SPI (EV/PV)	1.1	1.2	1.1	1.2	1.1	1.1	1.2	1.2	1.5	1.4	1.3	1.3	1.2	1.3										
CPI (EV/AC)	1.2	1.2	1.2	1.2	1.2	1.2	1.4	1.6	1.8	1.7	1.8	1.9	2.0	2.0										



3. Plan and transition toward a centralized data repository that can be updated from multiple sources (automated and manual) but will serve as the main data set for all reporting
4. Design, develop and use a series of dashboards that would serve as a simple and short way of visually communicating key reporting data.
5. Develop a centralized reporting team, corporate-wide, which will be in charge of collecting all required information, verifying the data sets, developing reports, administrating the update meetings, and maintaining the historical report repository for future needs.

10 Summary Remarks

Given Toronto Hydro's successful track record over the last 20+ years, it is evident that the organization already has the necessary knowledge and skills to manage and execute its portfolio of projects.

The most notable strengths highlighted by our team include:

- The level of interest and belief in standardized project management practices that exist with the Toronto Hydro team
- The abundance of project management practices (estimating, change management, project initiation, etc.) that are already in place within the organization
- The use of SAP (as highly capable and robust ERP) as the backbone of the program and project management practices with Toronto Hydro
- Clear channels of communication (regular meetings, data stored within SAP, reporting, etc.) are defined and followed throughout the organization which is a critical aspect of successful program/project management

Continuous improvement as an ongoing initiative for Toronto Hydro is one of the key drivers for this assessment. As such, below we summarized some of the key areas for improvement for Toronto Hydro to focus on to help improve its existing PMO capabilities:

- Although there are many project management practices in place within the organization, they are largely undocumented in terms of governance, guidelines, processes, and procedures. Formalizing existing processes already in place as well as identifying and developing any additional processes should be the top priority for Toronto Hydro as this proactive action will provide the most benefit in terms of standardizing and improving its overall project management capabilities.
- Scheduling as a practice is generally underdefined and not implemented within the organization consistently. We recommend scheduling be a second key area of focus for improvement for Toronto Hydro as it can impact other areas of project management such as cost, forecasting, change management, etc. Improving scheduling as a function will improve the overall project management capabilities of the organization as a whole.
- To help further develop its project management capabilities we also recommend Toronto Hydro engage with AACE and the PMI to adopt and remain up to date with modern and innovative program/project management practices.

Overall Toronto Hydro's already capable PMO can extract the most benefit from implementing organizational measures to formalize, document, and integrate all of the (existing and yet to be developed) processes and procedures as well as defining the organizational structure and roles and responsibilities for all of the functional disciplines within the PMO.

FINAL SUMMARY REPORT

PMO BEST PRACTICES ASSESSMENT

APPENDICES

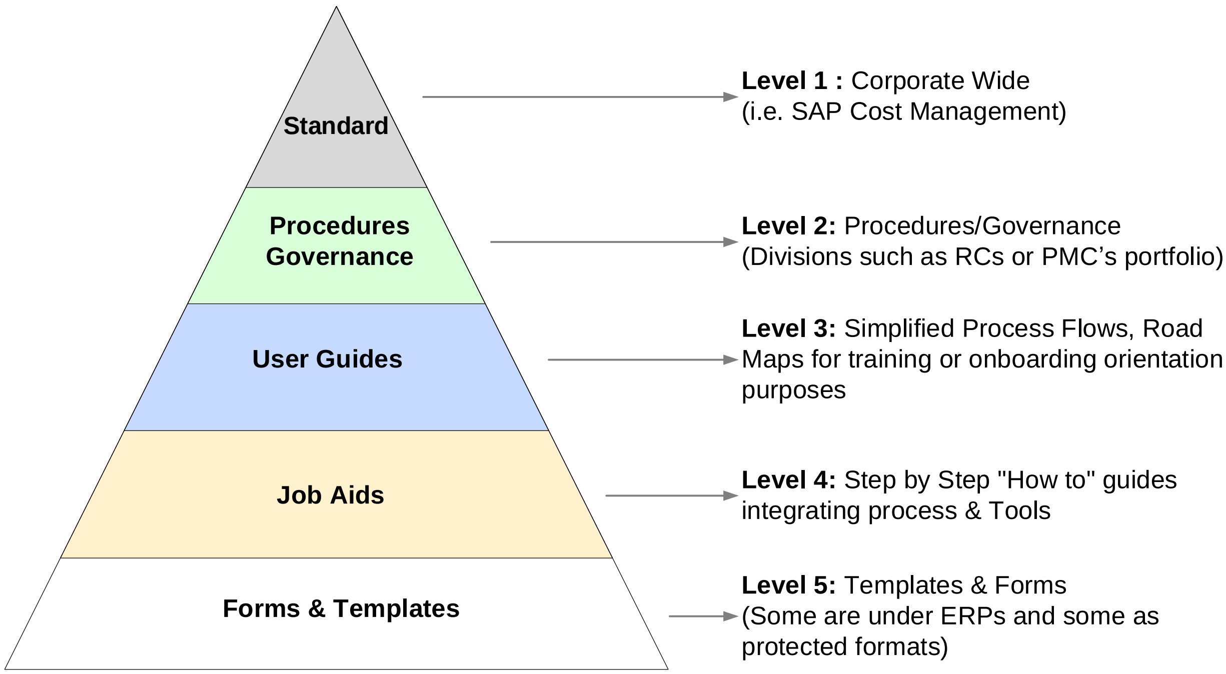
SUBMITTED BY:
Comtech Group Inc.

DATE SUBMITTED:
Feb 17th. 2022

Appendix A: Proposed Document Hierarchy

Any management system is required to adopt a breakdown for its documentation (governance & procedures down to forms & formats) to organize the compliance, alignment, and revision control at the enterprise level.

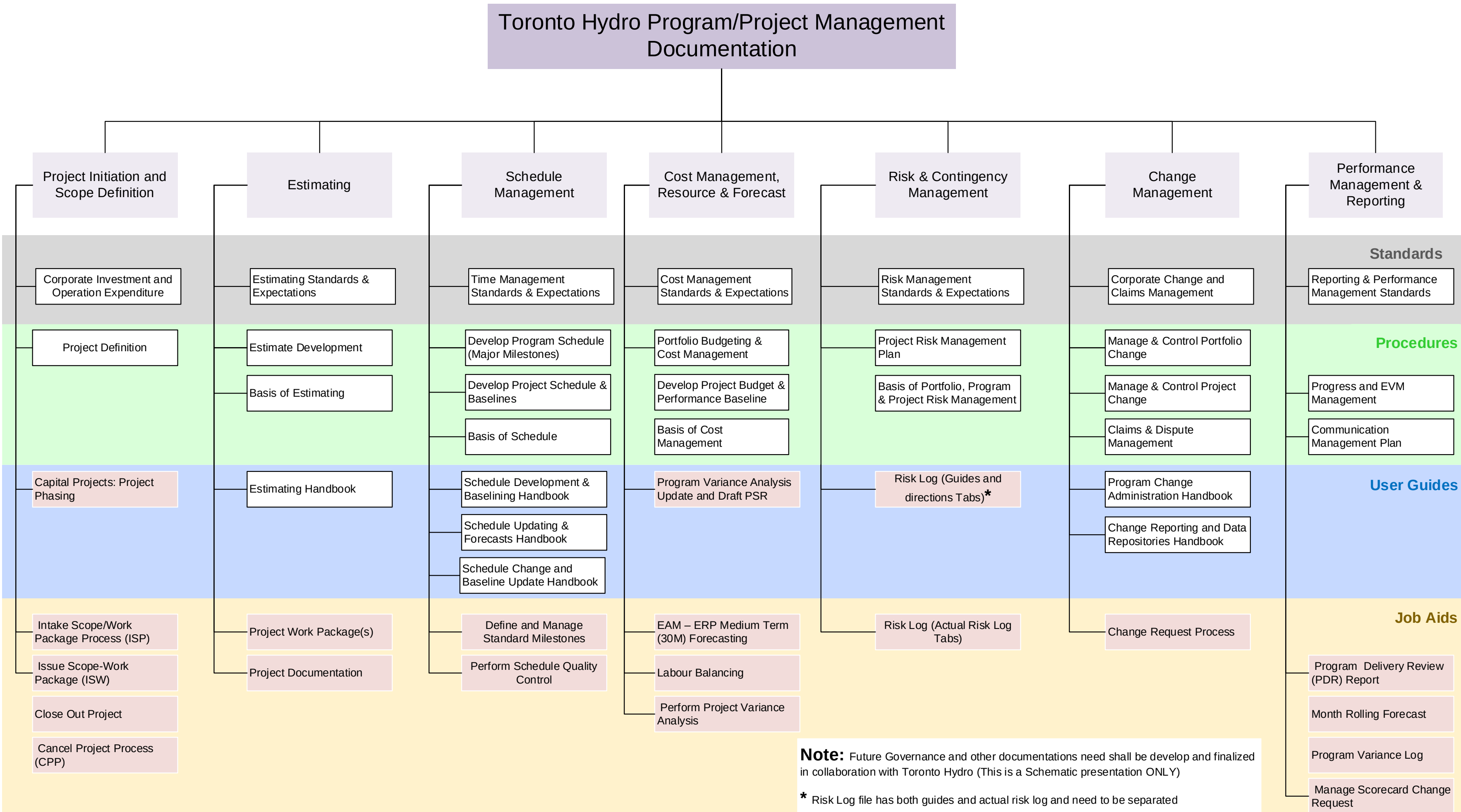
A typical documentation breakdown could be similar to the following model:



Our assessment team developed a schematic document hierarchy based on the breakdown above, which could be used as a guide to start a detailed review and planning with Toronto Hydro's team.

In the diagram that follows, red items are those documents that a copy of them is provided to the assessment team and white items are suggestions for new documentation.

Corporate PMO Documentation Hierarchy (Typical Structure – To be Finalized)



Note: Future Governance and other documentations need shall be develop and finalized in collaboration with Toronto Hydro (This is a Schematic presentation ONLY)

* Risk Log file has both guides and actual risk log and need to be separated

Appendix B: Sample Dashboard (Generic)

Project Management Review Package: PROJECT January 2022

Review Date: Jan 15th, 2022

TORONTO HYDRO

Safety

1 Discuss any project Safety Issues
2 Perhaps share a specific technical safety design issue challenging the project at each meeting
3

Executive Summary / Overview

30,000 ft

1 Overall, the RC's portfolio projects status, challenges, overall budget and cost
ENSURE TO ADDRESS KEY NEGATIVE VARIANCES FROM PLAN IN THE EXEC SUMMARY, IE. WHY THERE IS A VARIANCE, AND HOW YOU PLAN TO ADDRESS/RESOLVE IT.

Progress

#	Status		Planned	Completed	Earned	%
1	On Plan	Total Deliverables	230	218	-	95%
		To-Date Deliverables	532	495	-	93%
		Life-To-Date Workhours	34,000	28,500	27,900	82%

Priorities

1 Finalize the ongoing project charters and discussion with two major customers
2 Prepare deliverable-based **bottoms-up estimate** for XXX and ZZZ Projects
3 Finalize design basis for Project 1234 & 9876
4 Hire 5 resources to complete xyz by December to ....
5

Key Accomplishments this month

1 Issued all (5 of 5) Work packages for main challenging projects
2 Issued first WP related to xyz system
3 Held information session on. ....
4 Resolved xyz design inputs with Major customers
5 90% complete the specification for ....
6

Committed Accomplishments Planned in next Month

1 Complete ....
2 Start design substantiation of ....
3 Hire 3 process engineers
4 Issue 5 work packages for xyz Project ....
5 Brainstorming / whiteboarding session for xyz deliverable to ....
6

Resource Management

1 -10% Variance from Plan
2 Discuss Status of Resource ramp up - either internally at Toronto Hydro, or through partnerships / external engagement.

Explanation of Variance from Plan --> We are behind by 1 FTE's, 1 Civil/Structural to focus on preliminary engage for ....

Planned FTE's	10
Actual FTE's	9
Variance from Plan	**-1**

Cost / Budget

$ '000

1 -1% Variance from Planned Cost Expenditure
2 Variance from plan is timing only, not execution related - represents delayed major projects approval to support Engineering. Expect to have the project back on track by Q3-2022

Planned Cost Expenditure	$	234
Actual Cost	$	232
Variance from Plan	**$**	**(2)**

Schedule Activities (** near-term ~3-6mos)

** Program Milestones to be tracked separately

#	Activity Description	days away	Plan	Forecast	Actual	Variance
1	Xyz deliverable mildly late	256	10/Sep/22	12/Sep/22	13/Sep/22	3
2	Finalize WBS	261	15/Sep/22	20/Sep/22		5
3	Xyz deliverable	264	18/Sep/22	18/Sep/22		0
4	Xyz deliverable	319	12/Nov/22	12/Nov/22		0
5	Xyz deliverable	324	17/Nov/22	17/Nov/22		0
6	Xyz deliverable	339	2/Dec/22	2/Dec/22		0
7	Xyz deliverable	342	5/Dec/22	8/Dec/22		3
8	Xyz deliverable that is really late	342	5/Dec/22	23/Jan/22		-316
9	Finalize Deliverable-based Estimate for Prelim Eng'g	367	30/Dec/22	12/Jan/22		-352
10	Finalize Deliverable-based Estimate for Prelim Eng'g	367	30/Dec/22	12/Jan/22		-352

Top 3 Issues and Actions to Resolve

#	Description	Action(s) to Resolve
1	COVID has negatively impacted supply chain and Toronto Hydro may have challenges with some major equipment purchase	Work on Long Lead and critical item list and develop priorities
2	Issue	What we are doing about it.........

Risk & Opportunities

#	Description	Action(s) tracked in MS Planner
1	Pandemic is negatively impacting the job market and availability of qualified resources	Action:
2	Risk:	Action:
3	Opportunity: to collaborate with .... To resolve	Action:
4	STAFFING RISK - The Program will not achieve sufficient progress if resources are not planned and engaged pre the Program plan.	

Safety: In everything we do ------ Agile: Simplistic and Practical. Follow the 80:20 Rule ------ Accountability: Say It, Do It. One Team helping each other with Accountability ------ Make Progress: The secret to getting ahead is GETTING STARTED

Appendix C: Sample Integration Management Plan

Plan	Document Number:	Revision
Title: PROJECT INTEGRATION MANAGEMENT		

Project Integration Management Plan Template

[Document Number]
[Date]

Prepared by:

Reviewed by:

Approved by:

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Title: PROJECT INTEGRATION MANAGEMENT			

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Title: PROJECT INTEGRATION MANAGEMENT			

Revision Summary

Revision Number	Date	Comments
RError! Reference source not found.	YYYY-MM-DD	Describe the Revision Summary Information

Manual	Document Number:	Revision	Page: 4 of 11
Title: PROJECT INTEGRATION MANAGEMENT			

1.0 DIRECTION

The Project Integration Management Plan delivers direction on the process of integration when it comes to establishing and functioning an effective program/project management environment from initiation of projects down to closeout process. This management plan is in alignment with the organization's standards for PMO and Project Controls practices.

2.0 INTRODUCTION

Integration Management covers all the required activities and functions when it comes to Project Controls and Management methods and harmonization of all responsibilities from involved stakeholders. The Integration Plan is the main protocol through which the management teams guarantee that all Project Management Office required steps and expectations, and deliverables are sufficiently established, harmonized, succeeded, and aligned.

3.0 INTEGRATION PROCESSES

The following practices are typically configured the integration process and are used when it comes to aligning and coordinating deliverables around project management requirements by the management team :

- Develop Business Case or Investment Plan
- Develop Project and other required Management Plan
- Accomplish Project Work
- Project Work tracking and controlling
- Implement and execute a Change Control Process
- Perform Project Closeout (Including all the required documentation)

3.1 Develop Business Case/Investment Plan

The investment plan (Business Case) is developed when management teams (most of the time led by the project manager) are initiating the Project to respond to a problem/need/expansion/regulatory obligation or other similar causes and define the project goals. The Investment Plan standard format is developed and shall be followed to facilitate the creation, review, and approval of the document and includes the following components:

- Historical, regulatory, expansion information in support of defining the project;
- List all those possible gaps or issues which the project is defined to address;
- Summary on financial requirements, high level, and target dates;
- Summary on potential Risks and Opportunities;
- Environmental, Regulatory and Safety Obligations;
- High-level resource and external vendors requirements;
- Results, deliverables which project would provide by its completion;

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Title: PROJECT INTEGRATION MANAGEMENT			

The investment plan must be reviewed and approved by:

- Investment Management (Capital, Operation, Regulatory);
- Engineering Team;
- Construction Team;
- Procurement Management (Focused on Long Lead Material);
- Program Management Office

Once approved, the investment plan turns into one of the major components of the Scope Management process.

3.2 Develop Project Management Plan (PMP)

The Project Management Plan (PMP) is initially developed during the Initiation phase and contains planned project work to be used to guide project execution. The Project Manager is responsible for developing PMP with support and contribution from all stakeholders as required.

PMP shall include the following areas:

- Project Summary;
- Regulatory, Safety and Environmental Obligations;
- Basis of Estimate / Financial Summary;
- Contract Management Strategy;
- Project Organization and Communication Plan;
- Scope Management;
- Schedule Plan;
- Cost Control Plan;
- Risk Management;
- Quality Management;
- Project Management and Control;
- Appendices and Related Documentation;
- Other supporting documentation;

As mentioned, the plan shall be developed as all stakeholders' contribution and needs to be acknowledged and followed by all parties. Past Similar completed projects information, lessons learned, and industry's best practices shall be considered in this when it comes to developing the plan.

Initial scope, high-level schedule, and required budget risks among their mitigation plans, and contingencies shall be recorded under the first revision of the Management plan and is updated as required. The management team needs to assure that they review and update (as required) the Project Management Plan as the project progresses and better definition of Engineering, Deliverables and detailed requirements are available to the project team.

The chart below shows the main steps toward developing a management and Investment plan.

3.2.1 Scope (Deliverables)

Scope documents shall include the deliverables (including services and other subjects) which the project will have completed by the end of it. Defining the scope (as detailed as possible) is a critical requirement for project success.
Sets of these activities consist the "Scope Management" and include the following areas:

- Project Objectives Definition;
- Requirements, basis, and assumptions;
- Scope Details (including a brief description of each scope item);
- Project Work Breakdown Structure (WBS) and deliverables identified under it;
- Scope Confirmation and possible gaps identification;

The scope document would be developed as per bottom-up practices; stakeholders would develop their deliverables list and communicate them with the management team (Project Manager as main responsible). The project Manager consolidates all the information, assures projects goals are met, required standards and regulatory obligations are considered, and maintains the single integrated Project Scope list.

Scope document shall be reviewed, and updated as required when the project progresses from initiation up to end of Detailed Design. It's preferred to freeze the scope document before construction (or installation) starts and manage any further updates through the change control process.

3.2.2 Work Breakdown Structure (WBS)

The work breakdown structure shall be in alignment with the needs and requirements of the organization and directed standard format. Codes, Deliverables, and Control Accounts shall be identified, verified, and confirmed by project stakeholders.

The Work Breakdown Structure shall cover:

- Programs: Corporate, Major Divisions, Project Bundles;
- Projects: Project, Phases, Sub-Phase, Control Accounts, Deliverables;

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3.2.3 Schedule

The project schedule is the backbone of project management and control methodology, and all the PMO disciplines need to get integrated under the schedule. The schedule shall be detailed enough (considering the project phase and level of completion) so all parties would easily understand and use it as a communication basis over the project life cycle. The schedule needs to be developed based on a predefined WBS, contains interrelationships and dependencies among activities, and provides target dates for deliverables completion. The project team may use the WBS as CBS and post developing key activities, start/finish dates, durations and resources use the schedule for the basis of developing the budget.

The project team, under the project manager's lead, shall identify the project's "Critical Path" under the schedule, monitor the forecast dates on the critical path to keep the project on time.

Post Schedule and Budget development and agreed, a copy of them (Baseline) will be developed and used as a performance measurement basis for the whole project life cycle.

3.2.4 Contract Strategy

The project team is required to investigate all the possible options to complete the project as successful as possible and this would include an assessment on any requirements to outsource or hire team members for the project. The organization's capabilities, past completed projects, workload, risks, and other strategic factors shall be considered before finalizing the contract strategy for a project.

3.2.5 Estimate

The estimating team needs to start its support to the project and its management team right after the initiation phase is completed and approved. They're required to develop the estimates as per the organization's approved methods, following the approved Work Breakdown Structure and among with the Basis of Estimate. The Estimating team continues supporting the project until the performance baselines are developed.

The estimating team shall also be involved in any major change preparation plus after project completion needs to obtain all the actual quantities and incorporate the information in their library data and for future Estimate preparations.

3.2.6 Budget and Cost Control

The cost control team works closely with the project team (Project Manager, Estimating and Scheduling teams, other stakeholders), developing project budget based on the standard WBS, and down to deliverables (if the project maturity permits), developing all the Risk response fundings and assign them into dedicated accounts.

Post the project budget completion, the cost control team shall review, discuss and obtain approval on the budget from all stakeholders. Developing the project baseline (including direct, indirect, and cost-only elements) completes the cost control team's deliverables. All further changes, including a possible required new baseline establishment, will be managed under the Change Control process.

3.2.7 Risk

Risk management practices, need to cover:

- Risk Identification;
- Risk probability and impact assessment;
- The risk score and priority development;
- Risk response and mitigation plan;
- Risk monitoring and tracking reports;

The risk management team shall perform listed activities above as per the list above and according to the corporate's Risk Management Standard.
Risks are required to be managed at the program and project levels.

3.3 Monitor and Control Project Work

Outputs from the Integration activities will cover change requests, performance dashboards and updates, updates on the project management plan, and project data repository updates.

The Project Control team is in charge of following, studying, and controlling project progress, changes and adjustments to meet performance purposes. Project performance tracking shall be completed through key performance indexes (KPIs) and approved performance baselines (Scope, Cost, and Schedule). Baselines for scope, cost, and schedule are established when funding is approved at each project's main phase such as initiation, conceptual design, preliminary design, detailed design, etc. Baselines shall be logged under Investment Plans, PMPs, and any other funding release documentation plus corporate source systems (i.e., SAP or Primavera).

The Reporting processes shall be performed as corporate's standards for communication and performance measurements. The project progresses, occurred and accruals costs, variances in comparison with performance baselines, risks, issues, and forecasting shall be the major components of any project report.

Project controls shall be applied throughout the entire life cycle of projects. New performance baselines may be established as the projects are progressing to reflect the newest approved target dates and released fundings.
The project team, as per the scalability level of Project Controls, has to identify and log the following setups (Sample values are provided):

No.	Discipline	Alignment Level	Source System
1	Scope	WBS (Or CBS), Control Accounts, Deliverables	SAP
2	Estimate	WBS (Or CBS), Control Accounts, Deliverables	SAP, Cleopatra
3	Schedule	WBS, Deliverables and Major Milestones	MS-Project, P6
4	Budget	WBS/CBS, Deliverables, Control Accounts	SAP, EcoSys
5	Risk	Deliverables as per WBS	SAP, ARM

No.	Discipline	Alignment Level	Source System
6	Changes	Deliverables as per WBS	EcoSys, SAP
7	Actions	Deliverables or Individuals, Stakeholders	Action Tracking, Other databases
8	Lessons Learned	Projects, Program, Deliverables, Phases	Any approved ERP or database
9	Closeout Documentation	Projects, Program, Deliverables, Phases	Any approved ERP or database

The planned work shall be progressed and managed as planned under the project management plan.
The following actions and communications are required to assure the proper progress and completion of the project:

- Schedule review meetings;
- Budget occurred cost and forecast review meetings;
- Performance(KPIs as SPI, CPI, Overall Progress) review meetings;
- Risk workshops and review meetings;
- Overall Oversight Meetings/Reviews;
- Develop and review multi-layer dashboards and metrics
- Program/Projects Change review and monitoring meetings/reports

Project Controls team members are the main supporting group to the Project Manager by performing the following activities as per corporate's standards:

- Planning and Time Management;
- Budgeting, Cost Controls and Forecasting;
- Dashboards and Reports Development;
- Risk and Contingency Management;
- Perform Integrated Change Control;
- Program/Projects Documentation;

3.4 Perform Integrated Change Control

The Change Control process includes recognizing, assessing, and supervision on changes all over the project life cycle. The change could impact scope, cost, schedule, or a mixture of all items. The change control process shall be designed and delivered as an integrated process that covers all the areas of project management and control. Key results of this change control process are:

- Project Change Log (With their status);
- Approved change requests (with supporting documentation);
- Project Management Plan and other project updates;

Not all the approved changes shall result in a baseline update and the process shall make all the information available to the management who is in charge of approving change requests.

Change control is not planned to rearrange a project plan due to low performance and over budget results; the process recommends when changes are allowed and the level of approval required.

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3.5 Close Project or Phase

The integration process completes by logging the final project results, completed scope, and other deliverables.

The project shall go through a formal closing process which needs to include handing over all the assets and complete scopes to the final users (such as Operations), closing out all contracts, finalizing project costs and closing the accounts, ensuring all new or revised documentation (specifications, drawings, calculations, etc.) have been received and approved, documented, and finally, lessons learned are received and logged.

The Project Manager is the main responsible individual for closing the project with the support of all other stakeholders.

4.0 DEFINITIONS & ACRONYMS

4.1 Definitions

Performance is the proportional relation between the target value of progress over a certain period of time and the actual achieved progress.

Variance is the insignificant difference between planned and actual or forecasted progress or cost.

Work Breakdown Structure (WBS) work-breakdown structure is a major deliverable breakdown of a project into smaller and manageable components.

4.2 Acronyms and Shortenings

CPI	Cost Performance Index
EV	Earned Value
KPI	Key Performance Indicator
PMP	Project Management Plan
SPI	Schedule Performance Index
WBS	Work Breakdown Structure
CBS	Cost Breakdown Structure

5.0 ARCHIVES AND REFERENCES

5.1 References

- Documents No. 11111-1
- Documents No. 11111-2
- Documents No. 11111-3

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- Documents No. 11111-4
- Documents No. 11111-5
- Documents No. 11111-6
-

Appendix D: Sample Scope Management Plan

Plan	Document Number:	Revision
Title: PROJECT SCOPE MANAGEMENT		

Project Scope Management Plan Template

[Document Number]
[Date]

Prepared by:

Reviewed by:

Approved by:

Manual	Document Number:	Revision	Page: 2 of 8
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Revision Summary

Revision Number	Date	Comments
RError! Reference source not found.	YYYY-MM-DD	Initial Issue

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Title: PROJECT SCOPE MANAGEMENT			

1.0 DIRECTION

Project Scope contains the set of deliverables based on the requirements defined for the project, assumptions, exclusions, and constraints.

Defining the project scope is an important phase of the project and a critical factor for project success as it creates the basis for the project cost, schedule, uncertainties and risks caused by them, contracts and commitments, and strategic moves within the organization.

A well defined and detailed project scope is a great input to estimating, scheduling and budgeting of that project and would eliminate lots of risks from the project path when it enters the execution.

The Project Manager is the main responsible for developing the scope and managing the collaborative process team work around it. The project manager remains as the owner of the scope for the whole project life cycle and shall include any possible update or changes in the scope document as they occur.

1.1 Outline

The main steps of defining and managing project scope are:

- Comprehend, communicate and well document the objectives for the project;
- Gather all requirements and supporting data;
- Identify and log constraints and assumptions for the project;
- Challenge scope and innovative options to enhance value for money;
- Align the scope element with the standard Work Breakdown Structure (WBS);
- Develop guidelines for scope completion verification and utilized them;
- Track and control the scope (including enforcing scope change management);

The scoping process shall be integrated with the project phases and completion. The scope of work for each consequential phase of the project shall be identified and logged plus being compared to the whole scope prior to starting that phase.

2.0 SCOPING PROCESS

2.1 Define Project Objectives

Project objectives are defined in response to:

- Need or gap (for example identified through a walkdown or a self assessment;
- Opportunity for improvement or enhancement;
- Regulatory, environmental or standard obligation;
- Strategic capital expansion program;
- Routine repair, replacement or inspection activities;
- Other required modifications;

These objectives shall be properly broken-down and being translated into elements of deliverables which they form the scope.

This is process is normally listed and approved under project charter, scope request forms or investment plans. It is vital that the need be attentive on the subject or opportunity and not a predetermined reason or indication. The purposes shall be defined on the anticipated end result with clearly recognised accomplishment standards.

Using predetermined reasons and resolutions can frequently change the concentration away from gaining the best value for money and perhaps from shaping the true cause and best resolution. This may possibly result in substantial scope changes and adversative cost and schedule effects. All scope changes shall be approved by the Project Sponsor through predefined processes and under the recognized tools. For less composite projects the scope may be predetermined, for example a “like for like” replacement which would skip phases like detailed engineering.

2.2 Gathering Requirements

Collecting requirements includes identifying all the limitations and necessities associated with addressing the need or opportunity. It contains identifying, documenting and responding to stakeholders’ requirements and expectations concerning project purposes.

Required information around the scope could be gathered from a variation of sources including:

- Project Charter, Business Case or Investment Plan;
- Stakeholders (Project Sponsor, Engineering and System Engineers, Operation & Maintenance team, Supply Chain, Regulatory and Environmental Team, Contract Management, Subject Matter Experts, Contractors, etc.);
- Regulatory and Standards requirements and commitments;
- Asset Management information (System Health, Condition Assessment reports);
- Safety Reports and safety related incidents logs;
- Workshops and brain storming sessions;
- Lessons learned;
- Industry best practices;
- OPEX;
- Risk logs and response plans;
- Corporation governances;

Throughout this development it is significant to ensure value for money and to narrow the scope is considered and performed as much as possible. There must be agreement on the project purposes, limitations and prohibitions. The necessities form the foundation for which substitute selections and resolutions are established to accomplish the objectives.

Once the suggested substitute is corresponded by the stakeholders, the detailed scope, plan and cost requirements to deliver the scope must be determined.

2.3 Define the Scope Details

The scope and deliverables for the subsequent project phase must be planned and well-defined in detail. This process will be directed by the project manager and by the support of project stakeholders.

The scope and deliverables for the balance of the project may also be determined based on available information at the time. Typically, this is done at a high level and with far less detail as the specifics are yet to be developed.

The scoping process continues as additional details become known. Once the design is nearly complete, the scope and deliverables for procurement, installation and commissioning can be further defined in detail and finalized into work packages.

2.4 Project Components Supporting the Scoping Process

2.4.1 Work Breakdown Structure (WBS)

The Work Breakdown Structure (WBS) is a deliverable-oriented breakdown of the project structure created to divide and organize the project's entire scope of work into a hierarchy of alliances for the main project deliverables.

The WBS will prescribe the construction of how the project scope is estimated, scheduled, monitored and controlled and therefore should be broken down to a suitable level of detail.

Areas to consider when producing the WBS include:

- Program/portfolio breakdown necessities;
- Common work that can be monitored as a group;
- Separating the project into major types or areas of work;
- The quantity of detail mandatory to successfully monitor the project;
- Contracting, design and construction strategies;

2.5 Scope Verification

Scope verification is the recognised corporation reception of the accomplished project scope deliverables. Confirmation is a continuous and periodic process through the project lifecycle. Scope confirmation and reception includes:

- Engineering Deliverables reviews, comments, approvals;
- Material and equipment receiving and acceptance;
- Inspection and walkdown reports and minutes;
- Manufacturing and vendor factory reports or inspection logs;
- Tests and Commissioning practices;
- In-Serve Acceptance and confirmation communications;

2.6 Tracking Scope

Project scope monitoring and control includes the identification and management of proposed changes to the approved project scope. Project scope changes have a high possible to impact the project performance baselines and overall value for money, therefore these changes must be carefully measured.

Project scope control is required to limit changes to only those that are unconditionally required to fulfill the project charter, business case, or investment plan. They must be efficiently communicated, understood, accepted, and align with the project purposes. Scope control must be managed with a balance of; flexibility for critical items "needs", and firmness against adding further "requirements", in order to minimize scope creep.

Some variations and supplementary scope may advance the project result and therefore should not be immediately rejected.

Possible scope changes may be identified through:

- Design reviews and self assessment;
- Stakeholders' updates and information;
- Reports and variance analysis;
- Proposals reviews and assessment;
- Performance and progress meetings;
- Field Changes;
- Regulatory or Standard changes;
- Corporate strategic changes or adjustments;

Some documents may need to be updated as soon as a scope change is happening:

- Project Charter, business case or investment plan;
- Project Management Plan;
- Basis of Estimate (BOE);
- Budgets, Cashflows or Contingency assignments;
- Performance baselines and major Milestones;
- Other Design, Procurement, Operational documents;

2.7 Scoping Applications

Scoping ERPs or databases shall be used for preparing and tracking project scope. It's expected to have business processes, standard forms and formats and the approval/assessment steps established and managed under the applications.

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3.0 DEFINITIONS AND ACRONYMS

3.1 Definitions

Basis of Estimate (BOE) - Mandatory component of the cost estimate, as recommended by International standard practice organizations such as AACE or PMI. This document defines the scope and other information that forms the basis for the estimate, and eventually develops the basis for change management.

3.2 Abbreviations and Acronyms

AACE	The Association for the Advancement of Cost Engineering
BCS	Business Case Summary
BOE	Basis of Estimate
PMP	Project Management Plan
SME	Subject Matter Expert
WBS	Work Breakdown Structure

4.0 RECORDS AND REFERENCES

4.1 Records

List all the records used for the Scope Development under this section.

4.2 References

4.2.1 Performance References

List all the references used for the Scope Development under this section.

Appendix E: Sample Schedule Management Plan Template

Plan	Document Number:	Revision
Title: PROJECT SCHEDULE MANAGEMENT		

Project Schedule Management Plan Template

[Document Number]
[Date]

Prepared by:

Reviewed by:

Approved by:

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Revision Summary

Revision Number	Date	Comments
R000	YYYY-MM-DD	Initial issue.

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Title: PROJECT SCHEDULE MANAGEMENT			

1.0 INTRODUCTION

The Project Schedule Management Plan determines how the schedule will be controlled throughout the life of the project. The schedule will be developed using the Schedule Development Process and is a part of the Schedule Management Plan. The schedule will be based on the Project WBS.

The **Project Schedule Management Plan** will include the following elements:

- The Project Schedule (Project Baseline)
- Schedule management accountabilities, Schedule Update Frequency, Schedule Monitoring and Controlling strategy, details
- The Project Schedule IT Specifications & Information Management System (IMS) Interface (identify schedule tool, produce the interface plan with all necessary project tools (cost, scope, quality, risk, etc.)).

- **Schedule Development** (as per PMBOK) is the process of defining the project components needed to produce the project deliverables, determining the order in which the components should be executed, estimating the amount of time required to complete each one, identifying significant milestones during the performance period of the project, and documenting the outcome.

- **WBS** is a Work Breakdown Structure. The project will be broken down into manageable pieces and is a deliverable-oriented hierarchical decomposition of the work that must be performed to accomplish the objectives and create the program deliverables. The lowest level of the WBS is called the "Work Package". The Project Schedule includes all Work Packages.

- **Work Package** is the lowest level of the WBS. A Project Manager should be able to assign an individual's name to the work package (deliverable) as accountable, as well as a cost per work package.

- **Milestones** are significant events during the Project (with time duration equal to zero) that are developed to monitor the schedule and drive the project team to meet key dates.

In this section, the Project Manager will write a summary describing the purpose of the Project Schedule Management Plan and how it will be used to communicate to the Project Team and stakeholders (consider the background information above to form the summary).

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1.0 PROJECT DESCRIPTION

In this section, the Project Manager describes the program, the program packages (based on the WBS), the program schedule and duration with major milestones.

- *Description of Project Scope, Purpose*
- *Work Packages (from WBS)*
- *Program Schedule, duration statement*

2.0 PROJECT SCHEDULE MANAGEMENT APPROACH

In the following sub-sections, the Project Manager explains the approach to communications management from the beginning to the close-out of the Project using the headings in the template. No writing is required in this Heading 1 section.

The following sections must be addressed in describing this approach:

2.1 Roles and Responsibilities

In this section, the Project Manager will outline the roles and responsibilities for each of the following team/stakeholder members of the program. This is a suggested list of roles. The Project Manager has the flexibility to reduce or increase the number of roles in this list, but all the responsibilities of risk management must be represented in this section.

- Program Manager
- Project Manager
- Project Controls Team
- Program Management Office
- Construction Management Team
- Engineering Management Team

2.2 Schedule Management Processes

2.2.1 Project Schedule Management Processes

In this section, the Project Manager will identify the process that ***Project Schedule Management*** *will follow and list all the documents that will be produced to support this plan.*

The Project Manager will also identify the document expectations from all stakeholders and team members. ***Include all document expectations in this section.***

For example:

Schedule Management Processes, Procedures

Schedule Expansion Planning	[Document Number]
Funding Request for Projects	[Document Number]
Schedule Management Plan	[Document Number]

2.2.2 Proposed Level 1 Schedule with Identified Critical Path

This is a high-level initial Level 1 schedule for the project that will be used to present with the Schedule Management Plan for the PMP. Follow the Schedule Development processes and procedures for guidance on the Level 1 schedule development and identification of the critical path to complete this component of the Project Schedule Management Plan.

In this section, the Project Manager will provide a written summary describing the overall Level 1 Schedule, highlighting the project scope and overall duration. The Project Manager should also list all known significant constraints that have affected the schedule development to date and categorize them (e.g., financial constraints, client date constraints, resource constraints, weather/environmental constraints, procurement lead time, etc.)

- ***The Project Manager will insert the Level 1 Schedule with Critical Path in Appendix A of this Schedule Management Plan.***

3.0 PROJECT SCHEDULE STRUCTURE

The project schedules will be constructed and maintained in a software tool. The Project Manager (together with the Project Controls functional team member) will define the technical structure for the project schedule to be integrated with the information management system (IMS) throughout the development and the life of the project, through to closeout.

If the project is part of a Program, the Program Manager (and Program Office) will write a Program Schedule Management Plan, specifying the structure and management strategy for all program projects. The project manager will follow this specified strategy.

The schedule structure and management strategy information must be completed by the Program Manager (if the project is part of a program) or the Project Manager, before any projects are set up in the software tool. The information will be given to all team members who are accountable for a part of the schedule accuracy and/or management.

Use the Schedule Structure Document. The Schedule Structure Document template includes the following information:

a) **Setting up the Schedule.** Specific, technical directions for the set up and rules regarding the set up of the program and projects in the software tool. Include any forms or software inputs that must be provided to set up a new project to the required standards.

b) **Schedule Mandatory Requirements.** Required and mandatory fields, codes, data, structure for all projects (including task duration guidelines, task inclusions, WBS guidelines, mandatory project milestones, mandatory project tasks, rules regarding open ends, constraints, etc.) The requirements will also include the instruction/procedure on how the schedule will be integrated and managed as an integrated schedule (if applicable).

The mandatory requirements **must** be received and understood by all team members, as well as communicated to contractors who may be responsible for providing any schedule data to the projects. It is important to specify this information **prior** to contract award, such that the appropriate data is requested as part of the contractual obligation. For example, if the project manager must calculate earned value but the contractors do not provide resource information or cost information at the level required, the earned value will be difficult to calculate, and the project metrics will be of little value.

c) **Schedule Accountability Matrix.** The Project Manager must complete the Schedule Accountability Matrix to identify areas of accountability when managing the schedule. This template will identify the individuals accountable for producing the project schedule, producing reports, accountability for schedule data and accuracy, accountability for approving changes in schedules, accountability for approving issued schedules, accountability for different sections of the schedule, etc.

In this section, the Project Manager will summarize the process to develop the schedule structure document, using the background information above and highlighting any specific and potentially difficult areas in the program schedule structure.

- ***The Program Manager will insert the schedule structure document in Appendix B of this Schedule Management Plan.***

4.0 RESOURCE REQUIREMENTS, CONSTRAINTS, AND CALENDARS

The Project Manager will determine the appropriate resources calendars to be used in the schedule software tool for all work performed in the Project. All project team members will receive these. If the Project is part of a program, the Project Manager must ensure the appropriate calendars are incorporated in the Program Schedule list of approved calendars.

In this section, the Project Manager will summarize the approach to scheduling, researching and leveling resources for the project.

The resource requirements summary begins as an estimate at the Project Level and will develop into a detailed requirements summary that can be obtained from the schedule management tool (software) or the information management system. This requirements summary will be updated in

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this plan as the plan revisions are approved. The summary will provide the Project Manager with a view of all requirements from all projects and will assist in the management of resource risks, constraints and coordination at the Project Level.

- ***The Project Manager will insert the Resource Requirements Summary in Appendix C of this Schedule Management Plan.***
- ***The Project Manager will insert the Resource Calendars in Appendix D of this Schedule Management Plan.***

5.0 INFORMATION MANAGEMENT SYSTEM AND SCHEDULE INTEGRATION

The information management system (IMS) integration information must be completed by the Project Manager before the Project information is entered into the schedule software tool. The information will be communicated to all team members who are accountable for a part of the schedule accuracy and/or management.

The schedule will be integrated with an information management system. The Project Manager will provide an IMS and Schedule Integration Requirements document to all Team Members to outline all requirements for the schedule data to be managed through the information management system and how the project team will enter and manage the information to support the project information management system.

In this section, the Project Manage will summarize the overall information management systems to be used on the project and how the schedule will integrate with the system.

- ***The Project Manager will insert the IMS and Schedule Integration Requirements document in Appendix E of this Schedule Management Plan.***

6.0 SCHEDULE MONITORING AND CONTROL

Throughout the program, the Project Manager will need to monitor and control the Project Schedule:

Schedule control by the Project Manager is:

1) The ability to determine the status of the Project at any time
2) The ability to determine that the Project schedule has changed
3) Influencing factors that create the schedule changes
4) Managing the changes as they occur (not 'catching up' with the changes after they occur)

In this section, the Project Manager will describe how the schedule will be monitored and controlled, including a Project 'run stream' plan that specifies when the schedule will be updated

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issued, scheduled throughout the life of the Project. This 'run stream' plan is likely to change and evolve several times throughout the Project, but it is important to document the run stream and communicate to stakeholders in order to manage the schedule adequately. The Project Manager should specify a run stream plan to communicate to all stakeholders, team members and a program office/program manager (if applicable). If the project is part of a program, it is likely the schedule run stream will be set by the Program Office and the project will need to adhere to the run stream. It is important to include information regarding the run stream to contractors, and possibly include in a legal contract if necessary to ensure the correct schedule data is received by contractors to manage the run stream effectively.

- ***The Project Manager will insert the Project Schedule Run stream document in Appendix F of this Schedule Management Plan.***

7.0 SCHEDULE REPORTING (METRICS AND REPORTS)

The Project Manager will provide reports and metrics to show schedule performance.

In this section, the Project Manager will outline the schedule reporting for the Project. This could include weekly Project report inputs, Project reports, Executive Board reports, external communication reports, etc. Specify which metrics and what specific information is required for each report and the person accountable to provide the information.

- ***The Project Manager will insert the suite of Project Schedule Metrics in Appendix G of this Schedule Management Plan.***

8.0 SCHEDULE MANAGEMENT PLAN APPROVAL AND REVISIONS

In this section, the Project Manager will outline the required approvals and revisions for the Project Schedule Management Plan.

The Project Manager will identify the person(s) who will approve the Schedule Management Plan and their position.

The Project Manager will update the signature page of this document (Project Schedule Management Plan Template) with the correct names and positions of authors and approvers, as well as removing the 'template' field.

The Project Manager will also identify the planned revision frequency and the strategy for updating the Schedule Management Plan in the PMP (i.e., mandatory updates).

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APPENDIX A LEVEL 1 SCHEDULE WITH IDENTIFIED CRITICAL PATH

APPENDIX B-1 SCHEDULE STRUCTURE DOCUMENT

APPENDIX B-2 SCHEDULE ACCOUNTABILITY MATRIX

APPENDIX C RESOURCE REQUIREMENTS SUMMARY

APPENDIX D RESOURCE CALENDARS

APPENDIX E IMS AND SCHEDULE INTEGRATION REQUIREMENTS

APPENDIX F SCHEDULE RUN STREAM

APPENDIX G SUITE OF PROJECT SCHEDULE METRICS

APPENDIX H LEVEL 1, 2, AND 3 SCHEDULE BASELINE

APPENDIX I UPDATED RESOURCE REQUIREMENTS

Appendix F: Sample Cost Management Manual Template

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SAMPLE

Cost Management Plan Template

[Document Number]

[Date]

Prepared by:

Reviewed by:

Approved by:

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Revision Summary

Revision Number	Date	Comments
R000	YYYY-MM-DD	Initial issue.

1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to establish the roles and responsibilities, processes, and tools for Cost Management of Projects.

Cost Management processes involve planning, estimating, budgeting, funding, monitoring and control, forecasting, and performance reporting.

1.2 Scope

This manual is applicable for all projects.

2.0 COST MANAGEMENT PLANNING

Cost Management Planning occurs early in the project lifecycle and establishes a cost management framework for the project. The following subjects shall be planned carefully:

a) **Cost Breakdown Structure (CBS)**. CBS is the work packages of the Work Breakdown Structure (WBS) that are used for the cost baseline, earned value, cost collection, and forecast.

b) **Cost Baseline.** Cost Baseline is the authorized time-phased Planned Values (PV) for the project on which the project cost performance is to be measured against. The baseline is established as the 'Original Budget (OB)' and once Change Control is applied, changes are captured into the 'Control Budget (CB)'.

   For Earned Value, Control Budget is typically used. The Original Budget does not change.

c) **Earned Value Rules.** Earned Value Rules shall be established as part of the Cost Baseline and earned in accordance with Appendix A of this Manual – Earned Value Management.

d) **Cost Collection.** The company source systems shall be set up properly to collect actual cost.

e) **Forecast.** The method for forecasting shall be planned in accordance with Appendix B of this Manual – Forecasting.

f) **Contingency.** Contingency shall be included in the overall budget. Contingency planning and estimating shall be in accordance with Risk Management Team. Separate Cost Account(s) shall be used to track contingency.

g) **Escalation.** Budgets for escalation due to inflation shall be <u>included</u> in the Cost Baseline. There should <u>not</u> be a separate Cost Account for escalation.

h) **Interest.** Budgets for interest shall be included in the Cost Baseline for all capital projects. Budget shall be estimated using a template developed or endorsed by Finance. Separate Cost Account(s) shall be used to track interest.

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3.0 COST ESTIMATING

The Budget-at-Completion (BAC) of a project shall be supported by the Basis of Estimate, prepared in accordance with Estimating Team.

4.0 COST BUDGETING

Cost Budgeting is the process of time-phasing the BAC in order to establish the Cost Baseline.

The Cost Baseline shall align with the project schedule, payment schedule, and accrual requirements. There are two (2) types of budgets:

a) Original Budget represents the initial Cost Baseline; and

b) Control Budget represents the initial Cost Baseline plus – through Change Control – all approved changes.

Budget changes shall follow Change Management procedures.

5.0 FUNDING

Funding is the process to obtain authorization to proceed with the project and occurs in stages, dependent on the phase of the project. Funding Released is the portion of the approved lifecycle budget released to the project.

Contingency is usually included in the Funding Released, however the usage of contingency shall follow Change Management procedures.

6.0 MONITORING AND CONTROL

Cost Monitoring and Control is the process of monitoring the cost performance of a project and of ensuring controlled changes to the Cost Baseline. Cost monitoring shall include the monitoring and analyzing key performance indicators such as:

a) Cost performance indices (CPI);

b) Cost variances to Budgets; and

c) Estimate-at-Completion and Budget-at-Completion variance.

Mitigating actions shall be taken to correct any unfavourable cost performance.

7.0 FORECASTING

Forecasting is defined as the process of continuously predicting the outcome of the cost, time and resources required to complete a scope of work. It is achieved by examining the performance history of the project and evaluating applicable information to predict the schedule and cost to complete the project.

With accurate forecasts, project teams can detect issues ahead of time and implement the appropriate corrective actions. Forecasting can also detect positive trends so projects may take further advantage of such trends.

Forecasting shall be in accordance with Appendix B of this Manual - Forecasting.

8.0 REPORTING

Cost performance reports will be part of the overall program and project performance reports.

9.0 ORGANIZATION, ROLES & RESPONSIBILITIES

- To be developed as per corporation's structure.

10.0 TERMS, ACRONYMS & DEFINITIONS

Actual Cost of Work Performed (AC) – Actual cost of work performed to date; the actual costs charged against the activities.

Cost Baseline (CB) – The approved time-phased cost plan. There are two (2) kinds of Cost Baselines based on budget type – Original and Control. For EVM purposes, the Control Budget baseline is used.

Cost Breakdown Structure – Derived from the work breakdown structure (WBS) primarily for cost management.

Cost Performance Index (CPI) – The cost efficiency ratio of Actual Cost to Earned Value calculated by dividing the Earned Value by Actual Costs. CPI = EV/AC.

Cost Variance (CV) – The difference between the Actual Cost and the Earned Value.

Earned Value (EV) – Earned value of accomplished work.

Estimate at Completion (EAC) – The forecasted cost of the project. It is continuously updated as the project progresses.

Estimate to Complete (ETC) – The forecast of remaining costs to be incurred to complete the project.

Planned Value (PV) – The total baseline costs budgeted for the activities scheduled or planned.

Schedule Performance Index (SPI) – The schedule efficiency ratio of earned value to planned value. The SPI represents the portion of the planned schedule that was accomplished. SPI = EV/PV.

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Schedule Variance (SV) – The difference between the earned value and the planned value.

Scope Baseline – The approved Project scope, the associated execution plan, and its associated WBS and WBS dictionary.

Work Breakdown Structure (WBS) – The deliverable-oriented hierarchical decomposition of a project, broken down into manageable pieces of the work that must be performed to accomplish the objectives and create the program deliverables.

Appendix G: Program/Project Management Governance Questionnaire

Attendees:

Toronto Hydro		**In the meeting?**
Ade Plumptre	Supervisor, Program Delivery, Improvement, and Governance	✓
Alisa Studzienny	Supervisor Program Management Office	✓
Brad Lueger	Program Management Consultant	✓
Jeremy Pasma	Supervisor, Program Management Office	×
Michelle Leung	PMO Supervisor	✓
Odilon Bondoc	Program Delivery Improvement and Governance Associate	✓
Rachel Fung	Program Management Consultant	×
Soumya Srivatsa		×
Trudy Chu	Supervisor, Program Management Office	×
Comtech		**In the meeting?**
Pasha Mohsenin	Director / Project Controls - Energy and Utilities	✓

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
1. Governance	1.1	**Breakdown of Governance**: Is there any hierarchy defined when it comes (Standards, Governance, Guides, Forms, etc.)?	◆				
		Notes: - *There's a guide and document (i.e., Scope QA/QC), when PMO receives the request, they perform an overall review based on that.* - *Toronto Hydro PMO performs design review and makes sure all the phases are aligned and in line.* - *Change requests would be reviewed and PMO makes sure they will complete them in time.* - *There's a library of governance, but there's no hierarchy defined plus the overall need and requirements are not assessed and documented.* - *PMO Documents are published under the company's intranet (this information is internal) but the contract administrator will let the contractor know about the requirements and needs around this.* - *When an RFP is released (By execution group and not PMO) all the expectations are communicated by the execution team to the vendor.*					
	1.2	**Centralized Control**: Does the organization have a dedicated team in charge of governance development and updates?		◆			

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
		Notes: - *PMO is responsible for controlling the publication, release, and revisions of governance.* - *When a change is required, the document owner would communicate the need to PMO and request a change (through a service request form), this request will be assessed, a time frame will be developed (like a negotiation process) and then they agree on it. Most of the requests are coming from PEM (Planning, Engineering, and Modernization) but in some other cases, the requests could come from other teams.* - *The service for PMO is a matrix setup and they support operations with a PMC (Program Management Consultant) which is in charge of tracking the project performance. PMO supports non-project related (Operations) similar to Work control and inspection.* - *PMO keeps the governance library based on received requests plus checking future needs and other sources for possible improvements.*					
	1.3	**Governance development process**: What's the process for issuing a new or updating current existing governance?		◆			
		Note: - *When new governance (or process) is started, a team will contribute to this effort (matrixed to PMO).* - *All the process owners will review and approve new or updated processes/procedures.* - *The required funding for governance update/development will be sourced through CAPEX funding.* - *All the stakeholders will review/comment/approve any new procedure or updates.*					
	1.4	**Need Identification**: What's the process of identifying and requesting a procedure or governance need or update?	◆				

		Note:
		- *There are two major methods to start a process:*
		    o *Service Request*
		    o *Forecast*
		- *No planned review and update of governance was mentioned.*
		- *Roles and responsibilities for TH stakeholders against PMO governance are not defined.*					

	1.5	**End-End Governance**: Do the current set of Governance cover all the phases of projects (Initiation to Closeout) for all the PMO disciplines (Scope, Schedule, Estimate, Cost, Risk, Change)?	◆				
		Note: - *Current documents start from initiation and go to capitalization (by finance) such as project variance analysis.* - *For PMO disciplines sets of documents exist. For scope, schedule, estimate, cost, change they have a process map, but* ***Risk is missing****.* - *Some of the business processes are established under ERP but the rest don't have dedicated tools (except Risks which are managed under an Access database.* - *Contingencies are managed at the program level (to cover known-Unknown). In some scenarios, the contingency is located at the project level (sometimes a buffer is added into the project estimate).* - *Roles and responsibilities are not defined and followed.* - *PMO assists the operation team to execute the work (ISA: In-service addition and that's the moment which asset is in service, and depreciation starts).*					

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
	1.6	**Other Governance notes:**					

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
2.People / Practices	2.1	**Training**: Is there any training program in place for client resources when it comes to PMO initiatives?		◆			
		Notes: - *There's no planned training program in place, new staff goes through some onboarding-related training (partially Computer Based); in addition, some PMO disciplines (i.e., Cost team) have extra orientation sessions.* - *PMO is responsible for rolling out and developing every process map plus PMO conducts introduction to process mapping when it's requested.* - *PMO provides pieces of training on how to align with processes (such as how to develop a change request or document an estimate in the system) if requested and on Ad-Hoc basis.*					
	2.2	**OCM**: What's the Organizational Change Management (OCM) when it comes to rolling out new or updated governance?			◆		
		Notes: - *PMO is involved in any new governance rollout.* - *There was no mention of planning for OCM and impact analysis.*					
	2.3	**Alignment and Enforcement**: What's the oversight and QC practice when it comes to assuring the PMO initiatives are followed?		◆			
		Note: TH defined some KPIs in place to make sure people are following the requirement: - Scope In Taking: PMO tracks how many scopes are back and if they're following the requirement - Change Request: PMO makes sure that all have adopted this and following. - PVA (Project Variance Analysis): Each project develops one PVA post the project is completed.					
	2.4	**Enterprise Approach**: Is there a central team in charge of all PMO initiatives and practices? This team shall be the SPOC for any questions.		◆			
		Note: - *PMO functions as a matrix service model, PMC (Program Management Consultant) will be responsible for making sure the initiatives are followed.*					

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
	2.5	**Other People notes:**					

Area	No.	Question	Undeveloped	Emerging	Recognized	Improving	Mature
3. Tools (Project Management Information Systems)	3.1	**Automated Integrity**: Is there a central repository location for all the PMO governance, procedures, guidelines, forms, and other related information?			◆		
		Notes: - *All the current documents are stored under TH Intranet and all the employees have access to them.*					
	3.2	**Accessibility of PMO team**: How could PMO team members access the governance and their related information?			◆		
		Notes: - *PMO documents are all accessible under Toronto Hydro's Intranet.*					
	3.3	**Automated Revision Control and History**: Is the main governance location that tracks the revisions, updates histories, changes?			◆		
		Note: - *The versions are tracked and maintained under the archives.* - *There's a naming convention that PMO follows to manage the revisions.*					
	3.4	**Data Flow:** What's the current data flow (Information distribution) through the tools?		◆			
		Note: - *There's a program documentation mailbox and they issue an update email to that.* - *When a new employee or vendor is joining TH, the manager or contract administrator is responsible to make sure those people are clear with the PMO requirements and assignments.* - *PMO is not directly involved in the orientation process but supports that.*					
	3.5	**Other Tools notes:**					

Appendix H: Schedule Management Questionnaire

Attendees:

Toronto Hydro		**In the meeting?**
Ade Plumptre	Supervisor, Program Delivery, Improvement, and Governance	✓
Alisa Studzienny	Supervisor Program Management Office	✓
Brad Lueger	Program Management Consultant	✓
Jeremy Pasma	Supervisor, Program Management Office	×
Michelle Leung	PMO Supervisor	✓
Odilon Bondoc	Program Delivery Improvement and Governance Associate	✓
Rachel Fung	Program Management Consultant	×
Soumya Srivatsa		×
Trudy Chu	Supervisor, Program Management Office	×
Taylor Rohman	Planner	✓
Comtech		**In the meeting?**
Pasha Mohsenin	Director / Project Controls - Energy and Utilities	✓

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
1. Governance	1.1	**Basis of Schedule**: Do you develop and maintain this document?	◆				
		Notes: - *The basis of estimate is not developed.* - *A project table is developed and the major dates (i.e., Design Finish, Construction Start) are logged into that table.* - *The mentioned list lacks some general basis that is required to be documented and communicated with all the stakeholders such as Calendars, productivity rates, Global codes, reporting requirements, Standard WBS, etc.* - *There's one document per department.* - *The forecast document package covers resource management and a list of projects only.*					
	1.2	**Predefined Scheduling Practices**: - What is Scheduling related governance? - What are the documented Schedule quality control guidelines?	◆				

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature

		Notes:
		- *There's a System Planning (or Investment Planning) team which are in charge of identifying the needs. This includes sustaining the current customers plus all those new customers (This could be considered as the top-down approach).*
		- *The RCs (Responsibility Centers) will be in charge of breaking down the received funding into smaller components (Projects).*
		- *The PMC identifies when the project is required to be done (Just the start date), PMO translated that into when/where to be included in the portfolio.*
		- ***Schedule practices are not documented** in one single and integrated document.*
		- *Some Schedule templates exist (i.e., a certain duration for a certain type of project) which include required material and resources.*
		- ***There's no Schedule Quality control document**. There's a schedule adherence report which covers possible delays.*
		- *The existing MS-Project schedule is:*
		    o *More a resource planning schedule and not tracking the deliverables.*
		    o *Less than 10% of activities carry logical ties*
		    o *There's no Milestone included in the schedule*
		    o *Critical Path is not identified and tracked.*
		    o *The schedule is not calculatable.*					

	1.3	**Is the Schedule updating process covered under governance**? - Cyclical updates? - Review and accept progress? - Forecasting?		◆			
		Note: - *No governance is providing direction to update and reschedule the plans.* - *Review and acceptance of updated schedules are not considered.* - *Projects are tracked as per their single target dates and Actual Cost.* - *Forecasting is performed yearly and mostly covers the cost.*					
	1.4	**How much involvement the stakeholders (Internal and External) have in developing scheduling governance**: - Cover best practices - Involve lessons learned - Productivity rate and benchmarking - How are the external stakeholders' inputs/updates communicated with schedulers?	◆				
		Note: - *Scheduling practices are not performed and therefore there are no lessons learned.* - *Productivity rates and benchmarking are not performed.* - *External stakeholders are communicating single target dates with PMO.*					
	1.5	**Schedule templates and guidelines**: - Are schedule templates developed and used? - Are standard reporting layouts developed and used (All teams looking at the same set and arrangement of information)?	◆				

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
		Note: - *Some schedule templates exist (Manual and under Excel with few under MS-Project).* - *No standard scheduling report is developed the only report covering scheduling is Adherence which covers the target dates.*					
	1.6	**Other Governance notes:**					

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
2.People / Practices	2.1	**Communications / Training**: - Is training provided to schedulers? - Is training planned or Ad-Hoc? - Are standards practices (same WBS, same rollout, etc.) promoted? - What are the documented scheduling communications (Within the schedulers and with external stakeholders)?	◆				
		Notes: - *General training is provided to newly hired resources, but it doesn't cover scheduling practices.* - *Few Job-Aids are developed and function as Ad-Hoc training.* - *No scheduling application is used as standard and therefore there's no room for practicing standard approaches.* - *On the program level, there are standard structures and for projects (CAPEX or OPEX project for example).* - *Usually, data communication is done manually. Target dates are stored under SAP (with email notifications capabilities).* - *There are standard schedule meetings on every project life cycle which could be considered as the standard method of communication between planners, but no formal documentation.*					
	2.2	**Sustainability / Staffing Plan**: - Is there a staffing plan and sustainment developed? - Is there a standard scheduling organizational chart? - Is there a roles/responsibilities document developed for the scheduling team?	◆				
		Notes: - *There's no specific document for the staffing plan but the PMO supervisor oversights the overall supply and demand of schedulers.* - *There's a high-level Organizational Chart for PMO which is not cover schedulers.* - *There's no roles and responsibilities document.*					

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
	2.3	**What's the scheduling process?** - Development - Resource loading - Baseline review and approval - Updates - Changes	◆				
		Note: - *Schedules are not resource loaded but resource balancing practices (which are done on the construction supervisor level) exist.* - *Baselines are not developed and just the target dates are covered under Excel.* - *Target Dates would get updated based on the project progress, but initial dates are always kept and shall be communicated under the PVA report.* - ***Updates**: on the program level the end date for major phases (design or construction) are tracked and updates are logged (Under Excel spreadsheets).* - ***Changes**: Changes are submitted formally as a change request, those changes within the same calendar year don't need a formal request but if the project is moving its completion dates from one year to another one, they need to submit and obtain approval. Changes would get incorporated in target-date tables, but original dates are not getting updated.*					
	2.4	**Schedule Consistency**: - Logic ties the schedules, calculates them, and updates? - Monitor the critical path, schedule floats, and changes? - Are program/project milestones identified, registered, and track? - Risk and inconsistency? - What-If scenarios? - Benchmark with other teams? - Pre-discuss, document, and utilize Rules of Credit? - Update remaining units and expected finish dates?	◆				
		Note: - *Project-to-project under programs are defined with sequence (but not logic ties), there are no logic ties under project or programs.* - ***Critical Path and floats are not monitored**.* - ***PMO does not use milestones**.* - *No risk on schedule **confidence** practice is performed.* - *The remaining units are not getting updated.* - ***Physical Percent Progress is not calculated and tracked.*** - ***EVM is not calculated and used.***					
	2.5	**Other People notes:**					

Area	No.	Question	Undeveloped	Emerging	Recognized	Improving	Mature
3. Tools (Project Management Information Systems)	3.1	**Scheduling Tool**: - Is there any standard scheduling application accepted for the company? - Where are the schedules residing? - Who is administrating the scheduling tool? - Is there any schedule quality control tool (ACUMEN) used?	◆				
		Notes: - *No scheduling tool is used, some divisions use MS-Project without logic-ties.* - *Excel files are used to log target dates and other scheduling information.* - *Considering no Enterprise scheduling tools being used, there's no Scheduling Administrator.* - *There's no centralized location for all the schedules.* - *No application is used for quality control of the schedules.*					
	3.2	**Scalability / Popularity / Consistency**: - What percentage of schedules are handled automated? - Are the tools set up to be used as a scalable platform? - What are the data consistency and accuracy improvement practices? - Are external stakeholders' information validated also?	◆				
		Notes: - *There's no automation on the schedules.* - *There's no scalability, most of the project's target dates are tracked under MS-Excel.* - *No data consistency or accuracy practice is performed.* - *No verification on received external data is performed.*					
	3.3	**Library Data**: - Is library data developed and used as a corporate-wide approach (Calendars, Codes, etc.)? - Are those library data review and updated frequently?	◆				
		Note: *- None of the standard practices are followed.*					
	3.4	**Automation / Integration**: - How are the schedule templates loaded into the tools? - Are schedules integrated with other PMO disciplines (i.e., Cost) automatically? - Are changes logged and kept under the scheduling tool (i.e., for possible future claims or disputes)?	◆				
		Note: - All scheduling is done under Excel or MS-Project and is manual practice.					
	3.5	**Other Tools notes:**					

Appendix I: Cost Management Questionnaire

Attendees:

Toronto Hydro		**In the meeting?**
Ade Plumptre	Supervisor, Program Delivery, Improvement, and Governance	✓
Alisa Studzienny	Supervisor Program Management Office	×
Brad Lueger	Program Management Consultant	✓
Jeremy Pasma	Supervisor, Program Management Office	×
Michelle Leung	PMO Supervisor	×
Odilon Bondoc	Program Delivery Improvement and Governance Associate	×
Rachel Fung	Program Management Consultant	×
Soumya Srivatsa		✓
Trudy Chu	Supervisor, Program Management Office	×
Comtech		**In the meeting?**
Pasha Mohsenin	Director / Project Controls - Energy and Utilities	✓

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
1. Governance	1.1	**Cost Management Plan**: Does Toronto Hydro develop and maintain a cost management plan for its portfolio and associated projects?	◆				
		Notes: - *Cost Management plans or other related documents don't exist (neither on the project level and nor on the program level).* - *Standard practice is in place which more or less all projects are following but it's not documented.* - *The cost control process is simple: If the project is overspent, the project needs to submit a change request, and if less they need to report.* - *The concept of WBS/CBS (Work and Cost Breakdown Structures) is defined and Toronto Hydro treats WBS as CBS.* - *Currently available documentations are in the form of Process Flows.*					
	1.2	**Estimating and Cost Management Interaction**: - What is the estimate-cost interaction management-related governance? - What are the documented cost management quality control guidelines? - What are the Estimating and Cost Management documented integration?			◆		

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
		Notes: - *Although none of the cost control processes are documented, a common practice is followed within the organization.* - *Estimates are developed by the Engineering planning team (developed by Engineers and approved by the Engineering Supervisor) as high-level estimates.* - *Post receiving the high-level estimates, they will be sent to PMO which performs a high-level portfolio level assessment on the quality and consistency of the estimate.* - *PMO forwards the high-level estimates to the Design-Construction team When the project reaches Detailed Design, and another round of estimate update is performed which will be more comprehensive (Detailed Level Estimate).* - *The detail design team has the option to review and modify the scope also. For example, if they find out that soil is contaminated, they can add the removal/decontamination into the scope.* - *The budget is getting frozen after Detailed Design and all other increases or decreases will be managed through the change control process.* - *The detailed estimate is also used as the basis for a quotation for the customer.* - *Toronto Hydro maintains an approved vendor list among their approved rates, post the detailed design Vendors could check and change the quantities of work but not the rates.* - *Escalations and inflation rates, including other changes, are included in the Estimate.*					
	1.3	**Is the cost management process covered under governance**? - Develop Cost baseline? - Collect Cost and Accruals? - Forecasting? - Cost Changes?		◆			
		Note: - *These processes are followed as a general practice, or maybe logged as a job aid but there's no overall governance or formal procedure for this purpose.* - *No forecasting (Estimate to Complete and Estimate at Completion) is performed, TH calls their actual project cost tracking forecast which it should not be mixed with forecasting practice.* - ***No Earned Value analysis is performed and accordingly, no Forecast based on standard methodologies is available.*** - *Costs are collected by Finance and logged under SAP (The same platform on which the Estimates and Budgets are stored).* - *Trending of cost is monitored as LTD/YTD Actual Cost vs. Budget among the completion dates (The PDR "Project Delivery Report" is prepared by each PMC covers this).* - *There's a monthly cash flow developed for the projects, and this gets compared monthly which just covers the top ten most expensive projects. There are no document or basis logged directions on Cost, Schedule, and Cashflows standardization or uniform approach.* - *Big infrastructure projects (i.e., Metrolinx) have their own dedicated PMO team which needs to follow the same PMO standards (transit and capital projects large are two examples). Comtech's report is not covering those projects.*					
	1.4	**How much involvement the stakeholders (Internal and External) have in developing cost management governance**: - Cover best practices - Involve lessons learned - Automated Cost Management - How are the external stakeholders' inputs/updates communicated with cost controllers?	◆				

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
		Note: - *No documentation is developed in this regard.* - *Cost Management is managed by the Contract Administration team and not PMO.* - *Any interaction with external and Internal stakeholders shall be managed through the Contract Administration team.* - *No Automated Cost Management tool is adopted at this time. Vendors are emailing their invoices to Toronto Hydro and then get them processed (High-Risk process when it comes to Cyber-Security requirements plus very manual, high effort and cost consuming process.*					
	1.5	**Standard Cost Management Practices**: - What breakdown is used to manage Cost? - Deliverable-based cost management? - Cost Adjustments? - At What level do you track cost (Project, Deliverables, Control Accounts)? - What's funding release administration			◆		
	1.5	***Note:*** - *WBS is used as CBS but not for all the projects in the portfolio, but just* - *Cost (progress and EVM) is not monitored on the deliverables level.* - *Cost management is performed in Excel so, cost adjustment would be manual and consume lots of energy.* - *PMO tracks cost on portfolio level (LTD/YTD vs. total budget).* - *Contract administrators are dealing with Cost Management initiatives of stakeholders.* - *PMO's role is to monitor the cost (changes/risks/etc.)* - *Lessons Learned and other related information are communicated with Contract Management.* - ***Any project finishing with more than 15% of its budget needs to go through root cause analysis, it will be flagged.*** - *PMCs are responsible for projects and developing a list of their managed portfolio. PMO collects all this data and makes sure that the whole portfolio is within the annual budget.* - *There's no Gated process defined when it comes to releasing funding to the projects.* - ***Earned Value Management and Physical Progress tracking are not practiced.***					
	1.6	**Other Governance notes:**					

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
2.People / Practices	2.1	**Communications / Training**: - Is training provided to cost controllers? - Is training planned or Ad-Hoc? - Are standards practices (same WBS/CBS, common cost control calendar, etc.) promoted? - What are the documented cost management communications (Within the cost team and with external stakeholders)?		◆			

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
		Notes: - *Cost Controllers go through training as part of their onboarding process when they start with TH with some Ad-Hoc orientation sessions.* - *There's no training and qualification tracking process.* - *Toronto Hydro has some Computer Based Training (CBTs) for its staff which covers a little part of PMO disciplines.* - *No documented governance was mentioned as a communication plan for the Cost Controller's internal information sharing.*					
	2.2	**Sustainability / Staffing Plan**: - Is there a staffing plan and sustainment developed? - Is there a standard cost organizational chart? - Is there a roles/responsibilities document developed for the cost team?	◆				
		Notes: - *There's no specific staffing plan developed for PMO while PMCs are developing hiring plans (under Excel) which may include some PMO roles.* - *There's a high-level Organizational chart for PMO but not detailed.* - *No roles and responsibilities documents are developed for PMO or Cost Controllers.* - *Design Supervisors and Contract Administrators have roles in the cost management process on the project level and PMO controls the portfolio.*					
	2.3	**What's the cost management process?** - Development (Converting Estimates to Budget and Cost Baseline) - Cashflows development - Baseline review and approval - Updates, Variance Analysis - Change Requests (Log, Acceptance, Approve/Reject)			◆		

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature

		Note:
		- *Projects and their associated budgets are initiated as per the following steps:*
		  ○ *Engineering defines the project based on technical, regulatory, or capital investment needs.*
		  ○ *Engineering develops a high-level Estimate (Including major equipment, required labor, duration) which could be considered a* ***Top-Down approach.***
		  ○ *Engineering provides the estimate to the Planning team for creating Work Packages and elaborating the estimate (Assembly Units are used to develop estimates). These estimates are logged under the SAP system and will be used as Material requirements identification and purchase.*
		  ○ *PMO receives the Work Packages, adding required equipment information and additional resources into them. Then finding the available team to execute the project.*
		  ○ *Work Packages will be transferred to execution RCs for detailed design estimate* ***Bottom-Up approach****.*
		  ○ *Projects have different phases: i.e., supplying power into an under-construction project and then post in service*
		- *There are placeholders under the program budget, PMCs (sometimes) add buffers (contingencies) into the received Estimate.*
		- *The budgets and forecasts are reviewed and approved by RC leaders.*
		- *There's a standard change request tool (a module under SAP), they need to enter the last approved budget for the project and the change request.*
		- *A process and approval route are defined to go to different approving individuals until it's incorporated in the final budget* ***(50K$ for OPEX and 100K$ CAPEX triggers the change process).***
		- *TH has Change orders when it comes to smaller items.*					

	2.4	**Budget Consistency**: - Known and Unknown Unknown identification and register? - Develop a risk log and have a budget for risk response? - Program vs. Project level contingency?		◆			
		Note: - *Estimates are not carrying the uncertainties, but the risk log does include this. This would create a big change for gaps.* - *RCs (Responsibility Centre similar to Department) have control over their portfolio and moving contingency, sometimes two RCs could offset the positive and negative contingencies.*					
	2.5	**Other People notes:**					

No.	Area	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
3. Tools (Project Management Information Systems)	3.1	**Cost Management Tool**: - What's your Budget Management Tool? - What's your Cost collecting tool? - Who is administrating the cost tool(s)?	◆				
		Notes: - *Following reports and matrixes are developed and maintained under MS-Excel:* - *All the estimates are maintained under SAP and the budgets (Forecasts), and budgets are maintained under PSAT (Program Spend Allocation Table or spending balancing file).* - *Each PMC develops prepares its own PSAT for the managed RC.* - *PMO develops the "Forecast Summary Report" which is a consolidation of all RC PSATs.* - *Invoices are communicated by email and Contract Administrators are handling the invoices.*					
	3.2	**Scalability / Popularity / Consistency**: - What percentage of Budgets are handled automated? - What are the data consistency and accuracy improvement practices? - How external stakeholders are contributing to the Cost Management process? - Are external stakeholders' information validated also?	◆				
		Notes: - *All are under Excel, so the level of automation is low (projects are going to move everything under SAP).* - *Data validation currently is performed low and manual but all PSATs.*					
	3.3	**Library Data**: - Is library data developed and used as a corporate-wide approach (Control Accounts, Unallocated Cost, etc.)? - Are those library data review and updated frequently?	◆				
		Note: *- There's no enterprise cost system in place so no enterprise library data could be developed and maintained.* *- Not applicable*					
	3.4	**Automation / Integration**: - How is the Cost and Budget information loaded into the tools? - Are budgets integrated with other PMO disciplines (i.e., Estimates, Risk) automatically? - Are changes logged and kept under the cost tool (i.e., for possible future claims or disputes)?	◆				
		Note: - *There's no enterprise tool in place so no budget loading (automated) would be in place.* - *Integration between Schedule, Cost, and Risk is not established (or it's at the early stages of implementation).*					
	3.5	**Other Tools notes:**					

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Appendix J: Resource Management Questionnaire

Attendees:

Toronto Hydro		**In the meeting?**
Ade Plumptre	Supervisor, Program Delivery, Improvement, and Governance	✓
Alisa Studzienny	Supervisor Program Management Office	×
Aida Ahmadi		×
Brad Lueger	Program Management Consultant	✓
Jeremy Pasma	Supervisor, Program Management Office	×
Mahinthan Subramaniam		×
Michelle Leung	PMO Supervisor	×
Odilon Bondoc	Program Delivery Improvement and Governance Associate	✓
Rachel Fung	Program Management Consultant	✓
Soumya Srivatsa		×
Trudy Chu	Supervisor, Program Management Office	×
Comtech		**In the meeting?**
Pasha Mohsenin	Director / Project Controls - Energy and Utilities	✓

<table>
<tr><th>Area</th><th>No.</th><th>Question</th><th>Ad-Hoc</th><th>Emerging</th><th>Recognized</th><th>Improving</th><th>Mature</th></tr>
<tr><td rowspan="2">General</td><td rowspan="2">1.1</td><td>Resource Management Plan:
- Is there universal resource management developed and maintained with Toronto Hydro, what about PMO?
- What’s the current existing governance around resource management?
- What are the documented procedures to focus on organizational culture and promoting PMO initiatives?</td><td>◆</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="6">Notes:
- For projects/programs, the PMC develops PRAT (Project Resource Allocation Template) and corporate-wide every department provides input into Establishment Report (Corporate Resource Plan)
- There’s no document covering the resource management, some general guidelines exist plus the onboarding process. TH has the “Performance Contract document” which measures the PMO practices alignment.
- There’s a mission statement and core values for TH, but no document around PMO practices.</td></tr>
</table>

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature

	1.2	**Need Identification:**
		- What's the documented process for identifying resource needs?
		- Is the basis for resource need identification documented and enforced between different business units (Calendars, total working hours per week, month, or year)?
		- Does the governance direct:
		    ○ A master resource management plan (short, medium, long term) being developed and maintained as a rolling plan (i.e., getting updated on a year-by-year basis)?
		    ○ Identification of sources for supplying resources as a strategic plan.
		- What tools and applications are used for this purpose?
				◆			

		Notes: - *Need: PRAT is the process for identifying the need document plus. This document specifically talks about people and integrates budgeted units, labor types, resources, and scope.* - *Supply: FAS (Forecast Assumption Summary) provides available resources.* - *All assumptions such as calendars, holidays, vacations are logged under the Excel tools.* - *Both PRAT and FAS are Excel spreadsheets. TH is in the process to transition to BPC (Business planning and consolidation) which is a module of SAP and provides more automated resource balancing capabilities.* - *Resource Management is synchronized with the schedules, Resource histograms and availabilities are not aligned with projects.*					
	1.3	**Supply Identification:** - What's the documented process for identifying resource supply (Currently available resources within the company and under contract)? - Is the basis for resource supply identification documented and enforced between different business units (Calendars, total working hours per week, month, or year)? - Does the governance direct: ○ The resource supply and need being integrated, compared, and monitored on a routine basis? - A resource sustaining plan being developed and maintained? - What tools and applications are used for this purpose?	◆				
		Note: - *Response.*					

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
	1.4	**Documented Training and Upgrading Resources:** - Is there a formal resource training plan (supported by governance) issued for the corporation? What about PMO? - What's the documented plan for hiring, training, and utilizing junior and newly graduated resources? - Is there a plan for supporting innovation methods of resource management supported by governance? - Is there any computer-based training?	◆				
		Note: - *New PMC would be walked through the forecasting process while getting on board.*					
	1.5	**Resource Alignment Process:** - What is the documented plan for checking alignment? - Is there a pre-developed and documented assessment process? - Are roles and responsibilities defined and documented? - Is Resource-Leveling, over-allocation, bottleneck expertise, and other similar roles studied, logged, and monitored? -	◆				
		Note: - *During the PPR the PMO alignment is performed.* - *The PPR process and templates are providing the alignment process.* - *Resource-Leveling on the project level is done.* - *Over allocation of resources is done (make sure a certain percentage is considered).* - *Bottleneck expertise identification and other similar roles studied are monitored but just a practice but not logged and monitored.* - *When not enough resources exist inside TH, they switch to contractors.*					
	1.6	**Other notes:**					

Appendix K: Risk Management Questionnaire

Attendees:

Toronto Hydro		**In the meeting?**
Ade Plumptre	Supervisor, Program Delivery, Improvement, and Governance	✓
Alisa Studzienny	Supervisor Program Management Office	×
Aida Ahmadi		✓
Brad Lueger	Program Management Consultant	×
Jeremy Pasma	Supervisor, Program Management Office	×
Mahinthan Subramaniam		✓
Michelle Leung	PMO Supervisor	×
Odilon Bondoc	Program Delivery Improvement and Governance Associate	×
Rachel Fung	Program Management Consultant	×
Soumya Srivatsa		×
Trudy Chu	Supervisor, Program Management Office	×
Comtech		**In the meeting?**
Pasha Mohsenin	Director / Project Controls - Energy and Utilities	✓

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
1. Governance	1.1	**Risk Management Plan**: How well the risk management practices are covered under current existing governance, guides, and job aids of Toronto Hydro?	◆				
		Notes: - *There's no Risk Management plan but sets of process flow supporting this area of PMO.* - *Integration and uniformity of the risk management process are not covered as documented guidelines.*					

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature

	1.2	**Risk Identification:**
		- What's the current process of risk identification and recording directed by Governance?
		- Is there an integrated (centralized) risk log that covers all programs, projects, and other corporate-related business?
		- Do governances enforce:
		  ○ Quantitative Risk Analysis (Utilizing verifiable information to analyze the impacts of risk in relation to cost overruns, scope changes, resource consumption, and schedule delays)?
		  ○ Qualitative Risk Analysis (Subjective approach to risks by identifying risks to focus the likelihood of an explicit risk event happening during the project/program life cycle plus the overall impact)?
		- Do governance direct projects to develop risk scoring matrixes, define priorities and come up with mitigation plans?
		- Monitor risks before and post-mitigation?
					◆		

		Notes:
		- *As soon as the project is logged under the program, currently identified risks are identified and logged (The first one is developed by the Engineering Planning team and while they're developing the scope) and teams continue elaborating on that.*
		- *Two risk logs exist within TH (both developed within the company as MS-Access Database):*
		  ○ *Enterprise Risk Log*
		  ○ *Program Various Log*
		- *Quantitative and Qualitative risk analyses are performed (including probability and impact), the options are provided as drop-down lists (with pre-populated values).*
		- *All the risks are qualified and reviewed monthly*
		- *Risks are monitored and pre-and post-mitigation. When a risk is closed, no one reviews that anymore.*
		- *When developing a new project, people could have access to a historical risk log and use that as their starting point.*					

	1.3	**Risk Analysis Practices**: What's the governance direction on: - Method: Workshops, Brainstorming, other. - Frequency of performing risk analysis: How often? What combination of teams? - Repeating risk analysis at completion of each program/project phase? - Performing risk analysis on each change (pre-and post-approval)? - Utilizing Stochastic methodologies?		◆			

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
		Note: - *There's no governance directing to any specific method (i.e., workshop) when it comes to risk and developing their log.* - *Toronto Hydro has bi-weekly risk review meetings scheduled, in which project teams are directed to update and assess all the changes and their possible impacts.* - *Phase-by-phase risk review sessions are not very detailed and major reviews are happening at the end of Design and Construction (when two different teams are handing over the project to each other and reviewing it).* - *At any change, especially if the change is significant, the risk will be reviewed.* - *Yes, the governance is directed on probability assessment.*					
	1.4	**Risk Sources**: Is governance recommending to: - Collect internal and external risks and log them? - Did benchmark identify risks with similar projects within the corporation or from other utilities? - Identify event, cause, the impact for every single risk?			◆		
		Note: - *The contract administrator is responsible to deal with external contractors and has to make sure this exists, but they don't mandate having a risk log for the vendor.* - *Depending on the method by which risk was identified, TH in many cases uses the history information and performs benchmarking against past risk logs.* - *Identifying events, causes, the impact for every single risk is part of the risk practice.*					
	1.5	**Risk Administration**: Does Toronto Hydro: - Utilize external subject matter experts when it comes to assessing program or mega-projects associated risks? - Assign a risk single point of contact (SPOC) at the program or project level? - Provide pre-developed forms and formats to communicate risks? - Schedule meetings and communication channels to update and monitor risk logs? - Are opportunities are identified and monitored also?		◆			
		Note: - *The division uses other TH divisions Subject Matter Experts, but the team can't recall cases in which they used external resources.* - *PMO does have a SPOC for risks, but there's a corporate group (Enterprise Risk Management Department) in charge of corporate overall risk management.* - *There are pre-developed forms and formats in Toronto Hydro which individuals could use.* - *The enterprise risk management team has meetings and reports (on scheduled meetings reviewed and discussed).* - *The risk log (as a pre-defined drop-down box) provides the option to log opportunities also. At the beginning of Q3-Month, there's an opportunity log released which would get compared against risks and checked if TH could use those to mitigate risks.*					
	1.6	**Other Governance notes:**					

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
2.People / Practices	2.1	**Communications / Training**: - Is training provided to PMO-Risk Staff? - Is training planned or Ad-Hoc? - Are standards practices (same analysis, approaches, formats, etc.) promoted? - What are the documented risk management communications?	◆				
		Notes: - *There's the onboarding training that all new staff goes through, but PMC takes some risk management courses (provided by external sources).* - *PMO holds monthly reviews and under those reviews, the risk is reviewed; this is the planned communication channel for risk. When risks are scaled up to a certain level, PMO will communicate them with the Enterprise team.*					
	2.2	**Sustainability / Staffing Plan**: - Is there a staffing plan and sustainment developed? - Is there a standard Risk Management organizational chart? - Is there a roles/responsibilities document developed for the Risk management team?	◆				
		Notes: - *There's no risk staffing plan within PMO since the PMCs are responsible for their associated risk.* - *PMCs are responsible for risk management, so they would appear in their Org chart. For Example, on construction, there's a staffing plan and it includes Risk resources but not the design side has the same process.*					

	2.3	**Risk and Contingency Management**:
		- Are identified and high-priority risks always correlated with appropriate contingency and management float?
		- What's the method of tracking, returning, and re-assigning contingency?
		- Does Toronto Hydro perform schedule uncertainty, Monte-Carlo simulation, and the following measures to manage schedule risks:
		    o Criticality: Measures the probability that an activity is on the critical path.
		    o Significance: Measures the relative importance of an activity.
		    o Sensitivity: Measures the relative importance of activity taking the criticality into account.
		    o Cruciality: Measures the correlation between the activity duration/cost and the total project duration/cost.
			◆				

		Note: - *Yes, all the risks are correlated with a contingency. PMC (as per general experience) adds up to 15% into the duration received from estimating team (Contingencies are logged at the Program level and not projects and possibly their associated deliverables).* - *There's no integrated scheduling process in place, so management floats are not developed and flagged.* - *Contingencies are not monitored for PMCs.* - *No Monte-Carlo analysis is performed around schedules since PMO is dealing with program schedules and not a detailed project.*					

	2.5	**Other People notes:**

Area	No.	Question	Undeveloped	Emerging	Recognized	Improving	Mature
3. Tools (Project Management Information Systems)	3.1	**Risk Management Tool**: - What's your Risk Management Tool? - What's your Risk Communication tool? - Who is administrating the Risk tool(s)?			◆		

		Notes:
		- *There's an MS-Access Database that is used as a central tool for risk management.*
		- *The MS-Access database has a dedicated DBA.*
		- *There are two Risk logs:*
		  ○ *PVL (Program Variance Log): Those risks which we know could occur with more than 70% probability or has already happened (An Excel spreadsheet).*
		  ○ *ERL (Enterprise Risk Log): Enterprise Risk Log (An MS-Access Database which everyone is using)*					

	3.2	**Scalability / Popularity / Consistency**: - What percentage of risks are linked to actions and have an owner? - What are the data consistency and accuracy improvement practices? - How external stakeholders are contributing to the Risk Management process and tools? - Are external stakeholders' information validated also?			◆		
		Notes: - *Risks have owner and action is assigned to a team member for the identified risks.* - *The monthly review performs data validation and verification.* - *The tools are internal only and external stakeholders would need to communicate their updates with their PMC (This brings manual work for the Toronto Hydro team).*					
	3.3	**Library Data**: - Is library data developed and used as a corporate-wide approach (Risk and Opportunities Categories, Mitigation Methods, etc.)? - Are those library data review and updated frequently?			◆		
		Note: - *The MS-Access database has some library data incorporated in it.*					
	3.4	**Automation / Integration**: - How is the Risk information loaded into the tools? - Are Risks integrated with other PMO disciplines (i.e., Estimates, Cost) automatically? - Are Risks around changes logged and kept under the risk tool (i.e., for possible future claims or disputes)? - Are Risk modeling applications utilized?			◆		
		Note: - *MS-Access has the capability of uploading MS-Excel spreadsheets, but no automation practice was mentioned during the interview.* - *The risk description has the link to PMO discipline (also OPEX or CAPEX).*					

Area	No.	Question	Undeveloped	Emerging	Recognized	Improving	Mature
	3.5	**Other Tools notes:**					

Appendix L: Change Management Questionnaire

Attendees:

Toronto Hydro		**In the meeting?**
Ade Plumptre	Supervisor, Program Delivery, Improvement, and Governance	✓
Alisa Studzienny	Supervisor Program Management Office	×
Brad Lueger	Program Management Consultant	×
Jeremy Pasma	Supervisor, Program Management Office	×
Michelle Leung	PMO Supervisor	×
Odilon Bondoc	Program Delivery Improvement and Governance Associate	×
Mahinthan Subramaniam		✓
Rachel Fung	Program Management Consultant	×
Soumya Srivatsa		×
Trudy Chu	Supervisor, Program Management Office	×
Comtech		**In the meeting?**
Pasha Mohsenin	Director / Project Controls - Energy and Utilities	✓

<table>
<tr><th>Area</th><th>No.</th><th>Question</th><th>Ad-Hoc</th><th>Emerging</th><th>Recognized</th><th>Improving</th><th>Mature</th></tr>
<tr><td rowspan="3">1. Governance</td><td rowspan="2">1.1</td><td>Change Management Plan: Is there governance developed in Toronto Hydro to guide:
- Change Management Process
- Change Management Key Resources (Including their roles and responsibilities)
- Frequency of Change Review process
- The structure (components) of the change request forms and formats</td><td>◆</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="6">Notes:
- No documentation or governance is developed for Change Management and just a few process flows are available.
- The change management in Toronto Hydro is called CR (Change Request) process which a process is developed for it.
- The “Change Request” process is established under SAP and all standard templates, forms are stored under SAP also.</td></tr>
<tr><td>1.2</td><td>Change Request/Review Development:
As per current governance:
- Who could raise a change request?
- What forms or formats shall be used?
- Who is authorized to review/accept/reject changes?
- Who is authorized to approve changes?
- Who will incorporate the approved changes?</td><td>◆</td><td></td><td></td><td></td><td></td></tr>
</table>

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
		Notes: - *Depending on the change, the level of authority changes (The level is measured by $ amount) plus Project teams. A standard change request tool under SAP is developed, which covers all types of change requests (Scope, Schedule, Cost) and it comes with a pre-defined request/approval process.* - *All the change requests (regardless of their status of rejected/approved or even Draft) could be retrieved under SAP.* - *Toronto Hydro is not directing its stakeholders to continue the work under the risk of not being approved budget (In case more funding is required to complete the project). If a project is nearing getting over budget, conditional approval to proceed is granted until the change request is approved.* - *TH Management may direct the execution teams to slow down the project until the change request is approved.* - *The External Contractors **are not** authorized to proceed to work at risk of being over budget.* - *For a CAPEX project, we need a change request if the total value is more than 100K$ and for the OPEX project the threshold is 50K$. for changes less than the threshold there's no need to process a change request. PMO team keeps monitoring the budget, actual cost, and forecast to make sure if a change request is required or not.*					
	1.3	**Actions Post a Change**: As per current governance: - Who has the action? - Do we document all the actions related to changes? - Do we perform/document impact analysis? - Do we update the risk log? - Are Vendors involved in the process?	◆				
		Note: - *Any individual submitting a change request is responsible to perform all the follow-ups to make sure the change is processed. PMO's responsibility is to oversight the process and assure there's no deviation.* - *All the actions related to change requests are logged and tracked.* - *Impact analyses are performed (under CLM1/2/3 under SAP) which covers the impact assessment.* - *The PMC usually updates the risk log when receiving a change request. Most of the time, the change request initiator provides an early heads up to PMO/PMC to discuss the change and assess it even before it is submitted.* - *For external vendors (contractors): The contract administrator needs to submit and follow up until the change is approved.* - *TH processes change requests for cases in which projects/programs are forecasted to finish under budget or ahead of their target completion date.*					
	1.4	**Other Change Subject**: - What if a change is not approved, do we continue with variance? - Is change control centralized and integrated?		◆			
		Note: - *If a change is rejected the project will need to either fully stop or get canceled.* - *The Change Administration is centralized.*					

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
	1.5	**Future Steps**: - Is there any monitoring in place? - How often do you assess the requirements? - Do we monitor the changes-Contingencies' interaction?		◆			
		Note: - *The only plan is to improve the change management process and they're looking for opportunities for improvement as they're going ahead with their projects. i.e., some new roles are added to the TH Organizational chart and now they need to align the process with this.* - *TH performs monthly audits, and the results could trigger changes.*					
	1.6	**Other Governance notes:**					

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
2.People / Practices	2.1	**Communications / Training**: - Is training provided to PMO-Change Staff? - Is training planned or Ad-Hoc? - Are standards practices (same approach, same data, formats, etc.) promoted? - What are the documented change management communications?	◆				
		Notes: - *Same as other PMO disciplines.*					
	2.2	**Sustainability / Staffing Plan**: - Is there a staffing plan and sustainment developed? - Is there a standard Change Management organizational chart? - Is there a roles/responsibilities document developed for the Change management team?	◆				
		Notes: - *Staffing is covered under PMO.* - *There's no roles and responsibilities document.* - *There's no organizational chart.*					
	2.3	**Other People notes:**					

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
3. Tools (Project Management Information Systems)	3.1	**Change Management Tool**: - What's your Change Management Tool? - What's your Change Management Communication tool? - Who is administrating the Change Management tool(s)?			◆		
		Notes: - *Change Request tool is SAP*					
	3.2	**Scalability / Popularity / Consistency**: - What level are changes managed on (Project/Deliverables/Program)? - What's our quality plan for changes? - Is there any overall change report developed for divisions?		◆			
		Notes: - *Refer to earlier sections.*					
	3.3	**Library Data**: - Are the definitions and assumptions around changes gathered as one documented?			◆		
		Note: - *Library is developed under SAP*					

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
	3.4	**Automation / Integration**: - How much automated change is defined?	◆				
		Note: - *Under SAP*					
	3.5	**Other Tools notes:**					

Appendix M: Performance Management/Reporting Questionnaire

Attendees:

Toronto Hydro		**In the meeting?**
Ade Plumptre	Supervisor, Program Delivery, Improvement, and Governance	✓
Alisa Studzienny	Supervisor Program Management Office	×
Aida Ahmadi		✓
Jeremy Pasma	Supervisor, Program Management Office	×
Michelle Leung	PMO Supervisor	×
Odilon Bondoc	Program Delivery Improvement and Governance Associate	×
Mahinthan Subramaniam		✓
Rachel Fung	Program Management Consultant	×
Soumya Srivatsa		×
Trudy Chu	Supervisor, Program Management Office	×
Comtech		**In the meeting?**
Pasha Mohsenin	Director / Project Controls - Energy and Utilities	✓

No.	Area	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
1. Governance	1.1	**Reporting Management Plan**: Is there governance developed in Toronto Hydro to guide: - Reporting Structure - Review meetings attendees (Including their roles and responsibilities) - Frequency of report review meetings - The structure (components) of the reports (KPIs, Safety, Changes, Forecast)	◆				
		Notes: - *MCRS (Management Controls and Reporting System) defines the administration around reporting and frequency of status review meetings but it's no governance or procedure.* - *MCRS is corporate-wide and covers both project and program levels, it has some templates attached to it also which put a kind of standing around that.* - *There's an MCRS library that includes all the history action logs, depending on the size of the project TH has all the history MCRS stored under one place (it could go as far as 4 to 5 years in the past).* - *MCRS report is not developed on a regular frequency and is more like an Ad-Hoc report.*					

No.	Area	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
	1.2	**Report Development:** As per current governance: - Who's in charge of reporting? - What are the data sources? - Are data sources integrated? - Is there a data date (reporting cut-off date) defined? - Are vendors contributing to the reporting? - What are the identified reporting tools?		◆			
		Notes: - *Most of the reporting is PMC's responsibility (PDR: Program Delivery Report).* - *MCRS is usually developed by a supervisor on an as-required basis development.* - *SAP is the main data source for data, open text is another source. Excel, Risk log (MS-Access) for program level (Project Status reports could be used as data sources).* - *For the Project level, there is a project status report, but they are not in the scope of this assessment.* - *Reports are developed by PMCs for their associated RCs, PMO gathers these reports and consolidates all the results under one package.* - *PDR reports are developed on a certain time (post-release of capital expense report) and monthly basis.* - *Regular meetings are held with contractors to obtain updates on their scope* - *Design Readiness or Maintenance Summary reports are developed by one single responsible team.*					
	1.3	**Actions Post a report**: As per current governance: - Is there an action assignment in place during the report review meeting? - How are the actions logged and tracked? - Is there a pre-developed agenda for meetings + MOM? - Is there a repository of all past reports for reference? - Is there a review/approval process in place for the report release?	◆				
		Note: - *There's an action log that gets reviewed and a designated person is maintaining it.* - *Actions get reviewed at the end of each meeting.* - *MCRS captures the agenda, action log, follow up and steps to be taken during the meeting.* - *Yes, there's a repository for all the MCRSs.* - *PMCs take the data from all PDRs, consolidate them, review the results with stakeholders and then release it. There's a hierarchy of review and approval for the reports.* - *PMO produces KPIs (on monthly basis) and adds it into the scorecard (Schedule adherence is tracked by complete or not complete status of the projects, the percentage is based on the actual cost over budget.*					
	1.4	**Other Reporting Subject**: - Are reports enterprise covering projects/programs under one group? - Do we cross-check the reports with teams?	◆				

No.	Area	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
		Note: - *Reports depending on Project or Program level are prepared by different teams and do not necessarily cover all the portfolios for a division.* - *During the PDR meetings, each PMCs would walk the team over the report but may receive comments from other stakeholders (i.e., the numbers could be interpreted differently between two teams)*					
	1.5	**Future Steps**: - Considering the ongoing effort, are you considering changes on reports? - How often do you assess the requirements?	◆				
		Note: - *No major change is considered for reporting at this time. SAP remains the main source of data (with some manual data handling) and feeds BI or other dashboard or report developing platforms.* - *PMO is responsible for developing Score Cards, while PMC is developing their report (such as PDRs) which includes lots of PMO initiatives. On a year-by-year basis, the PMO reviews the reporting with stakeholders and check the needs.* - *PDRs (which are more or less the same template) is the basis for all the performance reporting. PMO reviews all the PDRs on monthly.*					
	1.6	**Other Governance notes:**					

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
2.People / Practices	2.1	**Communications / Training**: - Is training provided to PMO-Reporting Staff? - Is training planned or Ad-Hoc? - Are standards practices (same KPIs, metrics, formats, etc.) promoted? - What are the documented report management communications?	◆				
		Notes: - *Same as other disciplines.*					
	2.2	**Sustainability / Staffing Plan**: - Is there a staffing plan and sustainment developed? - Is there a standard Report Management organizational chart? - Is there a roles/responsibilities document developed for the Report management team?	◆				
		Notes: - *Same as other disciplines.*					

Area	No.	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
	2.5	**Other People notes:**					

No.	Area	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
3. Tools (Project Management Information Systems)	3.1	**Report Tool**: - What's your Reporting Tool? - What's your Report Communication tool? - Who is administrating the Reporting tool(s)?		◆			
		Notes: - *Excel, SAP BI, Tableau, PowerPoint are the tools for reporting.* - *Emails, Team meetings, and messages. There is notification (Such as SAP BI sending weekly notification).* - *Reporting tools are not enterprise and there is no administrator*					
	3.2	**Scalability / Popularity / Consistency**: - Are reports multi-layers? - Do we develop special reports for higher management? - Do we share reports with external stakeholders? - Do we incorporate any comments from external stakeholders in the reports?		◆			
		Notes: - *PMO-related reports are sometimes multi-layer (such as Planned Capital Project Completion Report or Design Readiness report).* - *There are some dedicated reports for senior management and provide rolled-up and summary reports.* - *For a specific and standalone large project, they may share the TH developed reports with external stakeholders (Ade was not sure about this) but PMO develops reports that are not shared with external resources.*					
	3.3	**Library Data**: - Are the definitions and assumptions around the report develop documented? - Are there pre-defined values for developing reports (Library Data)?	◆				
		Note: - *The assumptions (i.e., thresholds) are documented internally within PMO plus if there's an external report (like PCR), they will document and communicate these reports with other stakeholders.* - *Most of the information is pre-calculated or populated and this could be considered as library data. Such as Conditional formatting under Excel.* - *TH is transitioning the team (i.e., PMCs) from the current manual to Tableau so lots of pre-populated information is available and used.*					
	3.4	**Automation / Integration**: - How much automated reporting is defined?	◆				
		Note: - *Most of the effort is manual and there's no opportunity for automation.*					

No.	Area	Question	Ad-Hoc	Emerging	Recognized	Improving	Mature
	3.5	**Other Tools notes:**					

Appendix N: References

No.	Document Title	Document Details
1	4.1 X 18364 Project Documentation	A predefined format from SAP
2	30M Forecasting Process-Sep25.	Spreadsheet for tracking all projects with their major dates and budgets
3	Issue Scope-Work Package (ISW) level 3 Process Map (1.0)15-Nov-2021	Process flow for issuing scope work packages
4	Capital Projects Project Phasing Job Aid	Guide on how to break the projects down.
5	Manage Scorecard CR(MSC) Process Map	Process flow for managing scorecards
6	Close Out Project (PPP8.0) Level 3 Process Map (v3.0)	Process flow for closing projects
7	RC 3110 DCE PDR Report September 2019	Sample "Monthly Program Delivery Review" report /cover for all the projects under one RC's portfolio
8	Cancel Project Process Map (v5.0)	Process flow for project cancellation
9	Managing Material Requirements Process_1.2	Project flow for material management
10	Perform PVA level 3 Process Map (v1.0) 25-Nov-2021	Process flow for the development of project variance analyses complete with descriptions and directions
11	Change Request (CR) Process Map (v2.0)	Process flow for developing change requests and approvals under SAP with details regarding approvers, thresholds, etc.
12	Intake Scope-Work Package (ISP)level 3 Process Map(D)	The process follows for intaking of scope work packaged with details regarding key stakeholders and required actions within SAP
13	Work Package PWN 17019	A detailed document providing quantity and cost estimate, logging risks, identifying the work condition
14	PVA Update and PSR	Development guide for the program variance analysis report
15	2019 V3.1 Program Variance Log (PVL)	Over 2000 projects are listed under this Excel spreadsheet which logs all the variances
16	EWP Risk Log (ERL)	Process and log for risk management

Appendix O: Acronyms

Acronym	Description
CAPEX	Capital Expenditure
CBT	Computer Based Training
CPP	Cancel Project Process
DBA	Database Administrator
DCE	Design Construction East (Toronto Hydro Division)
DCW	Design Construction West (Toronto Hydro Division)
ERL	Enterprise Risk Log
ISA	In-Service Additions
ISP	Integrated Intake Scope-Work Package
ISW	Issue Scope-Work Package
KPI	Key Performance Indicator
MCRS	Management Controls and Reporting System
OCM	Organizational Change Management
OE	Organizational Effectiveness
OPEX	Operating Expenditure
PDIG	Process Delivery Improvement and Governance
PDR	Monthly Program Delivery Review (PDR) Report
PEM	Planning, Engineering, and Modernization
PMC	Program Management Consultant
PMO	Program Management Office
PPP	Project Planning Process (Distribution)
PRAT	Project Resource Allocation Template
PSAT	Program Spend Allocation Table
PSP	Project Planning Process (Stations)
PVA	Program Variance Analysis (Report)
PVL	Program Variance Log
RC	Responsibility/Resource Centre
SCP	Scorecard Change Process
SPOC	Single Point of Contact

Toronto Hydro-Electric
System Limited
EB-2023-0195
JT4.12
Appendix B
ORIGINAL
(19 pages)

Project Variance Analysis (PVA)
Process Review

Final

For Toronto Hydro
May 10, 2022

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Table of Contents

Executive Summary

Toronto Hydro (TH) requested that John Hollmann, owner of Validation Estimating LLC (Consultant) review their Project Variance Analysis (PVA) process. The specific scope is to assess the PVA percentage cost variation trigger thresholds for alignment with standards (e.g., AACE® International) and best practices. The assessment includes a review of the PVA process of data collection, analysis, review and reporting. This report includes recommendations for practice improvement.

The PVA process uses a fixed threshold range derived from AACE Recommended Practice (RP) 18R-97: *Cost Estimate Classification System – As Applied in Engineering, Procurement and Construction for the Process Industries*. This report notes that the ranges in this and other AACE classification RPs are not intended for such use. The AACE ranges are indicative only for the purpose of illustrating relative class-to-class variation, not absolute range values for any particular project or portfolio. Research shows that actual ranges often vary quite significantly from the AACE reference.

The Consultant recommends that Toronto Hydro apply *internal* benchmarking to assess variance given that there are no reliable off-the-shelf external metrics. Valid external benchmarking requires a significant investment of resources working with a 3rd party benchmarking firm or similar. If the goal is to improve practices and outcomes over time (rather than a competitive analysis against peers), internal benchmarking serves the purpose.

Internal benchmarking requires study of Toronto Hydro's actual distributions or range. The revised +/- percent threshold(s) would be based on this study and adjusted each year with the objective of improvement. For example, the threshold might be updated each year based on the 80 percent confidence interval (i.e., p10/p90 range) of the updated historical dataset. A preliminary study of this nature is included in the report's Appendix.

The current PVA process uses a measure of the percent of projects outside the fixed threshold (%PVA) as a year-to-year performance metric. That requires fixed thresholds. By re-setting the threshold annually at say the p80 confidence interval of past data, the %PVA would be more or less fixed (i.e., by definition, 20 precent of projects fall outside the 80% confidence interval). The threshold would have the sole purpose of sizing a representative sample of variant projects for capturing lessons learned. Performance would then be measured using a *direct* measure of variability such as the p10/p90 *span* (e.g., p90 percentage variance plus the absolute value of p10) each year. Study of the actual variance distribution will also show the *pattern* of variance; i.e., the shape of the distribution illustrates behavior driven by the PVA process which may or may not be desirable. For example, the Appendix study shows that the current distribution profile is discontinuous; i.e., most projects are constraining their variance within the threshold bracket; how that is being accomplished should be studied (e.g., better estimating practices will generally not result in a discontinuous distribution).

The study in the Appendix also shows that variance is strongly correlated with project size. Therefore, the report recommends setting thresholds by project size categories. The historical data indicates a need for at least two categories: less than and greater than $200,000 is suggested (continue to exclude projects under $50,000 which have extreme random variability).

The report includes two main recommendations as follows:

1. Set the threshold using internal benchmarking. Study the last 5 years of variance metrics to set a baseline for threshold determination. Set the thresholds at the 80 percent confidence interval (i.e., p10/p90 values)[1]. Update the study annually to track any improvement or other trends, and to directly observe distribution pattern changes if any.

2. As part of the study in recommendation (1), also study the *variance vs. project size* and determine if the PVA process is biased towards small projects and whether multiple thresholds for different project sizes make sense. The Appendix study suggests the following initial 80 percent confidence interval thresholds[2]. Toronto Hydro should confirm these with its own refined study aligned with its needs:

    - $50,000 to $200,000 estimates: -31/+40%
    - >$200,000 estimates: -20/+26%

The report also includes the following secondary recommendations:

3. Study cost versus duration variance to see if there is a correlation (i.e., is cost variance an artifact of scheduling practice?). This can be done as part of the study in recommendation (1).

4. Study whether the use of the total cost variance, and the wide range of the secondary material cost and labor hour variances (-50/+50%) are allowing some larger projects with significant (but <50%) account-level variances to bypass PVA assessment and over-emphasizing the smallest projects that have less opportunity for offsets. The distribution of actual material cost and labor hour variances should be studied as part of recommendation (1).

[1] The AACE Classification RPs, and general industry practice, is to report ranges using the 80 percent confidence interval. This is used because values outside this range tend to reflect aberration (i.e., tails go asymptotic). Since the purpose of the PVA thresholds is to flag aberration, it is suggested as an objective range criterion in this report.

[2] If the range resulting from the 80 percent confidence interval is felt to be too wide for aspirational performance target setting purposes (which Is not the stated PVA objective), the threshold range criterion could be set to a tighter confidence interval. The study showed for example that the 60 percent confidence interval range was -14/+18% and -13/+16% for the $50,000-$200,000 and <$200,000 projects respectively. This would result in more projects being flagged for study (i.e., 40% in this case).

Introduction

Toronto Hydro (TH) requested that John Hollmann, owner of Validation Estimating LLC (Consultant) review their Project Variance Analysis (PVA) process. The specific scope is to assess the PVA percentage cost variation trigger thresholds for alignment with standards (e.g., AACE® International) and best practices. The assessment includes a review of the PVA process of data collection, analysis, review and reporting. This report includes recommendations for practice improvement.

Background

This section reviews the existing PVA process. The primary sources of information include:

- Virtual meetings on March 25 and 28, 2022;
- PVA Level 3 Process Map dated November 25, 2021 (v1.0);
- PVA PSR slide deck dated March 16, 2022;
- Several project PVA report examples;
- An Excel file with PVA variance values from 2017-2021

Organization

The PVA process is managed by the Toronto Hydro Program Delivery Improvement and Governance (PDIG) organization. The PVA process owner is the Director of the Enterprise Program Management Office (EPMO). The PDIG process also involves:

- Operations (OPS) leaders who meet in a Master Production Planning (MPP) meeting where PVA findings are reviewed and actions are followed up on;
- Investment planning in the various business units who judge the quality of PVA reports;
- Execution responsibility centers (RCs) including directly responsible persons (DRPs) who prepare the PVA reports.

PVA Strategy

The scope of this review does not include the overall strategy of the EPMO or PDIG organizations (e.g., no review of estimating, scheduling, funding, risk analysis, or other related processes). This is just a review of the PVA process including the strategy, measures and reports regarding planned versus actual project cost variance.

The PVA approach as reviewed is directed towards understanding and improving project cost *predictability* only. Typically, capital programs have two key cost performance indicators: cost effectiveness (achieve lower absolute cost for a given scope) versus predictability (accuracy or variance; i.e., spending what was budgeted). The word “versus” is used because predictability or accuracy can be achieved at the expense of effectiveness via over-estimation combined with laxity in project-level control. However, because effectiveness is difficult to measure, and business and finance stakeholders are often mostly focused on reliability of forecasts, most company portfolio management processes observed by the Consultant only measure predictability.

Some capital programs also measure both cost and schedule (time duration) variability because cost and schedule are often traded (e.g., expend resources to preserve completion milestones) and hence may be significantly related. It was indicated that PDIG has measures of project schedule duration variability but they are excluded from this review.

PVA Process

It is assumed by the Consultant that the PVA process is part of an overall, ongoing strategic deployment process. The usual process starts with strategic objectives that are agreed, putting processes in place to deploy the strategy developed at an appropriate organizational level, taking measurements of the process performance, and noting variances and taking correction actions. It is also assumed that other non-PVA measures are used and cross-learnings with PVA are assessed (e.g., cost/schedule trading behavior, change management, etc.).

The PVA Level 3 process reviewed measures the following:

- Percent of projects for which costs and/or hours are outside established thresholds (Business Requirements Planning (BRP) Metric 1-calculated by PDIG) triggering requirement to prepare a PVA "cause" report.
    - BRP Metric 1 = percent of projects for which either:
- ▪ cost variance [(actual cost/packaged estimate cost (PEC))/PEC x 100%] is outside the -15/+20% threshold range.
- ▪ hours variance [(actual hours/estimated hours)/estimated hours x 100%) is outside the -50/+50% thresholds[3].
- Likely causes of variation (identified by the execution RC with input from the DRPs) (*narrative*)
- Quality, including timeliness, of the PVA "cause" reports prepared by the RC (BRP Metric 2 – calculated by the Investment Planning group)
    - BRP Metric 2 = score based on quality check guidelines where 80% is based on quality and 20% on timeliness.

The PVA Level 3 process results in the following deliverables:

- PVA cause reports for individual projects outside the BRP Metric 1 threshold (a PVA Report template is provided to the teams by PDIG).

[3] The team reported that the material cost variance was similarly being used; however, the documented process reviewed by the Consultant did not show that.

- From the collective RC-identified likely causes, overall “lessons learned (LL)” are documented, recommendations for improvement are made and actions are planned in “inter-RC” lessons learned workshops.
- From the quality metric, (BRP-2), for low quality reports, “feedback” is given to the RC/DRP for their consideration and sharing.
- A PVA Project Status Review (PSR) report is developed for MPP review and follow through.

In a nutshell, the PVA process flags projects with significant variance so that lessons learned can be extracted from this sample of variant projects by responsible parties for MPP consideration. The flagging or trigger metric (%PVA) is used as an indicator of variance performance over time; however, no direct statistical measures of variance are applied or studied.

Observations and Findings

Establishing a Threshold; Measuring Variance

The PVA process uses an indirect “trigger” measure of cost variance that uses threshold limits to flag projects for variance cause (lessons learned) analysis. The process captures a measure of the percentage of projects requiring a PVA (% PVA) and uses this as a “performance” metric. This is an indirect measure; it does not directly measure the cost variance itself. The use of %PVA to measure performance is problematic because it constrains threshold setting as is discussed later.

For the cost variance trigger, the PVA process uses a *fixed* threshold range derived from AACE Recommended Practice (RP) 18R-97: *Cost Estimate Classification System – As Applied in Engineering, Procurement and Construction for the Process Industries*. The various AACE classification RPs provide a range-of-ranges. The PVA uses the most extreme range (-15/+20%) from the RP’s table 1 for Class 2 estimates. Class 2 estimates are those based on full scope definition, with full estimate detail, and with budgets *usually based on a contractor tender* (i.e., assumes some risk transfer to the contractor at that gate).

The Toronto Hydro phase-gate scope development process and scope definition requirements were not reviewed to determine if Class 2 appropriately reflects TH projects at sanction. While this report finds that Class RPs should not be used for PVA threshold criteria, the question of Class is important because research shows the most significant driver of accuracy or variability is the level of scope definition. It is generally understood in industry that the best practice for achieving predictability is maintaining rigor in the phase-gate scope development process (making sure the estimate and all other deliverables meet requirements). Using the lessons learned from the PVA process in phase-gate checklists or similar practices would be part of such a quality (and variability) improvement process. The scope of this review also did not include studying the lessons learned or how they were actually used.

It should be noted that all AACE classification RPs state that "*While a target range may be expected for a particular estimate, the accuracy range should always be **determined through risk analysis of the specific project and should never be predetermined***." While this statement is directed towards risk analysis (e.g., contingency setting, etc.), the principle of always using *specific* analyses in regards to accuracy or variability applies to the PVA threshold setting.

Further, the RPs state that the ranges exclude major risk event impacts. Further still, an ambiguous *range-of-ranges* approach was implemented by the AACE technical committee in part to minimize the inappropriate use of the RPs. There is no AACE accuracy range "standard"; the range-of-ranges are indicative only. They are primarily intended to show the *relative* change from class-to-class, not *absolute* values. In short, these ranges often have little relevance to the variance on any particular project or project type. Evidence of this fact is shown in the study in this report's Appendix.

While it is understood that an external benchmark or "standard" is desired by PDIG (and most companies), the Consultant is not aware of any such *off-the-shelf* measure. All quoted ranges in literature are indicative or anecdotal at best and rarely match any particular situation. There are external project cost benchmarking sources that develop more specific measures, but these are proprietary and require the parties to participate in benchmarking of their project systems at some investment of time and resources (e.g., Independent Project Analysis, Inc.). Another form of benchmarking is called reference class forecasting, but that also requires special study of comparable industry projects (the reference class) which requires significant multi-party effort and often relies on suspect public domain data.

There is one consistent practice in industry, and the AACE RPs in respect to range and that is the confidence interval used. The AACE Class RPs call for using the 80 percent confidence interval for reporting range. This practice is common in industry. Later, this report will recommend using the confidence interval as the objective criteria for selecting the range.

The Consultant has supported focused accuracy studies including for power transmission projects of Canadian provincial hydropower companies.[4] As an example of the limitation of the AACE Class range-of-ranges, that study found that the accuracy range of actual Class 3 estimates for the study participants was -29/+54% at an 80 percent interval (80 percent, representing the p10/90 range which is the typical reported interval for accuracy range). However, the RP 96R-18 (and 18R-97 for process industry) Class 3 estimate worst-case range is only -20/+30%. In that study, the actual variability (span of the p10/p90 range) of the transmission projects was <u>1.7X the worst-case</u> in RP 96R-18[5]. While Class 2 estimates were not studied, it is reasonable to assume that the magnitude of this gap

[4] Hollmann, et.al., "Variability in Accuracy Ranges: A Case Study in the Canadian Overhead Power Transmission Industry", AACE Cost Engineering Journal, Sept/Oct 2018.

[5] 83 percent span (54+29) versus 50 percent span (30+20) is a 1.7X multiplier.

between indicative ranges from the literature (AACE RPs or otherwise) and industry reality is not uncommon.

Further, research by the Consultant of project cost growth and accuracy[6] shows that small project systems (i.e., projects managed as portfolios with cost less than 5-10 million dollars, <2 years duration) often have much different accuracy range distribution profiles than larger, more strategic projects do. In particular, small project systems often show more distortion in their distribution (i.e., they are often discontinuous and do not fit well with any "natural" distribution). This distribution distortion is driven by how portfolio projects are estimated, controlled and accounted for; e.g., each individual project has very limited resources applied for these project control tasks. For example, industry small project systems tend to skew to more underruns (over-estimation) than large projects. Figure 1 from the Consultant's book shows an actual/estimate distribution for a typical small project system (based on studies by the Consultant); the example shows a sharp drop-off or discontinuity in overruns at +10% because this is often set in industry as a "threshold" or hard-stop above which a project must be re-reported to management; an experience teams will seek to avoid by whatever means. The resulting distribution does not reflect natural cost performance, but rather it is an artifact of a system with the main goal of annual portfolio budget predictability; in this case avoidance of overruns. This is typical of ongoing portfolio management as opposed to major project organizations which focus more on the competitiveness of individual strategic investments.

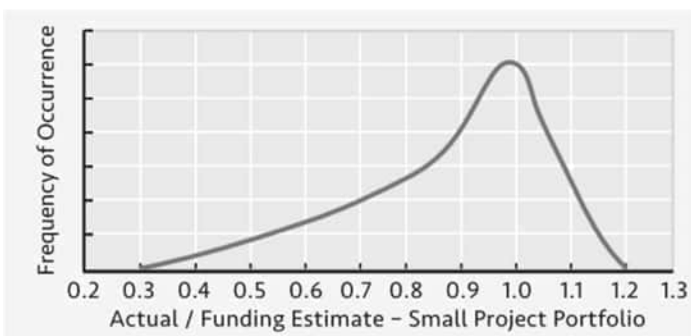

Figure 1: Typical Small Project System with Underrun Profile (Over-estimation)[3]

This illustrates a challenge of benchmarking is that "one gets what is measured"; i.e., if the main objective is to avoid overruns exceeding 10% as shown in Figure 1, then the process will naturally evolve in subtle (and not always desirable) ways to avoid that outcome. The study in the Appendix indicates that the PVA process is driving behavior at Toronto Hydro, but in this case the variance results are not just a high-side limit, but low-high bracketing (-15% and +20%). The process management questions for PDIG are what practices are being used to achieve this discontinuous distribution and whether those practices are consistent with objectives? For example, if the lower threshold were removed, would more projects underrun (as in Figure 1) and would that be desirable so long as funds are returned? If the actual range distribution were directly studied every

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[6] Hollmann, J. Project Risk Quantification, Probabilistic Publishing, 2016.

year, there would be sufficient evidence to spot over-estimation trends with setting a hard-coded threshold that incentivizes spending excess funds.

Given the lack of reliable external metrics, and the limited applicability of any published range metrics to given project situations, the Consultant recommends that the PVA process be based on *internal* benchmarking. In that approach, PDIG would benchmark cost variance against Toronto Hydro's own past performance with the goal of improving said performance over time.

This internal approach requires a baseline benchmark study of the variance statistics for projects completed in the last 5 years or so. From that, the mean and p10/p90 values or some other confidence interval values could be determined for use in setting target thresholds. A similar study could potentially be done for material cost and labor hours variance (for which PDIG has set a much wider -/+ 50 percent tolerance).

A benefit of internal benchmarking is that, if the study is updated every year, PDIG will have a direct variance range measure to gain more learnings about its project portfolio process. For example, measure BRP-1 does not convey any information about whether estimates are biased and in which direction (i.e., it does not indicate if there are distortions resulting from portfolio management process that may affect achievement of company objectives).

The first recommendation then is to conduct such a benchmarking study and update it annually. An initial example study is included in the Appendix. The study includes an example direct measurement of range by year.

Use of the Threshold and a Variance Metric or KPI

As discussed, the PVA process is using the range threshold to trigger the preparation of PVA reports that serve as a source of variance cause information (lessons learned). It is primarily a sampling devise, not a performance metric per se. However, the % PVA is being used as a key performance indicator (KPI), including looking at annual trends. Unfortunately, this dual use means the threshold percentages must be fixed for all time.

The recommended internal benchmarking approach would instead set the threshold at a fixed confidence interval range of the baseline history, and these baseline percentage values would be updated from time to time as the baseline, objectives, processes and conditions change or targets are set (i.e., hopefully to improve). The threshold would be set for the purpose of getting a reasonable sample of lessons learned in a way that avoids unnecessarily or unfairly burdening projects with reporting requirements that are not adding much value. The 80 percent confidence interval is suggested because the AACE Classification RPs, and general industry practice, is to report ranges using the 80 percent confidence interval. This is used because values outside this range tend to reflect aberration (i.e., tails go asymptotic). Since the purpose of the PVA thresholds is to flag aberration, it is suggested as an objective range criterion in this report

A trigger threshold range set on confidence interval criteria means the %PVA (or sample size) would always be more or less fixed (e.g., 20% of projects if 80% confidence interval is the criteria). To measure the year-to-year change in variability, a direct measurement of variation is recommended rather than %PVA. The direct measure could be the span (high percentage plus the absolute value of the low percentage). The Appendix provides an example of how that can be done. This measure would also provide directional information related to the process (e.g., is variation biased on the low or the high side and is that bias changing?).

If the range resulting from the 80 percent confidence interval is felt to be too wide for aspirational performance target setting purposes (which Is not the stated PVA objective), the threshold range criterion could be set to a tighter confidence interval. This would result in more projects being flagged for study.

Other Observations

The following are other observations in respect to improving the PVA process and metrics. These are mostly focused on assuring the process is value-adding, economical with team resources, and fair in how it treats various projects that may or may not be flagged for significant variances.

<u>Cost versus Duration</u>

Projects will sometimes trade cost for schedule; i.e., when schedule is slipping, they may spend more money to protect the completion milestone. Therefore, it is useful to compare cost and duration variance to see if there is a correlation. A scatter plot with cost variance on one axis and duration on the other gives a good visual indication. This may be a lesson learned in its own right (which is often not detected otherwise); i.e., is cost variation an artifact of scheduling practice?

<u>Randomness; Predictability vs. Project Size</u>

An attribute of small projects is that there are a relatively small number of significant cost items in the scope. As such, if one item overruns on a small project, there is less opportunity for counter-balancing underruns (and vice-versa) than on larger projects. Therefore, unless there is over-estimation bias with weak control, small project systems may have wider range of variance than larger projects. A "direct" study of cost variance as discussed previously would examine the variance vs. size and determine if a single threshold for all project sizes makes sense (i.e., is the PVA process biased towards assessing the smallest projects that in the end have little impact on overall capital spending?). The Appendix includes such a study and shows that indeed, size is a driving factor.

<u>Offsetting Plus and Minus Variance</u>

The PVA trigger process may not be flagging some larger projects that have variability issues worth reporting. For example, a project may have a material cost overrun, but a labor cost underrun, such that its overall variance is within the threshold; in that case, its material cost problem will be overlooked. However, another project with the same material cost overrun, but no counterbalancing labor underrun, will fall outside the variance threshold and be subjected to the PVA reporting regime. Are some projects with variability issues "lucking out" of having to prepare a PVA report? A study of a sample of larger projects (not done in this report) with variance within but near the threshold, would indicate if major variances are balancing out (i.e., are the range thresholds used for labor hours and material cost variance appropriate?).

Significance: Explain 90% of Variance?

The PVA process "rules" (PVA Process Quality Check Guidelines) states that for identifying the root cause of variance, "*the gap analysis must explain 90% of the variance between the packaged estimate and the actual construction costs*." As discussed above in regards to offsetting variances, is the rigorous PVA process requirement to explain 90% of the variance a value-adding criterion? Perhaps teams should be given some leeway to focus on the most significant drivers (e.g., just say "most" or "majority" of the variance).

Minor Observations:

The following are some minor items seen in the documents:

- In report graphics, use trend lines only where trend is being measured; i.e., some PVA PSR charts use trend lines between data points that have no relationship.
- Chart of cost variance has a line showing the absolute values (e.g., is PDIG saying a 15 percent underrun is worse than a 5 percent overrun?). See the recommendations for preferred distribution and variance range illustrations that give better insight into the process and performance.
- The PVA Level 3 Process Map does not show poor quality reports being recycled for improvement.

Recommendations

These recommendations are focused on better understanding the variance profile, the variation causes and to support improvement efforts year by year. They also help assure the PVA process is value-adding, economical with team resources, and fair in how it treats various projects that may or may not be flagged for significant variance items.

Recommendation 1 and 2 are most significant; 3 and 4 are secondary:

1. Set the threshold using internal benchmarking. Study the last 5 years of variance metrics to set a baseline for threshold determination. Set the thresholds at the 80 percent confidence interval (i.e., p10/p90 values) based on AACE RP use of this criteria for range reporting. This study should be done annually to track any improvement or other trends in the variance range and mean year-to-year, and to directly observe distribution (e.g., estimation bias) changes even if the mean and range are not changing. See the Appendix for an initial study.
    a. This could also be done at the account level (e.g., material, labor hours, etc.) to set thresholds for those accounts. The account level was not studied in this report.

b. Discuss the value of having a lower bound; are underruns being discouraged by PVA reporting requirements (i.e., are excess funds being spent to keep off the radar?). By directly observing the distribution, any over-estimation would be observed without setting a hard-coded threshold that incentivizes spending excess funds.

2. As part of the study in recommendation (1), also study the *variance vs. project size* and determine if the PVA process is biased towards small projects and whether a single threshold for all project sizes makes sense. See the Appendix study for an initial examination.

    a. The Appendix study suggests the following initial thresholds by size based on an 80 percent confidence interval:

        - \$50,000 to \$200,000 estimates: -31/+40%
        - >\$200,000 estimates: -20/+26%

    b. If the range resulting from the 80 percent confidence interval is felt to be too wide for aspirational performance target setting purposes (which Is not the stated PVA objective), the threshold range criterion could be set to a tighter confidence interval. For example, the Appendix study showed for example that the 60 percent confidence interval range was -14/+18% and -13/+16% for the \$50,000-\$200,000 and <\$200,000 projects respectively. This would result in more projects being flagged for study (i.e., 40% in this case).

3. Study cost versus duration variance to see if there is a correlation (i.e., is cost variance an artifact of scheduling practice?). This can be done as part of the study in recommendation (1). Such a study is not included in this report.

4. Study whether the use of the total cost variance, and the wide range of the secondary material cost and labor hour variances (-50/+50%) are allowing some larger projects with significant (but <50%) account-level variances to bypass PVA assessment and over-emphasizing the smallest projects that have less opportunity for offsets. The distribution of actual material cost and labor hour variances should be studied as part of recommendation (1).

APPENDIX – INTERNAL BENCHMARKING STUDY

This is a preliminary analysis of variance data pursuant to recommendations #1 and #3. The purpose is to determine appropriate cost variance threshold levels based on internal benchmarking. PDIG provided an Excel workbook with 5 years (from 2017 to 2021) of project cost variance data for this purpose.

For this initial study, the data fields used were the year, the estimated cost (for sorting by size)[7], the total cost variance percentage (the main metric of interest), and the flag whether a PVA report was required (used for BRP Metric-1). PDIG may desire to conduct more in-depth analysis using other fields for sorting/segregating data.

The Consultant uses a low-cost Excel add-on called "Analyse-It" for statistical studies (e.g., histograms, curve fitting, etc.). This software is the source of the graphics and tables.

Data Preparation

PDIG provided the data in separate annual spreadsheets; these were combined into a 5-year dataset (with year as a field). Records with -100% or no variance (or crossed out by the client) were deleted for this study. The remaining data was sorted by the variance value. Based on observation, "outliers" were segregated and not included in the overall distribution; these outliers were projects with <-80% variance and >250% variance based on the assumption that such variations were few and likely not the result of an ongoing process problem; PDIG may wish to apply other criteria for outliers.

Overall Variance Distribution

Figure A-1 shows the variance histogram for projects of <u>all</u> sizes. The statistics in Table A-1 apply to that distribution:

Number	2,447
Mean	4.3%
Std Dev	+/-37%
P50	-0.9%
P10	**-31%**
P90	**+41%**

Table A-1: Variance Statistics: All Project Sizes

Observations about the profile:

- The red-curve shows the nearest fit Normal distribution based on the mean and std. dev. The actual distribution (histogram in green) shows a compression of

[7] It appears that PDIG has exempted small projects from PVA requirements. However, the exemption was made using the actual cost. It is recommended that estimated cost be used for the exemption; using actuals results in only overrun causes being examined and not underruns.

values between -15/+20% which is obviously not a "natural" distribution; i.e., not the result of a natural variation in project system performance.

  - Teams are apparently able to exert control to minimize cost outcomes outside the PVA thresholds of +20/-15%. The study did not examine project behaviors that could explain this, or whether those were desirable.

- The Consultant also looked at this data by year; this same distribution pattern was seen consistently for each year's data.

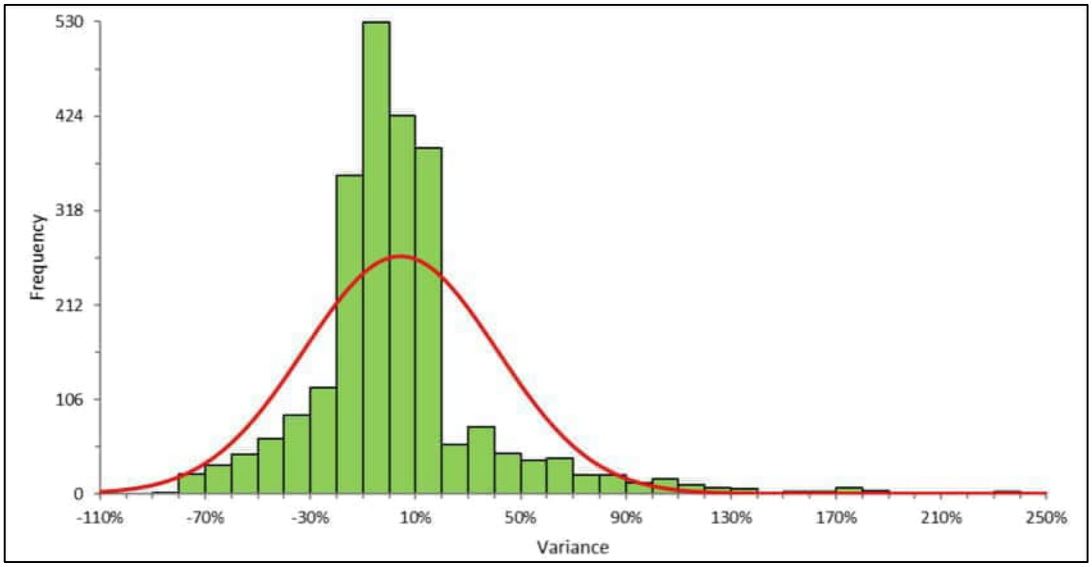

Figure A-1: Variance Distribution: All Project Sizes

It was observed that PDIG exempted projects <$50,000 from PVAs. Therefore, the statistics in Table A-2 apply to the projects with estimates >$50,000. The distribution for this project size range is visually the same pattern as Figure A-1; however, the statistics evidence a tighter range for the larger projects (i.e., the small projects are more variable).

If a single threshold range was set, the p10/p90 values in Table A-2 would be suggested. However, as shown in the next study section, this is not recommended because of the high sensitivity of variance to project size; i.e., the wide threshold in Table A-2 would be exempting most larger projects from PVA reports.

Number	2,025
Mean	3.5%
Std Dev	+/-31%
P50	-0.4%
P10	**-26%**
P90	**+34%**

Table A-2: Variance Statistics: Estimates >$50,000

Variance Distribution by Size Range

Table A-3 breaks the project data statistics into three datasets with estimates <$50,000, from 50,000 to $200,000 and >$200,000. While the <$50,000 projects are exempted, the statistics are shown to illustrate the strong variance range-to-size relationship. Small project costs are much more variable.

The $200,000 value was chosen based on examining the variance vs. project size regression shown in Figure A-2. Notice the sharp reduction in scatter for projects greater than about $200,000 (dashed vertical red line). Further, notice the "bounding" of variance for the larger projects at about +20/-15% (dashed horizontal blue lines). Would more projects underrun if there was no bound on the low end? Finally, notice that the mean variance (slanted line) is correlated with project size with underruns more common for larger projects (the regression t-score indicates a strong significance to this relationship).

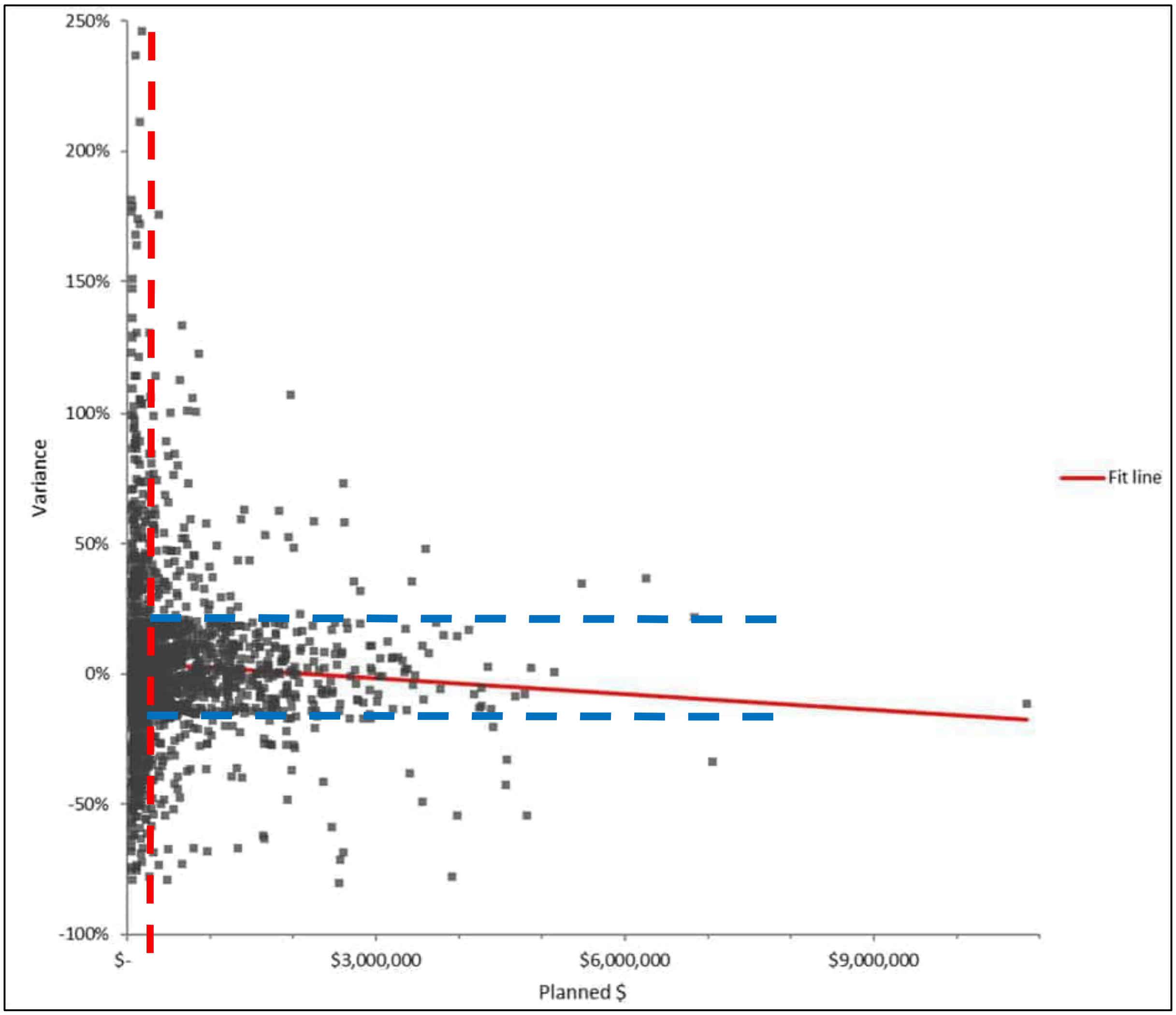

Figure A-2: Variance vs. Project Size

Estimate Size Range	<$50,000	$50,000-200,000	>$200,000
Number	422	859	1,166
Mean	8.2%	4.6%	2.6%
Std Dev	+/-56%	+/-37%	+/-26%
P50	-4.9%	-1.2%	0.05%
P10	**-51%**	**-31%**	**-20%**
P90	**+78%**	**+40%**	**+26%**
% of projects for which PVA was required with +20/-15 threshold	N/A	24%	16%

Table A-3: Variance Statistics: By Size Ranges

This data confirms that PVAs for projects <$50,000 would not be value adding; the practice of excluding them should be maintained. However, it also suggests that the variance threshold range should vary with project size. At a minimum, distinguishing between projects less than or greater than $200,000 is suggested. Doing this will help assure that smaller projects are not over-emphasized, and that larger projects are given proper attention. Based on this preliminary study, the resulting thresholds set at an 80 percent confidence interval initially would be:

- $50,000 to $200,000 estimates: -31/+40%
- >$200,000 estimates: -20/+26%

As to whether the p10/p90 range, which industry and AACE Class RPs use to represent estimate accuracy (i.e., 20% of projects are expected to fall outside this range), is appropriate as a threshold needs to be considered by PDIG. 20% of roughly 400 projects per year is about 80 PVA reports (less any exempted “reactive” projects); PDIG would need to decide if is this an adequate sample to capture key lessons learned.

If the range resulting from the 80 percent confidence interval is felt to be too wide for aspirational performance target setting purposes (which Is not the stated PVA objective), the threshold range criterion could be set to a tighter confidence interval. The study showed for example that the 60 percent confidence interval range was -14/+18% and -13/+16% for the $50,000-$200,000 and <$200,000 projects respectively. This would result in more projects being flagged for study (i.e., 40% in this case).

The use of the threshold should be as a trigger to obtain lessons learned. Using % PVA may not be the best metric of variance performance over time.

Variance Distribution by Year

Table A-4 and Figure A-3 compares the variance p10/90 range by year (for estimates >$50,000) to illustrate how a direct analysis of range differs from looking at % PVA only.

Of perhaps most interest, the March 16, 2022, 2021 PVA PSR report (slide 7) stated in the notes that the "*2021 [% PVAs] spike in all RCs due to COVID-19 additional costs (e.g., overtime/premium time), material cost increases and city restrictions)*". However, the Figure A-3 chart indicates that the number of underruns increased as well. An alternate explanation is that while there were indeed incidental COVID-19 increases, there is possibly and underlying, longer-term trend towards underrunning (i.e., over-estimation). This explanation is speculative, but illustrates the value of the improved measure and something for PDIG to examine further.

Another trend is the decreasing proportion of projects <$200,000 from 2017 to 2021 which may in part explain the decreasing percentage of projects requiring a PVA (i.e., apparent improvement is really just an artifact of project size mix; with 2021 being a remarkable exception).

	TOTAL	2017	2018	2019	2020	2021
Number	2,025	485	546	377	330	287
Mean	3.5%	4.9%	3.0%	3.7%	1.7%	3.7%
Std Dev	+/-31%	+/-31%	+/-31%	+/-33%	+/-25%	+/-35%
P50	-0.4%	-0.6%	-0.2%	-0.4%	-1.0%	0.1%
P10	**-26%**	**-18%**	**-28%**	**-27%**	**-15%**	**-33%**
P90	**+34%**	**+37%**	**+34%**	**+34%**	**+19%**	**+44%**
Span (P90-P10)	60%	55%	62%	61%	44%	77%
%<$200K		52%	50%	37%	35%	28%
%PVA		24%	21%	14%	12%	27%

Table A-4: Variance Statistics by Year (Estimates >$50,000)

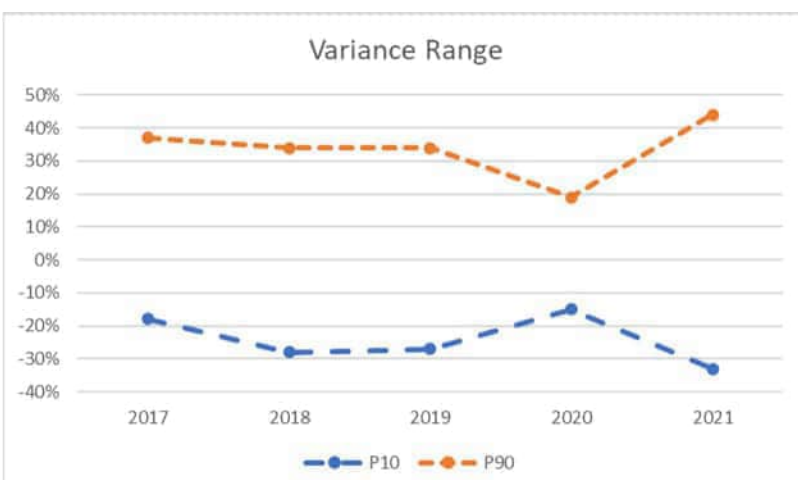

Figure A-3: Variance p10/p90 Range by Year

Rather than use the %PVA metric as a predictability performance metric, an alternative is to measure variance directly. For example, the "span" of the p10/p90 (P90-p10) could be used as a metric. This metric, in comparison to the current %PVA, is shown in Figure A-4.

Note that the actual range span increases from 2017 to 2019, but the %PVA decreases. The values of %<$200K in Table A-4 indicate that this reduction in %PVA was likely the result of having proportionally fewer small projects in the portfolio, not the result of practice or process causes.

Note that this direct span metric would always be based on the same p-values year-to-year (e.g., p10/p90) regardless of what p-values were used for the PVA reporting trigger threshold. The threshold can be varied for the purposes of getting a good sample of PVAs (you can vary the trigger for reporting year to year without affecting the reporting of the variation trend).

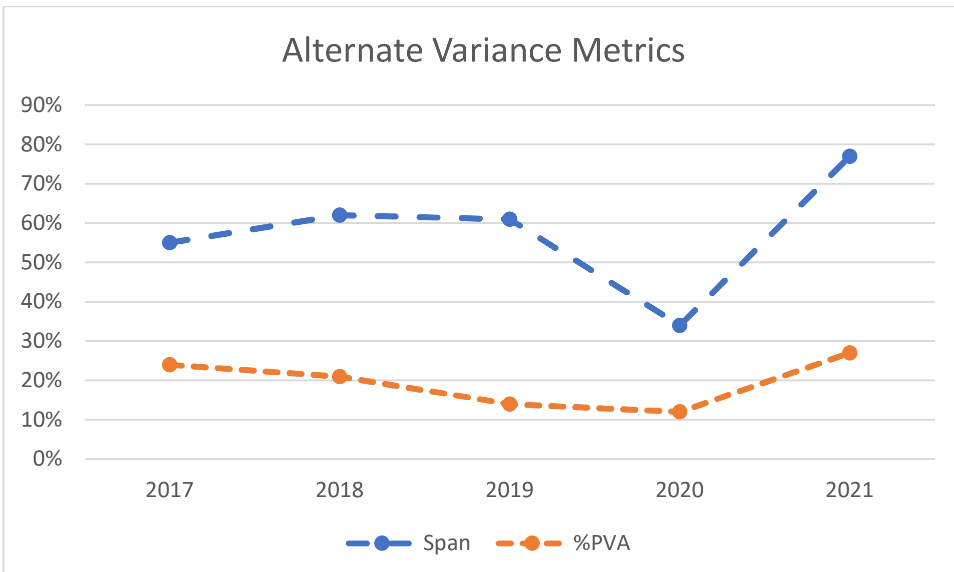

Figure A-4: Comparison of P10/P90 Span versus %PVA

Summary of Internal Audit Findings since 2020 with Status of Actions Taken by Management

Report Issue Date	Internal Audit Report Name	Title of Observation	Summary of Observation	Remediation Status	Agreed Completion Date	Agreed Management Action Plans	Remediation Actions Taken
19-Nov-20	Engineering, Capital Planning & Execution - Phase 1	Enhancing the Budget Review Process (Note 1)	An opportunity exists to enhance the existing review process for the key budgetary documents including the Capital Expenditure Budget, In-Service Additions Budget and Capital Model	**Completed**	31-Dec-20	Management will enhance the budget review processes by ensuring that the extract of the final Capital Model is signed off by the Supervisor, Capital Planning and final results of the In-Service Additions Budget and Capital Budget that form part of the Business Plan presentation are signed-off by the Chief Financial Officer and Controller prior to the board meetings. Final versions of these documents will be signed off with electronic signatures and retained on the shared drive to support the audit trail and control documentation. Internal Audit has reviewed the remediated actions and confirm that they were completed on time.	Management has enhanced the budget review processes by ensuring that the extract of the final Capital Model is signed off by the Supervisor, Capital Planning and final results of the In-Service Additions Budget and Capital Budget that form part of the Business Plan presentation are signed-off by the Chief Financial Officer and Controller prior to the board meetings.
07-Feb-23	Capital Planning & Execution	Approval for Changes to Capital Projects	Capital Project Change Requests, pertaining to project cost, scope and schedule, are not consistently submitted and approved prior to execution and / or on a timely basis	**Completed**	30-Jun-23	The Manager of Engineering (EPMO) will improve the communication of outstanding change requests with the Execution RC's by increasing the frequency of reminders and automating reminder e-mails to ensure Execution RC's are aware of outstanding change request submissions prior to the monthly reporting cycle of the Change Request Latency KPI. The Manager of Engineering (EPMO) will evaluate holding education sessions on a predefined frequency throughout the year and will share the recorded sessions with the Execution RC's to communicate change request process timelines. The Manager of Engineering (EPMO) will review outstanding change request submissions with Execution RC's during monthly divisional operational meetings (i.e. MPP, IOP meetings). The Manager of Engineering (EPMO) will evaluate including EPMO's departmental KPI for ensuring timely approval for project changes on the BRP scorecard, which is issued and reviewed during monthly divisional operational meetings. The Directors of Execution RC's will develop a process to communicate to their teams the requirement to submit and approve change requests on a timely basis. The existing Change Request Latency KPI feedback will be used in monthly departmental OSR meetings or at the individual performance level. Internal Audit has reviewed the remediated actions and confirm that they were completed on time.	1. The frequency of the email communications to the CR approvers has been increased in the system. If any CRs are pending approval, the CR approvers will get two emails every week as reminders. 2. Education sessions were organized by EPMO related to CR process and the importance of timely submission and approval of CRs with all Execution teams. 3. BRP scorecards now have two metrics related to CR latency. One is for CR not yet submitted and other one is for CRs that are not yet approved. These metrics are reported on each month and sent to all RC leaders for discussion in their respective OSRs. 4. RC leaders have confirmed that they have been using the BRP metrics for CRs in their OSRs on a regular basis.
07-Feb-23	Capital Planning & Execution	Reporting Root Causes for Change Requests	A formal process to document and report root causes for Capital Project Change Requests (CR) has not been established, however, is required to support the precision and accuracy of capital project scoping and costing within the Capital Plan	**Completed**	30-Nov-23	The Manager of Engineering (EPMO) will develop and implement a quarterly process to report the root cause of the differences between the high-level scope/work packages and detailed design estimates to the Investment Planners. The first report will be developed by March 31, 2023 and will be shared with the Execution RC's and Investment Planners. The report format will be finalized by June 30, 2023 and will be used to develop a formal feedback loop process between the Execution RC's and Investment Planners to monitor the quality/precision of scope/work packages issued for capital projects. A formal feedback loop process will be documented and reviewed by the EPMO and Investment Planning Manager and will be fully implemented by November 30, 2023. Internal Audit has reviewed the remediated actions and confirm that they were completed on time.	Following steps were taken by EPMO team: 1.Monthly reporting on the "Scope Quality/Accuracy" metric on the BRP scorecard to get planning to improve scope estimates. 2.Quarterly attainment reports are being issued – these are being used to identify root causes for CRs. 3.Quarterly attainment review meetings are held every quarter to review CR root causes and recommendations – terms of reference of meeting are formally documented which indicate participation of all Ops and Engineering leadership along with EVPs for respective BUs. 4.Formal feedback loop has therefore, been set to have root causes identified, discussed and implemented. Following additional steps have been taken by the System Planning team to improve the process of work packaging and reducing the likelihood of change orders: • Work Package Checklist (During Creation): For "Project Development" team to ensure key items are not missed while creation • Field Inspections: Ensure scoped work is field inspected before finalizing work package • Overhead & Inflation costs: Capture overhead and inflation costs to the estimate. • Work Package Review Checklist (During Engineer Review): To aid engineers with enhancing their reviews and capturing critical items. Formal documentation of the new improvements to the existing process documentation has also been completed.
07-Feb-23	Capital Planning & Execution	Capital Planning Process SOP Documentation	Some areas of the long-term and short-term capital planning process are not formally documented	**Completed**	30-Sep-23	As part of the activities underway to improve asset management processes within the ISO55001 project, the Manager of Engineering (IPPR) will engage with all stakeholder groups to document the SOP's as they relate to the long-term Investment Planning and Portfolio Reporting (IPPR) process. The Manager of Engineering (EPMO) will engage with all stakeholder groups to document the SOP's as they relate to the short-term capital planning process and development of Executable Work Program. Internal Audit has reviewed the remediated actions and confirm that they were completed on time.	Business has developed the process maps and associated task sheets for the IPPR and EWP process. These process maps and task sheets are approved by the directors (Integrated Planning & EPMO) and are published on plugged in.
(Note 1)	The title of the observation was originally mentioned as "Reporting Root Causes for Change Requests" in 1B-SEC-7. However, the actual title of the observation is "Enhancing the Budget Review Process". The Agreed Management Action Plans and Remediation Actions Taken are relevant to the correct observation title.						

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO

UNDERTAKING NO. JT4.13:

Reference(s): 4-AMPCO-87

To provide historical results in terms of percentage achievement of incentive pay targets and payments for each year 2020-2024, and assumptions for 2025-2029.

RESPONSE:

In reviewing transcript, Toronto Hydro notes that this undertaking does not capture the request made by AMPCO. The scope of the undertaking is to provide performance pay achievement assumptions for 2025-2029 and to provide historical data that Toronto Hydro relied upon for these assumptions.

Toronto Hydro applied a performance pay achievement assumption of 129.7% to derive the 2025-2029 forecasts. This assumption was based on the 2020-2022 historical data shown in Table 1 below. The 2023-2024 data was not available when determining the forecasts.

Table 1: Historical Incentive Pay Achievement Data

2020	2021	2022
132.8%	131.5%	125.0%

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO

UNDERTAKING NO. JT4.14:

Reference(s): 4-AMPCO-89

Regarding 4-AMPCO-89, to identify any other one-time costs in the two periods 2020-2024 and 2025-2029 that could be ring-fenced.

RESPONSE:

Table 1 below shows one-time OM&A costs and savings for 2020-2024. One-time savings are shown in negative/credits. Toronto Hydro does not have any one-time OM&A costs in the 2025-2029 period.

Table 1: 2020-2024 One-time OM&A Costs/(Savings) by Program ($ Millions)

Programs	Actual				Bridge	Total
	2020	**2021**	**2022**	**2023**	**2024**	
Disaster Preparedness Management Program (COVID)	3.9	3.6	3.8	-	-	**11.3**
Control Centre Operations – UWPC implementation	1.1	-	-	-	-	**1.1**
Customer Care – COVID Bad-debt Expense	17.2	-	-	-	-	**17.2**
Customer Care – CC&B labour capitalization	**-**	0.1	(2.0)	(1.1)	(1.2)	**(4.2)**
Total	**22.2**	**3.7**	**1.8**	**(1.1)**	**(1.2)**	**25.4**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO

UNDERTAKING NO. JT4.15:

Reference(s): 2B-Staff-261

To provide data in relation to Appendix 2-AA on an In-Service Additions basis.

RESPONSE:

Please refer to Appendix A to this response which provides OEB Appendix 2-AA on an in-service additions-basis and reflects the 2020-2023 actuals and 2024-2029 forecast in-service additions as set out in Exhibit 2A, Tab 1, Schedule 2, Appendix 2-BA (Updated April 2, 2024).

Toronto Hydro notes that for the forecast years, where forecasted expenditures are on a program basis, the utility used historical conversion rates of capital expenditures and CWIP to in-service additions. For large discrete projects, Toronto Hydro uses the latest projections of expected completion dates to forecast in-service amounts. Please refer to Toronto Hydro's response to 2B-SEC-60 for additional information on the approach used.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO

UNDERTAKING NO. JT4.16:

Reference(s): **1A-CCC-01, Appendix A**

To review Appendix A, Slide 13, to confirm objectives of this plan; if the goal is not 40 percent, to provide the number; to state whether the plan includes hybrid vehicles.

RESPONSE:

Toronto Hydro plans to electrify 50% of its Fleet by the end of the 2025-2029 rate period, as indicated in Exhibit 1B, Tab 3, Schedule 1, on page 37, lines 15-16 and interrogatory response 1B-Staff-97(a). The plan includes hybrid vehicles, please refer to Toronto Hydro's response to interrogatory 1B-Staff-97(b) for more information.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO CONSUMERS COUNCIL OF CANADA

UNDERTAKING NO. JT4.17:

Reference(s): 4-SEC-89

Referring to the chart in 4-SEC-89, to explain the lack of corresponding trade-offs between increases or decreases in capital costs and OM&A with respect to the Distribution System Plan.

RESPONSE:

Toronto Hydro does not expect significant trade-offs between increasing or decreasing capital costs and OM&A costs during the 2025-2029 period. The impacts of an expanding capital program on System O&M programs, such as Corrective Maintenance, are discussed in Exhibit 2B, Section E4.1.6.1, with further details provided in Toronto Hydro's responses to interrogatories 2B-Staff-180 and 2B-SEC-40. Additionally, while Corrective Maintenance can delay the need for asset replacement, the rate of investment is insufficient to significantly influence the timing of necessary renewal investments for managing system performance over the 2025-2029 period. Furthermore, Corrective Maintenance addresses priority deficiencies which may not be directly linked specifically to asset performance, such as nomenclature updates and trip hazards which are pertinent to employee and public safety. As stated throughout its application, Toronto Hydro is seeking to maintain reliability performance and hence, the system renewal capital programs and maintenance programs are setup to achieve this objective.

Certain O&M programs, such as Asset and Program Management or Work Execution Program, are positively correlated with an expanding capital program as additional resources are required within these areas to support the planning and delivery of a larger capital program. In addition, Toronto Hydro expects that the increasing complexity of the distribution grid, driven by electrification, will also place upward pressures on certain O&M programs. Exhibit 2B, Section E4.2.6 provides additional details of key drivers of increases in System O&M program expenditures.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO CONSUMERS COUNCIL OF CANADA

UNDERTAKING NO. JT4.18:

Reference(s): 1B-CCC-19

Referring to 1B-CCC-19, the discussion of distribution rate impacts: to calculate residential rate increases without the X-Factor in the overall Revenue Requirement.

RESPONSE:

The below table displays the distribution bill impacts for residential class without the 0.6% X-Factor in the overall revenue requirement.

		Change in Bill	2025 Proposed	2026 Proposed	2027 Proposed	2028 Proposed	2029 Proposed
Residential (without X-Factor)	Base Distribution (Excluding Rate Riders)	$/30 days	49.71	52.26	54.42	59.16	61.37
		%	9.7%	5.1%	4.1%	8.7%	3.7%
	Distribution Subtotal A (Including Rate Riders)	$/30 days	$46.12	$49.72	$53.66	$57.94	$61.21
		%	8.0%	7.8%	7.9%	8.0%	5.6%

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT4.19:

Reference(s): Exhibit 1B, Tab 3, Schedule 1, p. 24

To file 2023 performance statistics for the categories Escalations and Connections.

RESPONSE:

The Customer Escalations Resolution result for 2023 was 100%.

The New Services Connected on Time performance for 2023 was 99.78%.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT4.20:

Reference(s): Exhibit 1B, Tab 3, Schedule 1, Table 7 at p. 24

To explain the differences between customer additions over the period and the number of low-voltage customer connections of about 57,000 a year or more.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not accurately capture the data point underlying the request by OEB Staff. The reference in Table 7 on page 24 of Exhibit 1B, Tab 3, Schedule 1 refers to 5,700 low voltage connections per year.

For the purposes of the New Services Connected on Time performance incentive metric, Toronto Hydro has adopted the definition of "new service" in the Distribution System Code ("DSC"),[1] which refers to any connection that requires an Electrical Safety Authority certificate and therefore includes connections associated with service upgrades, temporary connections, or the conversion of unmetered connections into metered connections. The forecast of approximately 5,700 low voltage connections, approximately 120 high voltage connections, and approximately 180 distributed energy resource connections per year referred to in Exhibit 1B, Tab 3, Schedule 1, Table 7 at page 24 reflects that DSC definition.

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[1] Distribution System Code (last revised March 27, 2024), s. 7.1.

Toronto Hydro presumes that the reference for the customer additions figure for the 2025-2029 period is Exhibit 3, Tab 1, Schedule 1, Table 2 at page 3, which reflects net new customers connecting to the system for the first time and does not include service upgrades, new temporary services, or metering conversions.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT4.21:

Reference(s): Exhibit 1B, Tab 3, Schedule 1, Page 25, Lines 8-11

QUESTION (A):

a) To explain and give an example of a complex connection;

RESPONSE (A):

Toronto Hydro's reference to '*increasing complexity of connections-related work'* was used to described the increasing complexity of load connection work and not a distinct customer connection type. Exhibit 2B, E5.1.3.1 provides further details about the *'complexity of customer connections due to ongoing growth and development in the city*'. Typical challenges that describe a complex connection include but are not limited to:

- areas of overloaded or congested assets (feeders, cable chambers, vaults)
- areas of limited real estate with respect to road allowance (shared by the City of Toronto utilities, natural gas, communications, and transit above and below ground level)
- Insufficient safety clearances to existing assets
- Connections to legacy configurations/systems (e.g. 4.16 kV distribution)
- Work within the restricted transit corridor
- Complexity in scheduling and coordination among multiple projects and stakeholders
- Increasing requests for custom solutions

To resolve these challenges the utility may have to consider various options including but not limited to upstream expansions, load transfers, configurations that require connections from multiple stations, investments in complex control and protection schemes (fusing, switches, relays, etc.), relocation of existing assets, and development of new standards.

QUESTION (B):

b) To explain whether complex connections are distinct from DER connections;

RESPONSE (B):

As described in part (a), the complexity referred to in the evidence was in the context of load connection and therefore distinct from DER connections. However, Toronto Hydro notes that with increased penetration, DER connections may face increasingly complex connection configurations as well.

QUESTION (C) AND (D):

c) To provide the number of complex connections Toronto Hydro has experiences in the last five years, and Toronto Hydro's timelines in making those connections;
d) To provide a forecast of anticipated complex connections in the upcoming forecast period.

RESPONSE (C) AND (D):

As noted in the response to part (a), the statement regarding the 'increasing complexity' of connections does not refer to a specific type or size of connection. As a result, the utility is unable to provide the requested information. Toronto Hydro's performance relative to timeliness in making connections can be found in Exhibit 1B, Tab 3, Schedule 1, Section 2.21.

Additionally, as described in its response to 2B-AMPCO-49 and in Exhibit 2B, Section E5.1.4 at page 19, Toronto Hydro's load connections forecast is developed on the basis of historical capital expenditures. As such, the utility does not have a forecasted list of anticipated complex connections.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO DISTRIBUTED RESOURCE COALITION

UNDERTAKING NO. JT4.22:

Reference(s): 1B-DRC-1

To canvass the record and provide a summary of information on future customer preferences for EVs and DERs, and to point to where the information may exist on the record.

RESPONSE:

Toronto Hydro's evidence on customer outcomes and priorities with respect to the adoption and integration of technologies like DERs, EVS, solar power and battery storage, as well as net zero and the energy transition can be found in the response to 1B-DRC-1(c) and (e and f). Information about the ways in which Toronto Hydro more generally engages with its customers, including EV stakeholders and other DER customers, can be found in Exhibit 1B, Tab 5, Schedule 1, Section 3 (Page 11).

While Toronto Hydro does not have evidence on the record that speaks to *future* customer preferences on EVs and DERs, the utility's 2025-2029 Investment Plan is responsive to changing customer preferences with respect to EVS and DERs as noted in the following evidence:

- **Exhibit 2B, Section D4 (System Peak Demand Forecast):** Specifically:
    - **Section D.1.1.4 (Pg. 4):** discusses the forecasted impact of light-duty, medium-duty and heavy-duty EVs in Toronto Hydro's system peak demand forecast.

  - **Section D4.1.4 (Pg. 8):** discusses the Generation Capacity and Capability Assessment
  - **Section D4.2:** discusses Capacity Planning and the Energy Transition.
  - **Section D4, Appendix A and B:** provides the Future Energy Scenarios modelling which depicted a wide range of DER and EV uptake scenarios for the next decade and beyond.
- **Exhibit 2B, Section E3 (System Capability Assessment for Renewable Energy and Conventional Generation):** Specifically:
  - **Section E3.**1 (Pg. 1-2): discusses trends in customer applications to connect DERs.
  - **Section E3.2 (Pg. 3) and Exhibit 2B, Section E5.1** (**Pg. 15)**: provides the 2023-2029 DER connection and capacity forecast which considers historical trends and project pipelines and discusses customer trends and preferences regarding the type of DERs being installed (e.g. energy storage in Section E3.2.2 at page 5).
  - **Section E3.2.4 (Pg. 6-7):** provides the list of policies and economic factors that may affect customer choice.
- **Exhibit 2B, Section E5.5 (Generation Protection Monitoring and Control, Pg. 4):** discusses factors influencing customer uptake of DERs and the rate of uptake historically and projections used.
- **Exhibit 2B, Section E7.2 (Non-Wires Solutions):** Toronto Hydro's approach to Non-Wires Solutions, including leveraging customer-owned DERs
- **Exhibit 3, Tab 1, Schedule 1:** provides Toronto Hydro's revenue load forecast, including describing the methodology used to incorporate EVs and DERs.
- **Exhibit 4, Tab 2, Schedule 18 (Public, Legal and Regulatory Affairs):** ensures sufficient organizational capacity to provide expert legal, regulatory, communications, policy, government relations and public affairs services to

respond to public policy, technological advancement and customer driven evolutions.

- **Exhibit 4, Tab 2, Schedule 8 (Customer Operations, Pg. 22):** Toronto Hydro's key account's team provides direct and tailored service to critical load customers, many of whom have Environmental Social & Governance Goals (ESG) and are considering incorporating new technologies such as alternative energy sources, renewable energy, and electric vehicles.
- **Exhibit 4, Tab 2, Schedule 14 (Customer Care):** Toronto Hydro is investing in its technology, services and customer care teams to ensure capacity and knowledge to respond to and address evolving customer needs, including those related to increased adoption of EVS and DERs.
- **Exhibit 4, Tab 2, Schedule 7 (Control Centre):** Toronto Hydro is developing an Energy Centre (also known as DERMS) and gaining experience with managing DERS on the distribution system.
- **Exhibit 4, Tab 2, Schedule 9 (Asset and Program Management)** specifically**:**
    - **The Capacity Planning and Grid Innovation function** (Pg. 15) is responsible for planning future load requirements and requisite connection capacity to accommodate current and forecasted levels of DERs.
    - **The Grid Modernization function** (Pg. 16) is responsible for coordinating the development and implementation of long-term grid strategies, including providing leadership in the development of longer-term demand scenarios and capability roadmaps related to understanding and accommodating electrified loads and DERs.
    - **The Standards and Policy segment (Pg. 22)** is responsible for studying local impacts of evolving customer usage and technologies and modifying

construction standards and connections service policies to effectively accommodate changing demands.

- **The Flexibility Services program (Pg. 26, see also Exhibit 2B, Section E7.2)** identifies opportunities and use cases in addition to funding demand response programs that can leverage customer-owned resources as non-wires solutions.

Toronto Hydro also explored a number of specific issues around EV's and DERs through the following IRs:

- **2B-Staff-252**: EV Load by Station Forecasted for the Downsview Area for 2023 – 2029.
- **1B-PP-05 and 08:** Toronto Hydro actions to enable electrification
- **1B-DRC-02(e):** Toronto Hydro's approach to ensure sufficient capacity, should the high projection scenario in the FES report materialize.
- **2B-ED-11:** Enablement of EV chargers
- **2B-ED-25:** EV chargers in multi-unit residential buildings.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO DISTRIBUTED RESOURCE COALITION

UNDERTAKING NO. JT4.23:

Reference(s): **Ministry of Energy news release titled, "Ontario and Toronto Planning for the City's Growing Electricity Needs"** **https://news.ontario.ca/en/release/1004428/ontario-and-toronto-planning-for-the-citys-growing-electricity-needs**

THESL to review today's [April 11, 2024] announcement from the Minister of Energy regarding the Integrated Regional Resource Plan and a public engagement process and advise whether it appropriately falls within the context of this proceeding and whether it can comment.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not fully capture the request from the Distributed Resource Coalition ("DRC"). The scope of the undertaking is to confirm whether the release from the Ministry of Energy entitled "Ontario and Toronto Planning for the City's Growing Electricity Needs" appropriately falls within the context of this proceeding or not and comment, from that perspective, on whether it carries any significant impact for the proposals contained in the application with respect to: (1) demand forecasts, (2) public advocacy or approach to public consultations and (3) the need for infrastructure investment generally covered in the application.

On April 11, 2024, the Ministry of Energy issued a news release titled, "Ontario and Toronto Planning for the City's Growing Electricity Needs". The news release and the associated event, attended by the Minister of Energy, the Mayor of Toronto, and the President & CEO of the IESO, among others, announced the kick-off to this cycle of updating the Integrated Regional Resource Plan ("IRRP") for Toronto. Toronto Hydro is involved in the IRRP as set out in Exhibit 2B Section B3.2.3 and Section E2.4.1. The event does not have any incremental impact on this application.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION

UNDERTAKING NO. JT4.24:

Reference(s): 2B-BOMA-1

To clarify the general locations, the general distribution of the data centres throughout the territory.

RESPONSE:

Data centers are generally located within Toronto Hydro's Horseshoe distribution region (i.e. outside of the downtown core).

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION

UNDERTAKING NO. JT4.25:

Reference(s): 3-BOMA-3

To provide the monthly peak information by rate class from the forecasting perspective used to derive the Coincident Peak and Non-coincident Peak figures for 2025.

RESPONSE:

Please refer to Appendix A for the monthly peak information by rate class for 2025.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION

UNDERTAKING NO. JT4.26:

Reference(s): **3-BOMA-03**

To provide a comparison of capabilities of the AMI 1.0 and 2.0, with respect to the requested data.

RESPONSE:

For general information on predicted AMI 2.0 capabilities and use cases, please refer to Exhibit 2B, Section D5, subsection D5.3.1; Exhibit 2B, Section E5.4, pages 10-13; and interrogatory response 2B-Staff-194. Toronto Hydro expects that AMI 2.0 will provide greater granularity of customer consumption data, allowing the utility to gain insights into customer load profiles and key consumption drivers such as electric vehicles, heating and cooling equipment, etc. These insights would help provide more information at a local and distribution system level to feed into Toronto Hydro's load forecasting. Enhanced data granularity would also allow more accurate measurement of coincident peaks.

In order to effectively manage AMI data, Toronto Hydro will need to undertake significant investments to achieve effective analytics. As part of the AMI 2.0 strategy, the utility intends to implement an analytics platform to leverage the AMI data for various use cases, including load forecasting.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION

UNDERTAKING NO. JT4.27:

Reference(s): 3-BOMA-4

To provide a breakdown of the table at 3-BOMA-4 into the three GS classes.

RESPONSE:

Please see Appendix A for a breakdown of the table at 3-BOMA-4 into the three GS classes.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION

UNDERTAKING NO. JT4.28:

Reference(s): 3-BOMA-04

To determine whether the load profile information of the multi-residential class includes a breakdown based on number of customers, or based on kilowatt-hours, and if so, to provide the information.

RESPONSE:

As set out in 2B-ED-25, there are an estimated 7,161 MURBs in Toronto Hydro's service territory. Approximately 365 of these are classified as Competitive Sector Multi-Unit Residential Service (CSMUR) and are customers directly suite metered by Toronto Hydro. Please refer to JT4.25 for CSMUR 2025 load profile information.

The remaining MURBs are within a mix of Residential and General Service accounts. The MURBs customers within the General Service classes may be metered by sub-metering companies. As such, Toronto Hydro does not have information on the number of units or the load profiles associated with those accounts.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT4.29:

Reference(s): JT3.35

To inquire of Scott Madden to provide the formulas as applicable, and as necessary define the parameters for the attrition relief mechanisms.

RESPONSE (PREPARED BY SCOTTMADDEN):

ScottMadden's jurisdictional review relied on the formulas and defined parameters described in the materials cited in the table below.

Utility (Jurisdiction)	ARM Formulaic Approach
ATCO Electric (Alberta)	Details of the ARM formula are provided in: Alberta Utilities Commission*, Decision 27388-D01-2023*, 2024-2028 Performance-Based Regulation Plan for Alberta Electric and Gas Distribution Utilities, October 4, 2023, p. 1 Key variables include: Inflation factor, productivity factor, capital funding provisions Link to Decision: https://efiling-webapi.auc.ab.ca/Document/Get/794425
Hawaiian Electric (HI)	Details of the ARM formula are provided in: Docket No. 2018-0088, Decision and Order No. 37507 Instituting a Proceeding to Investigate a Performance-Based Regulation, Hawaii Public Utilities Commission, December 23, 2020, p. 14 Key variables include: Inflation factor, productivity factor, customer dividend, exogenous cost factor Link to Decision: https://puc.hawaii.gov/wp-content/uploads/2020/12/2018-0088.PBR_.Phase-2-DO.Final_.mk_.12-22-2020.E-FILED.pdf
Eversource (MA)	Details of the ARM formula are provided in:

Utility (Jurisdiction)	ARM Formulaic Approach
	D.P.U. 22-22, Petition for Approval of a General Increase in Base Distribution Rates for Electric Service and a Performance Based Ratemaking Plan, November 30, 2022, p. 15 Key variables include: Inflation factor, productivity factor, customer dividend, exogenous cost factor, capital funding provisions Link to Decision: https://www.eversource.com/content/docs/default-source/investors/nstar-electric-dpu-22-22-final-order-11-30-22.pdf?sfvrsn=c5739f9e_1
UK RIIO	Details of the ARM formula are provided in: Ofgem, RIIO-ED2 Final Determinations Overview Document, November 30, 2022, p.35 Key variables include: Uncertainty mechanisms Link to Decision: https://www.ofgem.gov.uk/sites/default/files/2022-11/RIIO-ED2%20Final%20Determinations%20Overview%20document.pdf

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT4.30:

Reference(s): JT4.1

To explain the interaction of the Revenue Cap and the Economic Evaluation Model.

RESPONSE:

The total revenue cap, and specifically the Demand-Related Variance Account (DRVA) that forms part of the proposed revenue cap framework, ensures that variances in cost and revenues, which are primarily driven by changes in customer demand, are reconciled so that neither customers nor the utility gain an unfair advantage/disadvantage from these variances during a time of greater uncertainty with respect to customer demand. There is no direct interaction between the Economic Evaluation Model (EEM) and the Custom Revenue Cap Index. Capital contributions are established through the EEM on the basis of customer-specific costs relating to new connections and service upgrades, and customer-specific revenues. The inputs to the calculation of capital contributions are not impacted by the proposed revenue cap approach. On the other hand, distribution revenue and net capital variances resulting from changes in the volume, type and mix of customer connections, including changes in capital contribution rates, will be captured in the DRVA.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT4.31:

Reference(s): 1B-Staff-12

For the projects identified in Part D, to update the figure and the table in Part A for the IRM scenario to illustrate the funding that would be available under the Capital Module.

RESPONSE:

The table below shows the funding associated with IRM plus Advanced Capital Module (ACM) associated with the projects identified in 1B-Staff-12(d).

$ in million	2025	2026	2027	2028	2029	Total
2025	978	991	1,005	1,019	1,034	5,028
2026		9	9	9	9	38
2027			11	11	11	33
2028				9	9	17
2029					6	6
Total	978	1,001	1,026	1,048	1,069	5,122

The table in 1B-Staff-12(a) is updated below including an additional line for IRM + ACM.

Revenue Requirement ($ million, two decimal places)	2025	2026	2027	2028	2029	Total
2025-2029 Investment Plan	978	1,031	1,077	1,176	1,221	5,483
IRM	978	991	1,005	1,019	1,034	5,028
IRM + ACM	978	1,001	1,026	1,048	1,069	5,122
Current Custom IR Formula (CPCI)	978	1,015	1,047	1,127	1,154	5,321
Proposed CRCI	978	1,024	1,061	1,152	1,186	5,401

As the revenue impact of growth in billing determinants is given back to customers through the current Custom Price Cap Index ("CPCI") rate formula and the proposed Custom Revenue Cap Index ("CRCI") rate formula, Toronto Hydro did not include the impact of growth in the other scenarios. If growth assumptions consistent with the billing determinants presented in the 2025-2029 load forecast detailed in Exhibit 3, Tab 1, Schedule 1 were included in the IRM and IRM plus ACM scenarios, the total 2025-2029 revenue in these scenarios would be approximately a $4 million lower. /C

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT4.32:

Reference(s): EB-2018-0165, Exhibit 1B, Tab 4, Schedule 1, Table 2

To consider and advise how the three factors, the Capital Factor, and the Scaling Factor, as shown in EB-2018-0165, Exhibit 1B, Tab 4, Schedule 1, might apply to this application; to provide an updated copy of the table referred to, if revision is necessary; if not to explain whether there is a difference.

RESPONSE:

Consistent with EB-2018-0165, Exhibit 1B, Tab 4, Schedule 1, Table 1 below provides the calculation of the capital factor, and Table 2 below provides the calculation of the scaling factor under the Custom Price Cap Index (CPCI) CIR1.0 framework which was presented in the response to 1B-Staff-12(b).

Table 1: CPCI Capital Factor Calculation

Revenue Requirement Component ($ in million)	2025	2026	2027	2028	2029
Rate Base	5,899.1	6,279.3	6,703.2	7,162.0	7,590.1
Interest Expense	142.9	152.1	162.4	173.5	183.9
Return on Equity	220.9	235.1	251.0	268.1	284.2
Depreciation	290.4	303.9	322.7	344.0	356.9
PILs/Taxes	28.9	31.1	20.7	56.5	48.3
Capital-related RR (A)	**683.0**	**722.2**	**756.8**	**842.1**	**873.2**
OM&A	343.0	358.0	370.1	385.5	399.6
Revenue Offsets	- 48.2	- 49.2	- 50.2	- 51.2	- 52.2
Total RR (B)	**977.8**	**1,031.0**	**1,076.7**	**1,176.4**	**1,220.6**
$C_n = (A_{yx} - A_{y(x-1)}) / B_{y(x-1)}$		**4.01%**	**3.35%**	**7.92%**	**2.65%**

Table 2: CPCI Scaling Factor Calculation

Revenue Requirement Component ($ in million)	2026	2027	2028	2029
Interest	152.1	162.4	173.5	183.9
ROE	235.1	251.0	268.1	284.2
Depreciation	303.9	322.7	344.0	356.9
PILs/Taxes	31.1	20.7	56.5	48.3
Capital-related RR (A)	**722.2**	**756.8**	**842.1**	**873.2**
OM&A	358.0	370.1	385.5	399.6
Revenue Offsets	- 49.2	- 50.2	- 51.2	- 52.2
Total RR (B)	**1,031.0**	**1,076.7**	**1,176.4**	**1,220.6**
S_{cap} = A / B	**70.05%**	**70.29%**	**71.58%**	**71.54%**

In the Custom Revenue Cap Index (CRCI), growth is an element of the escalation index. The CRCI escalates revenues which are subsequently used to establish rates on the basis of a customer and load forecast that includes growth. Toronto Hydro is unable to provide the calculation for the growth-factor for the CPCI, since the utility did not compute a similar top-level growth factor for the 2025-2029 period. For the purpose of the table provided in the response to 1B-Staff-12(b), the CPCI scenario assumes a growth factor that is identical to EB-2018-0165, (i.e. a 0.2% growth factor which is treated as a passthrough as shown in the response to Undertaking TCJ4.33).

Furthermore, as part of this undertaking Toronto Hydro was asked to confirm whether there was a typo in the tables provided in response to 1B-Staff-12(b) with respect to the rows titled **I x Scap**. Toronto Hydro confirms that this is not a typo. The reason why the values for I x Scap are different in 2028 and 2029 compared to 2026 and 2027 is because the scaling factor (i.e. the proportion of capital-related revenue requirement to total revenue requirement) is larger in the outer years as shown in Table 2 above.

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UNDERTAKING NO. JT4.33:

Reference(s): 1B-Staff-12

To provide the calculation of one year of escalation, with unrounded numbers.

RESPONSE:

See the Table 1 below for the calculation of 2026 under the 2020 CIR framework.

Table 1: 2026 Revenue Requirement under 2020 CIR Framework

		Revenue Requirement ($ Millions)	
2025		972.4	A
CPCI	3.76%	36.6	B=A*3.76%
Growth	0.20%	1.9	C=A*0.20%
2026		1,010.9	D=A:C

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT4.34:

Reference(s): N/A

To provide evidence references for a discussion of the influence and operations of the DRVA and its two sub accounts, and the Innovation Fund Variance Accounts.

RESPONSE:

With respect to the DRVA, pages 37 to 46 of Exhibit 1B, Tab 2, Schedule 1 provide significant detail regarding the uncertainties affecting programs included in the DRVA Expenditure Sub-Account. The manner in which such uncertainties materially influence Toronto Hydro's operations is best addressed in the following excerpt on page 41 of the same reference:

> "When faced with incremental distribution investment needs as a result of external drivers, Toronto Hydro must typically defer necessary expenditures in other investment priority areas, such as System Renewal, System Service and General Plant. Yet, to the extent Toronto Hydro does not carry out the planned investments in these areas, there could be significant reliability, safety or environmental risks that remain unmitigated, or customer needs and outcomes that are unmet. The proposed Expenditures Variance Subaccount, if approved, would enable Toronto Hydro to respond to unforeseeable increases in demand-related investment needs without having to defer other priority work within the plan and put customer outcomes at risk."

With respect to the Innovation Fund Variance Account, as noted on page 17 of Exhibit 1B, Tab 4, Schedule 2, the amounts recorded in the proposed variance account would depend on the actual expenditures incurred to execute the select pilot projects in accordance with the governance framework. The Innovation Fund expenditures materially impact operations by enabling Toronto Hydro to pilot new technologies and advanced distribution capabilities before scaling them into cost-effective programs or solutions for addressing distribution system needs or providing distribution services.

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UNDERTAKING NO. JT4.35:

Reference(s): **1B-Staff-41**
1B-SEC-16

To provide a demonstration of the calculations that created the table at 1B-SEC-16.

RESPONSE:

Toronto Hydro utilized the weather normalization methodology outlined in Exhibit 3, Tab 1, Schedule 1, page 9 to adjust the actual load data spanning from 2016 to 2023. This process involved applying regression coefficients obtained from the OEB-approved rate application load forecast equivalent for the years approved. These coefficients serve as quantitative indicators of how weather conditions influence actual load by accounting for all relevant weather determinants and related revenues, and effectively isolating the impact of weather. Appendix A (excel file *JT4.35 App A Example Weather-Normalized Calculation*) shows a demonstration of the weather-normalization calculations outlined in Table 2 of 1B-SEC-16 for 2022 GS<50 kW rate class.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT4.36:

Reference(s): **4-Staff-306**

To provide actuals by program for the data in the response to 4-Staff-306.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request made by OEB staff. The scope of the undertaking is to provide OEB Appendix for 2JA and 2JC for 2018 and 2019, including for the program described in 4-Staff-306.

Please see Toronto Hydro's response to undertaking no. JT4.37.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT4.37:

Reference(s): 4-Staff-306

To provide further information on departmental budgets, beyond JT4.36, if possible.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request made by the OEB staff. The scope of the undertaking is to provide OEB Appendix 2JA and 2JC for 2018 and 2019 actuals which is filed as an appendix to this undertaking.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT4.38:

Reference(s): Exhibit 6, Tab 1, Schedule 2

In the file THESL_2A_T01_S02, OEB Appendix 2-BA, Tab 2-BA, 2025, to show the calculations of monthly averages for one year.

RESPONSE:

Please see Table 1 within Appendix A to this response, which provides the calculation of monthly averages of Gross Fixed Assets and Accumulated Depreciation included in the 2025 Revenue Requirement Workform filed on April 2, 2024, in Tab "3. Data_Input_Sheet".

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT4.39:

Reference(s): Exhibit 6, Tab 1, Schedule 2

For each of the OEB capital categories, System Access, System Renewal, System Service, and General Plant, to provide a high-level average of depreciation; to include the types of equipment that typically go into the four categories.

RESPONSE:

Please see Table 1 below for the investment category level depreciation associated with the 2025-2029 forecasted in-service additions and Table 2 for the major assets included in the forecasted in-service additions for each category.

Toronto Hydro notes that the allocation of in-service additions to asset classes for distribution capital programs are based on averages derived from historical in-service additions. Additionally, derecognition expenses are not included in below amounts.

Table 1: 2025-2029 Depreciation from 2025-2029 In-Service Additions by OEB Investment Category ($ Millions)

Category	2025	2026	2027	2028	2029
System Access	2.0	7.4	13.3	19.1	24.4
System Renewal	3.0	10.8	19.1	28.1	37.6
System Service	0.4	1.6	2.6	3.4	4.4
General Plant	5.2	17.6	33.2	51.7	68.1
Other	0.0	0.0	0.0	0.1	0.1
Total	**10.6**	**37.5**	**68.2**	**102.4**	**134.5**

1 **Table 2: 2025-2029 In-Service Additions Breakdown % by Major Asset Category**

Category	Acct	OEB Account Description	2025	2026	2027	2028	2029
System Access	1840	Underground Conduit	28%	27%	27%	29%	31%
	1845	Underground Conductors and Devices	33%	32%	31%	33%	36%
	1860	Meters	15%	16%	17%	12%	8%
		Other Assets	25%	25%	25%	25%	25%
		Total System Access	**100%**	**100%**	**100%**	**100%**	**100%**
System Renewal	1830	Poles, Towers and Fixtures	10%	9%	8%	7%	7%
	1835	Overhead Conductors and Devices	10%	10%	8%	8%	7%
	1840	Underground Conduit	22%	22%	23%	25%	25%
	1845	Underground Conductors and Devices	24%	24%	25%	25%	25%
	1850	Line Transformers	22%	21%	19%	20%	19%
		Other Assets	12%	13%	17%	15%	17%
		Total System Renewal	**100%**	**100%**	**100%**	**100%**	**100%**
System Service	1609	Capital Contributions Paid	30%	49%	10%	4%	36%
	1805	Land	0%	0%	16%	0%	0%
	1808	Buildings and Fixtures	0%	0%	0%	0%	12%
	1840	Underground Conduit	13%	12%	18%	24%	13%
	1845	Underground Conductors and Devices	32%	29%	44%	60%	32%
	1955	Communication Equipment	19%	5%	2%	2%	1%
		Other Assets	6%	5%	9%	10%	6%
		Total System Service	**100%**	**100%**	**100%**	**100%**	**100%**
General Plant	1611	Computer Software	42%	34%	47%	31%	24%
	1908	Buildings and Fixtures	13%	21%	17%	26%	30%
	1920	Computer Equipment - Hardware	24%	22%	22%	24%	26%
	1930	Transportation Equipment	11%	10%	5%	8%	6%
		Other Assets	9%	14%	9%	11%	13%
		Total General Plant	**100%**	**100%**	**100%**	**100%**	**100%**
Other	1940	Tools, Shop and Garage Equipment	100%	100%	100%	100%	100%

Note: Rounding variances may exist.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT4.40:

Reference(s): **4-SEC-92**

To clarify the services provided by a third-party provider integrated with the Toronto Hydro workforce, and working together; to describe the breakdown, a best-efforts basis.

RESPONSE:

The FTE employees listed in the response to interrogatory 4-SEC-92 at Table 1 represent internal Toronto Hydro employees associated with the Supply Chain Services program (Exhibit 4, Tab 2, Schedule 13). The Supply Chain Services program consists of two interrelated functions: (i) Demand and Acquisition Services; and (ii) Warehouse and Logistics. Each of these functions relies on a mix of internal and external resources to carry out the critical functions of the Supply Chain program described in Exhibit 4, Tab 2, Schedule 13.

Demand and Acquisition Services is enhancing its procurement procedures to incorporate sustainable practices, encompassing Diversity, Equity, and Inclusion (“DEI”) as well as Environmental, Social, and Governance (“ESG”) considerations. A strategic focus has been placed on realigning the allocation of resources between internal capabilities and 3PP partnerships to better align with this objective. This recalibration aims to enhance the long-term resilience of the supply chain, while concurrently ensuring the resource execution agility needed to navigate evolving needs and requirements with respect to procurement functions. Table 1 below summarizes the relative work and responsibilities undertaken by internal versus external service providers in this program.

Table 1: Summary of External and Internal Resource Work and Responsibilities

Function	External Service Provider	Internal Resources
Demand and Acquisition Services	Responsible for repeatable processes and day-to-day operational work responsibilities, which includes managing inventory codes, issuing purchase orders, and conducting solicitations.	Responsible for strategic endeavours to secure a reliable supply of materials and equipment and to mitigate supply chain challenges. This includes implementing system enhancements and upgrades to enable better decision making, optimizing inventory schedules with suppliers, improving and embedding material demand planning across the organization, conducting frequent short interval control meetings to share information with operational leaders, and creating critical asset forecasts.
Warehouse and Logistics	Responsible for the majority of material receipting and warehousing (storage). This includes fulfillment of planned (and some reactive) requirements and distributing material to either external contractors, or to Toronto Hydro warehouses for distribution to internal crews. Also responsible for the replenishment of inventory for the industrial vending machines on-site at each Toronto Hydro work centre, and performing inventory management tasks such as cycle counting. Facilitation of material returns from contractors back into inventory.	Facilitate prompt material issuance to the crews departing from the three Toronto Hydro work centres for timely response to emergency response needs and for capital projects constructed by Toronto Hydro crews. With increased volume in capital projects, resources are needed to support increased material movements, including receiving and distribution of materials, arranging for equipment repairs or replacement to be returned to vendors, handling excess material returns, and performing daily inventory cycle count activities.

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UNDERTAKING NO. JT5.1:

Reference(s): 2B-EP-27

To provide the audits or data quality check that are completed to ensure that the correct interruption cause code is used; to describe the quality control done, or quality check, including the number of data entries checked, on a yearly basis, and the percent that fail.

RESPONSE:

Interruption cause codes are selected based on the information available to the control centre operators from field crews and/or other sources, such as the Network Management System ("NMS") and the Supervisory Control and Data Acquisition ("SCADA") system. All interruptions undergo a validation review by the control centre support team prior to the data being finalized. As noted in Table 2 of interrogatory response 2B-SEC-35(a), in 2023 Toronto Hydro recorded 2,577 sustained interruptions. This review includes verification of the interruption cause code against other operational records, such as switch sheets. Long-duration interruptions, interruptions involving key accounts, and/or interruptions impacting a high number of customers are further reviewed by the Planning, Power Quality, and Reliability team.

During any stage of the review process or afterwards, if new information is uncovered that provides better insights into the interruption cause, a revision is made to the outage report. Toronto Hydro does not track the number of interruption records that require a correction.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.2:

Reference(s): 1B-Staff-09

To state Toronto Hydro's position on receipt of a performance incentive under the PIM TRIF target, when there is a fatality of an employee or subcontractor.

RESPONSE:

Toronto Hydro's view is that it would not be eligible to receive funding through the performance incentive mechanism for the TRIF target component in the event of an employee fatality for which Toronto Hydro was found culpable under the relevant occupational health and safety legislation.

Toronto Hydro notes that contractor incidents are not included in the calculation of the TRIF metric. Contractors undergo a rigorous safety pre-qualification process to ensure they meet Toronto Hydro's health, safety and legislative requirements. The comprehensive pre-qualification process is administered by a third party. This prequalification process includes a review of things such as the contractor's performance statistics, content of their safety programs and procedures based on the work performed, and a review of WSIB and insurance status.

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UNDERTAKING NO. JT5.3:

Reference(s): 1B-Staff-9

For 1B-Staff-09, Figures 1 and 2, to include the calculations for the standard deviations of each cause code for Figures 1 and 2; to explain to the extent possible, and if not to explain why.

RESPONSE:

Toronto Hydro notes that the standard deviation is calculated for the aggregate system level reliability performance and not by cause code. The underlying calculations are provided as Appendix A to this response.

The standard deviation calculations that underpin the target setting for Figures 1 and 2 were performed using the 'LINEST' function[1] in Excel. This function was applied to historical reliability performance results from 2018 to 2022, separately for SAIDI (excluding Loss of Supply, Major Event Days, and Scheduled Outages) and SAIFI (Defective Equipment). The 'se_y' statistic parameter (standard error for the y estimate) from the function was utilized to determine the standard deviation of the linear regression for the SAIDI and SAIFI measures. This resulted in standard deviations of 0.958 and 0.016, respectively. As described in the evidence (Exhibit 1B, Tab 3, Schedule 1, at pages 10 and 16), the targets were set based on a two standard deviation basis.

[1] For more information, refer to Microsoft's documentation on the LINEST function.

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UNDERTAKING NO. JT5.4:

Reference(s): **1B-Staff-9, Appendix A**

To clarify the calculation of the five-year values between 2027 and 2021, in Cell G4.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that the undertaking does not properly capture the request made by OEB Staff. The scope of the undertaking is to clarify whether the reliability forecasts reflect a rolling five-year average of the individual years or a rolling five-year average of the five-year averages.

Toronto Hydro confirms that the breakdown by Major Cause Code reflects a five-year rolling average of annual results (i.e. individual years). Using *Adverse Environment* as an example, the projection for the year 2028 would be based on an average of annual results spanning from 2024 to 2028, inclusive. This principle applies consistently across all years and Major Cause Codes provided in the aforementioned table in 1B-Staff-9, Appendix A.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.5:

Reference(s): 1B-Staff-18

To clarify the use of the full division composite in 1B-Staff-18E.

RESPONSE:

Toronto Hydro did not rely on the composite index for tracking or forecasting its costs in any specific capital or maintenance programs. As noted in response to 1B-Staff-18(d), the purpose of the inflation figures provided was to convey the challenges faced by Toronto Hydro in the current 2020-2024 rate term, including 40-year high inflation across all facets of its capital and maintenance work plans, and to describe the steps taken to complete its work programs and manage its business in these extraordinary circumstances. For this high-level purpose, Toronto Hydro determined that a broad composite view of inflation was sufficient to highlight the inflationary challenges faced in the current rate term.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.6:

Reference(s): **Exhibit 9, Tab 2, Schedule 1**

Regarding the DVA Continuity Schedule updated April 2, Row 55, to provide the nature of the costs recorded or to be recorded in the accounts, with a breakdown of the costs by cloud solution; for each solution, to provide details of type of costs, such as configuration, testing, data conversion; nature of the costs, capital or OM&A, using the IFRS standard; and the dates the costs were incurred, or when they are expected to be incurred.

RESPONSE:

Table 1 provides the breakdown of the costs recorded in the Cloud Computing Implementation Costs Deferral Account for 2023-2024 by project.[1] /C

[1] Exhibit 9, Tab 2, Schedule 1, DVA Continuity Schedule (updated April 2, 2024). 2023 costs only cover the month of December in accordance with Ontario Energy Board, Accounting Order (003-2023) for the Establishment of a Deferral Account to Record Incremental Cloud Computing Arrangement Implementation Costs, November 2, 2023.

1 **Table 2: 2023-2024 Cloud Computing Deferral Account Expenditures by Project ($ Millions)**

Project Names	Project Overview	Detailed Sub-Project	2023 Actual*	2024 Bridge	Total Cost
Customer Cloud Portal Enhancements	This project focuses on enhancing the cloud portal to improve customer experience and service levels. It includes implementing new and improving existing self-service capabilities and enabling customers to receive accurate and timely information.	Customer Service Request Management Solution Outage Map Replacement	0.24	1.05	**1.29**
Mobile Workforce Managements Enhancements	This project focuses on enhancing the digital experience for Toronto Hydro's field crews to improve the productivity, mobility and safety of the field crews and field activities. This includes enhancing various cloud solutions and advanced AI technologies.	Smart Routing in Oracle Field Services Cloud (OFSC) Enhancements to Electronic Tailboard Onboarding 2.0 Upgrade Virtual Reality Training SAP Work Manager Migration to Cloud	0.07	1.00	**1.07**
Employee Digital Transformation	This project focuses on transforming Toronto Hydro's employees' experience through cloud-based solutions to enhance efficiency and automation, including digitizing manual processes and implementing new capabilities to improve the collaboration of employees.	HR Document Management Solution Service Management Modernization Solution MS Exchange Migration to Cloud	0.01	1.45	**1.46**
External Reporting Solution	This project focuses on implementing a solution to manage the external financial statement reporting process. The solution will automate business workflows and enhance document version control.	External Reporting Solution	0.17	-	**0.17**
Total			**0.49**	**3.50**	**3.99**

**Timing of 2023 Costs is from December 1, 2023 to December 31, 2023*

/C

Table 2 provides the requested breakdown of the costs recorded in the Cloud Computing Implementation Costs deferral account for 2023-2024 by major categories.[1]

Table 2: 2023-2024 Cloud Computing Deferral Account Expenditures ($ Millions)

Cloud Computing Major Categories	Nature of Cost	2023 Actuals*	2024 Bridge	2023-2024 Total
Configuration	OM&A	0.37	2.31	**2.67**
Testing		0.12	0.96	**1.08**
Training		-	0.03	**0.03**
Data Conversion/Migration		-	0.15	**0.15**
Business Process Reengineering		-	0.05	**0.05**
Total		**0.49**	**3.50**	**3.99**

**Note: 2023 Actuals are from December 1-31, 2023 only.*

Toronto Hydro confirms that the 2023 and 2024 balances recorded in the deferral account reflect incremental costs that are directly related to the implementation of the cloud solution. More specifically: /C

- *Configuration:* Toronto Hydro must tailor the cloud solution to address the necessary business requirements and processes.
- *Testing*: Toronto Hydro must execute a list of test cases and perform quality control activities to ensure that the configured cloud solution meets the necessary business requirements.
- *Data Conversion/Migration*: Due to the limited customizations available relative to the on-premise solution, data conversion is needed for cloud solutions to meet the specific data mapping and transformation requirements of the cloud provider.
- *Business Process Reengineering*: Toronto Hydro's processes must adapt to align with the pre-defined workflows and processes of the cloud solution.
- *Training*: Changes in processes and data mapping noted above result in the need to train Toronto Hydro staff to utilize the cloud solution.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.7:

Reference(s): Exhibit 9, Tab 2, Schedule 1

To clarify if any of the costs in the cloud computing account are associated with the new Enterprise Data Centre.

RESPONSE:

No, the 2023-2024[1] costs that Toronto Hydro recorded in the Cloud Implementation deferral account are not associated with the Enterprise Data Centre project.

[1] The OEB set the effective date for the Cloud Implementation deferral account as of December 1, 2023, and therefore, the costs recorded for 2023 only cover actual costs incurred between December 1, 2023 and December 31, 2023. The 2024 forecast is for the full calendar year.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.8:

Reference(s): Exhibit 9, Tab 2, Schedule 1 (DVA Continuity Schedule)

To identify savings that might be part of OM&A related to the $4.1 million cloud computing costs.

RESPONSE:

Toronto Hydro confirms that there are no incremental savings associated with avoided capital expenditures as a result of implementing cloud solutions that are eligible for recovery under the Cloud Implementation deferral account. Rather, as shown in Table 1 below, the capital-related revenue requirement avoided is negative because of the 100% Capital Cost Allowance deduction for tax purposes for IT Software investments in the first year they are placed in-service resulting in negative PILs.

Table 1: Revenue Requirement due to Avoided Capital Expenditures ($M)

	2020	2021	2022	2023	2024	2020-2024
Return on Equity	-	-	-	0.00	0.06	**0.06**
Deemed Interest	-	-	-	0.00	0.04	**0.04**
Depreciation	-	-	-	0.00	0.44	**0.45**
PILS	-	-	-	(0.10)	(1.08)	**(1.18)**
Capital-Related RR (payable)	**-**	**-**	**-**	**(0.10)**	**(0.53)**	**(0.63)**

/C

Including the variances noted above in the Cloud Implementation deferral account would increase the receivable balance. For clarity, this analysis is presented to demonstrate the impact of the avoided capital expenditures due to the cloud; Toronto Hydro is not proposing to amend the deferral account balance to collect these incremental amounts.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.9:

Reference(s): 4-Staff-296

Referring to 4-Staff-296, (A) to describe how Toronto Hydro distinguished between the locates programs, and specifically the effect of Bill 93; (B) to the extent possible, to identify the costs for labour, internal versus external, equipment related to the compliance with Bill 93, training and certification materials, administrative and overhead costs, and any penalties or fees incurred for the 2023 costs and the 2024 forecast costs; (C) to discuss the criteria used to ensure costs were prudently incurred.

RESPONSE:

Toronto Hydro used the historical trending of costs in the Public Safety and Damage Prevention segment from the years prior to the enactment of Bill 93 as a proxy for the growth of organic cost drivers such as the volume and complexity of local construction activity. In applying the OEB's accounting order for the *Getting Ontario Connected Act* variance account ("GOCA VA"),[1] the utility extrapolated historical costs and subtracted them from the actual locates costs for April 1-December 31, 2023 and the full calendar year of 2024 to identify incremental costs arising from Bill 93, which Toronto Hydro recorded in the variance account. This calculation is shown in interrogatory response 4-Staff-296(e). In Toronto Hydro's assessment, this top-down approach provides the most reliable approximation of incremental cost drivers arising from Bill 93. It is not possible to calculate such cost drivers using bottom-up inputs, as it is extremely difficult to assess to what extent

[1] EB-2023-0143, Accounting Order 002-2023 (October 31, 2023).

any individual standard locate was influenced by Bill 93. For additional detail with regards to how Toronto Hydro distinguishes the effect of Bill 93 on locates costs, please also refer to Toronto Hydro's testimony from Day 5 of the Technical Conference.[2]

Toronto Hydro also takes this opportunity to clarify that the OM&A forecast for the Public Safety and Damage Prevention segment for 2025-2029 in Table 6 of Exhibit 4, Tab 2, Schedule 8 reflects a conservative estimate of locates costs, *inclusive* of the anticipated effects of Bill 93 in the 2025-2029 rate period. However, as the utility stated in its evidence,[3] due to the significant uncertainty that still affects locates volumes, service levels and program administration costs in the context of ongoing legislative and regulatory developments, Toronto Hydro is requesting the continuation of the *Getting Ontario Connected Act* ("GOCA") variance account ("VA") to ensure adequate funding of non-discretionary locates work. In the event that the OEB does not approve the 2025-2029 forecast or the continuation of the GOCA variance account, Toronto Hydro would adopt the forecast shown in Table 7 of Exhibit 4, Tab 2, Schedule 8, which reflects the utility's current best estimate of potential costs for 100% compliance with the new regulatory framework.

Table 1 below provides the breakdown of costs recorded in the GOCA variance account by internal labour and external contractor costs for April 1 to December 31, 2023 and all of 2024. Toronto Hydro has not recorded any equipment, internal training and certification materials, overhead costs, and any penalties or fees in the GOCA variance account. Internal labour costs in Table 1 are driven by incremental locate program administration costs required to meet the requirements in Bill 93.

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[2] Technical Conference Day 5 Transcript (April 12, 2024), at p. 12, lines 2-19.
[3] Exhibit 4, Tab 2, Schedule 7, from p. 29, line 14 to p. 30, line 5. See also interrogatory response 9-SEC-128(c).

Table 1: Internal and External costs breakdown of GOCA VA ($ Millions)

	2023 Actual[4]	2024 Bridge
Internal Labour Costs	0.1	0.2
External Contractor Costs	0.8	1.3
Total	**0.9**	**1.5**

With regards to prudence, the overall cost control and productivity measures that Toronto Hydro has in place to ensure appropriate locates expenditures are covered in section 4.2 of the Customer Operations program in Exhibit 4, Tab 2, Schedule 8, on pages 12 and 15. In addition, Toronto Hydro has processes in place for the oversight of expenditures and to ensure cost-effective delivery of functions within the Public Safety and Damage Prevention segment. The services of locate service providers ("LSPs") are shared across gas, water, and telecommunications utilities and infrastructure owners in Toronto Hydro's service territory, and Toronto Hydro conducts audits on LSPs on effective service delivery, including quality and safety performance, in coordination with other utilities and infrastructure owners. In addition, Toronto Hydro performs verification steps on completed services to ensure financial accuracy. Locates delivery is managed through short-interval (e.g. weekly, monthly) meetings with LSPs focused on compliance with applicable legislative and regulatory requirements, effective operational performance, and process management.

More specifically to ensure fiscal prudence with respect to the incremental costs associated with Bill 93, to date Toronto Hydro has sought to minimize incremental costs by deferring some drivers that are within Toronto Hydro's control, such as increasing the quantity of resources for managing peak volume capacity and investments in IT systems, to avoid potentially unnecessary costs in the context of ongoing legislative and regulatory developments.

[4] 2023 costs only cover actual costs incurred between April 1, 2023 and December 31, 2023 in accordance with the OEB Decision and Order (EB-2023-0143, October 31, 2023).

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.10:

Reference(s): **Exhibit 9, Tab 2, Schedule 1 (Updated April 2, 2024)**

With reference to the Continuity Schedule, Row 60, updated April 2, to explain the increase to the Externally Driven Capital Variance Accounts, and what changed since the original filings.

RESPONSE:

Table 1 below summarizes the Externally Driven Capital Variance Account 2023 and 2024 revenue requirement variances between the evidence presented on November 17, 2023 in Exhibit 9, Tab 1, Schedule 1, Table 7 and the updated evidence filed on April 2, 2024. /C

Table 1: Externally Driven Capital Variance Account 2023 and 2024 Revenue Requirement Variance ($ Millions)

Difference	2020	2021	2022	2023	2024	Total
Rate Base	-	-	-	(1.7)	(5.3)	**N/A**
Return on equity	-	-	-	0.1	(0.2)	**(0.1)**
Interest	-	-	-	0.0	(0.1)	**(0.1)**
Depreciation	-	-	-	3.3	1.9	**5.3**
PILs	-	-	-	1.0	0.7	**1.7**
Revenue Requirement	**-**	**-**	**-**	**4.4**	**2.3**	**6.7**
Carrying Charges	-	-	-	0.0	0.3	**0.3**
Total	**-**	**-**	**-**	**4.4**	**2.6**	**7.0**

The increase in the total balance is associated with higher amounts of derecognition than forecast in 2023, which affects all components of the revenue requirement. Derecognition expenses are overwhelmingly reactive, even in the near term, because there are practical challenges in forecasting a precise and comprehensive view of all assets that will have to be removed from the system, especially in the context of an externally-driven relocation project. The initial forecast for the Externally Driven Capital Variance Account ("EDCVA") which was filed on November 17, 2023 was based on high-level assumptions derived from historical capital expenditures and derecognition expenses, whereas the updated balances filed on April 2, 2024 reflect actual derecognition impacts for 2023 based on major projects completed in 2023 and updated forecasts based on the carry-over impact of the 2023 actuals. The projects include the Eglinton Crosstown LRT and Finch West LRT, which involved the relocation of large volumes of assets to complete construction activities for both light rail transit projects. Please see Toronto Hydro's response to undertaking JT2.4 for additional information on derecognition triggered by Externally Initiated Plant Relocation projects. /C

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.11:

Reference(s): **6-Staff-320**
6-Staff-321

QUESTION (A):

a) To update Table 6.2 in 6-Staff-320 with the most recent version of the PILs model and the most recent version of Capital Additions in Appendix 2-BA;

RESPONSE (A):

Table 1 below provides the updated 2025-2029 capital additions forecast as of April 2, 2024. The 2023 and 2024 capital additions were unchanged as part of the evidence update relative to the amounts provided in 6-Staff-320. The reconciliation of 2023 and 2024 capital additions in the PILs model Schedule 8 and Appendix 2-BA were provided in Toronto Hydro's response to interrogatory 6-Staff-320. Table 2 below shows the reconciliation for 2023-2029 capital additions submitted on April 2, 2024.

Table 1: Updated Comparison of Capital Additions for 2023-2029

Capital additions	PILs model Sch 8	Appendix 2-BA	Difference
Historical Year 2023	578,747,322	594,237,479	(15,490,157)
Bridge Year 2024	604,748,823	626,323,423	(21,574,600)
Test Year 2025	640,282,996	657,249,067	(16,966,071)
Test Year 2026	685,927,116	701,933,545	(16,006,429)
Test Year 2027	772,314,135	816,131,844	(43,817,709)
Test Year 2028	754,457,205	777,203,292	(22,746,087)
Test Year 2029	838,987,204	899,001,415	(60,014,211)

1 **Table 2 - Reconciliation of Capital Additions in the PILs model Schedule 8 and Appendix 2-BA for 2023-2029**

2

Capital Additions	[A] PILS model Sch 8	[B] Capital additions for Non-Rate Regulated Utility Assets	[C] Capital additions for Socialized Renewable Energy Generation Investments	[D] Interest capitalized for accounting (AFUDC), not for tax	[E] Other post employment benefits (OPEB) amounts capitalized for accounting, not for tax	[F] Capitalized depreciation for accounting, not for tax	[G] Land additions not required to include in PILs model Sch 8	[H] Accrued decommissioning provisions capitalized for accounting, not for tax	[A] + [B] + [C] + [D] + [E] + [F] + [G] + [H] Appendix 2-BA
Historical Year 2023	578,747,322	-	-	8,303,302	5,928,377	1,293,555	-	(35,077)	594,237,479
Bridge Year 2024	604,748,823	5,990,032	552,685	7,366,822	6,444,840	1,220,221	-	-	626,323,423
Test Year 2025	640,282,996	3,403,977	-	5,634,924	6,478,384	1,448,786	-	-	657,249,067
Test Year 2026	685,927,116	1,991,135	-	5,647,260	6,613,087	1,754,947	-	-	701,933,545
Test Year 2027	772,314,135	7,124,571	13,857,710	7,522,153	6,752,991	2,021,000	6,539,284	-	816,131,844
Test Year 2028	754,457,205	7,143,521	-	6,441,962	6,880,722	2,279,882	-	-	777,203,292
Test Year 2029	838,987,204	31,551,256	7,337,579	11,518,153	7,008,131	2,599,092	-	-	899,001,415

QUESTION (B):

b) to update the depreciation table in 6-Staff-321 in the same way.

RESPONSE (B):

Table 3 below provides the updated 2025-2029 depreciation forecast as of April 2, 2024. The 2023 actuals and 2024 forecasted depreciation were unchanged in the evidence update relative to the amounts provided in 6-Staff-321. The reconciliation of 2023 and 2024 depreciation in the PILs model Schedule 1 and Appendix 2-BA was provided in Toronto Hydro's response to interrogatory 6-Staff-321, page 2, Table 1 and Table 2. Table 4 below shows the reconciliation for 2025-2029 depreciation submitted on April 2, 2024.

Table 3: Updated Comparison of Depreciation table for 2023-2029

Depreciation Expense	PILS module Sch 1	Appendix 2-BA	Difference
Historical Year 2023	259,865,782	247,107,134	12,758,648
Bridge Year 2024	276,564,046	259,753,795	16,810,251
Test Year 2025	290,386,052	272,947,807	17,438,245
Test Year 2026	303,927,677	287,008,872	16,918,804
Test Year 2027	322,740,962	306,002,467	16,738,495
Test Year 2028	343,965,642	328,707,225	15,258,418
Test Year 2029	356,947,682	343,623,671	13,324,011

Table 4: PILs module Sch 1 and Appendix 2-BA depreciation forecast

Depreciation Expense	PILS module Sch 1	Exclude Deferred Revenue	Exclude Derecognition	Appendix 2-BA
	[A]	[B]	[C]	[D] = [A]-[B]-[C]
Historical Year 2023	259,865,782	-15,745,226	28,503,875	247,107,134
Bridge Year 2024	276,564,046	-17,911,385	34,721,635	259,753,795
Test Year 2025	290,386,052	-20,050,183	37,488,428	272,947,807
Test Year 2026	303,927,677	-21,774,956	38,693,760	287,008,872
Test Year 2027	322,740,962	-24,104,436	40,842,930	306,002,467

Depreciation Expense	PILS module Sch 1	Exclude Deferred Revenue	Exclude Derecognition	Appendix 2-BA
	[A]	[B]	[C]	[D] = [A]-[B]-[C]
Test Year 2028	343,965,642	-26,617,890	41,876,308	328,707,225
Test Year 2029	356,947,682	-29,317,863	42,641,874	343,623,671

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UNDERTAKING NO. JT5.12:

Reference(s): **Exhibit 6, Tab 2, Schedule 2**

To explain the figure for Capital Contributions for 2026 to 2029 in the April 2nd update to the PILs model.

RESPONSE:

The tax adjustments for Capital Contributions for 2026 to 2029 in the April 2nd update to the PILs model were kept constant with the tax adjustments for the 2025 Test Year. The tax addback of the “Capital Contributions Received (ITA 12(1)(x))” and the tax deduction of the “ITA 13(7.4) Election - Capital Contributions Received” in the PILs model, net to $nil under income tax rules. Note that the approach is consistent with the approach taken by Toronto Hydro in its last rate application.

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UNDERTAKING NO. JT5.13:

Reference(s): **DVA Continuity Schedule**

To file an updated version of the complete DVA Continuity Schedule.

RESPONSE:

Please refer to Appendix A to this response for the updated DVA Continuity Schedule, which includes the Group 1 rate riders. Toronto Hydro's derivation of Group 2 rate riders are provided as Appendix B. Below Toronto Hydro provides certain explanatory notes to assist with the review of the appendices.

<u>Appendix A, Tab 2b – Innovation Fund</u>

The 2b Continuity Schedule tab of Appendix A does not show any balances for the proposed Innovation Fund Variance Account ("IFVA") during the 2020-2024 rate period because the IFVA is a new Group 2 variance account that Toronto Hydro is proposing for the 2025-2029 rate period.[1] The utility has no balances to record in the IFVA for the current rate period.

/C

<u>Appendix A, Tab 2b – Lost Revenue Adjustment Mechanism ("LRAM") Variance Accounts</u>

The 2b Continuity Schedule tab of Appendix A only shows balances related to 2015-2019 LRAM Variance Account ("LRAMVA") in the years 2017-2021. The reason for this is that Toronto Hydro's lost revenues in respect of conservation and demand management ("CDM") initiatives have crystallized as of 2022, following the wind-down of the

[1] Exhibit 1B, Tab 4, Schedule 2; Exhibit 9, Tab 1, Schedule 1, lines 16-26 at p. 41.

Conservation First Framework ("CFF")[2] and the OEB's approval of Toronto Hydro's proposal to defer the clearance of the balance from the 2023 incentive rate proceeding to its rebasing application.[3] In addition, the calculation of the 2020-2024 LRAMVA balances will be subject to the resolution of the methodology question relating to the determination of the LRAMVA threshold that the utility has raised in its evidence.[4]

<u>Appendix A, Tab 4 – Billing Determinants</u>

- Toronto Hydro has updated Section C under this tab with metered kWh values for wholesale market participants ("WMP"), which had been inadvertently omitted from an earlier version of Appendix A.
- Toronto Hydro notes that it relied on 2025 data from OEB Appendix 2-IB ("Customer, Connections, Load Forecast and Revenues Data and Analysis") updated on April 2, 2024, to populate customer numbers under the Billing Determinants tab of Appendix A. Table 1 below reconciles customer figures between the two sources.

/C

Table 1: 2025 Customer Numbers Reconciliation

Rate Class	OEB Appendix 2-IB (Update April 2, 2024)		DVA Continuity Schedule (Appendix A to JT5.13)	
	Customer Numbers	Devices/ Connections	Customer Numbers*	Devices/ Connections
Residential	618,693		618,693	
CSMUR	97,539		97,539	
GS < 50 kW	72,948		72,948	
GS 50-999 kW	9,941		9,941	
GS 1000-4999 kW	473		473	
Large User	44		44	
Street Lighting	n/a	172,781	1	n/a
Unmetered Scattered Load	n/a	12,873	791	n/a

*The proportion of customers for the Residential, CSMUR and GS<50 Classes are relied on to allocate Account 1551.

[2] Exhibit 9, Tab 1, Schedule 1 at page 19.
[3] EB-2022-065, OEB Decision and Order (December 8, 2022) at p. 16-17.
[4] Exhibit 9, Tab 2, Schedule 3.

Appendix A, Tabs 6 and 6.1

- Toronto Hydro notes that under tab 6 “Class A Consumption Data," on row 14 the year for account 1589 GA was last disposed remains as 2021. On row 17 of the same tab, the year account 1580 CBR Class B was last disposed has been updated to 2022, which previously incorrectly stated 2021.
- Upon further review of the 2024 DVA (Continuity Schedule) Workform utilized for 2025 Group 1 rate calculations, enabling macros in the files results in the deletion of 2022 Class A input data under the following tabs: “6. Class A Consumption Data” and “6.1a GA Allocation”, which resulted in the 2022 balances deferred from the 2024 incentive proceeding to not appear properly. Toronto Hydro is refiling the continuity schedule without the macros as Appendix A to this undertaking response to address the issue.

Appendix B – Reconciliation with Appendix A and Rate Smoothing

The calculation of rate riders in Appendix B to this response differs from the total DVA balances in Appendix A due to rate smoothing. As Toronto Hydro arranged the timing of dispositions to smooth out the customer rate impacts over the 2025-2029 rate period, this created incremental carrying charges for those balances which are not being disposed in 2025. For example, the utility proposes to dispose PILs and Tax Variance in 2025, hence no incremental carrying charges were calculated. However, Wireline Pole Attachments Revenue is proposed to be disposed in 2027, and therefore incremental carrying charges were calculated for years 2025 and 2026. In all cases Toronto Hydro calculated the incremental carrying charges using the OEB-prescribed DVA interest rate of 5.49% on the closing principal balance of each account as of December 31, 2023. The new Appendix C to this undertaking response provides a reconciliation of the DVA Continuity Schedule in Appendix A to the balances in the Rate Riders table in Appendix B.

/C

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UNDERTAKING NO. JT5.14:

Reference(s): **GA Analysis Workform**

To file an updated version of the GA Analysis Workform.

RESPONSE:

Toronto Hydro has further updated the Global Adjustment ("GA") Analysis Workform based on 2023 actuals and is filing it as Appendix A to this undertaking response. Below Toronto Hydro provides certain explanatory notes to assist with the review of the appendices.

The updates to the GA Analysis workform are as follows:

1. Under tab GA 2023, for Note 5 ("Reconciling Items") item 7 in row 86, the response to Principal Adjustment on DVA Continuity Schedule in cell I86 changed from 'No' to 'Yes' and the explanation in cell D86 was updated accordingly.

2. Under tab Principal Adjustments, included $2,237,906 as the third reversal in cell J82 and adjusted cell J81 the second reversal item on unbilled to actual revenue differences to $405,528 from $2,643,434, effectively splitting out the latter figure into two current year principal adjustments.

Toronto Hydro has updated the GA Workform to clarify the adjusted net change in principal balance in the GL line in cell C90 under the GA 2023 tab.

On a quarterly basis, Toronto Hydro trues up/down its general ledger ("GL") to ensure Class A GA costs to match its Class A GA revenues. However, when Toronto Hydro accrued GA /C revenue of approximately $2.2 million in its GL in respect of a billing adjustment relating to a large customer in December 2023, the true up/down did not occur until 2024 due to timing. As a result, this amount was recognized under tab GA 2023 in cell C75 as a credit to the net change in principal balance in the GL line, resulting in the balance being approximately $6.7 million. As the total expected GA variance in cell K60 of the same tab does not capture the impact of this accrual, it is classified as a reconciling item under Note, 5 which resulted in Toronto Hydro having a reconciling item of approximately $2.2 million presented within the GA 2023 tab.

The impact of this accrual was also captured in the current year principal adjustment amount, since Toronto Hydro trues up accounting accruals to actualized billing and calculates the principal adjustment as the difference between the accounting accrual and the actualized billing. Toronto Hydro's changes to cells J81 and J82 of the Principal Adjustments tab is to clarify the impact of this amount i.e. a principal adjustment of the same amount in the Principal Adjustments tab of the GA Analysis Workform.

This reconciliation difference will reverse for 2024. Toronto Hydro confirms that this was a one-time occurrence that has not impacted previous years.

/C

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UNDERTAKING NO. JT5.15:

Reference(s): 1B-Staff-49, Appendix A

To file the updated model for accelerated CCA at Exhibit 6, Tab 2, Schedule 1.

RESPONSE:

Please see Appendix A to this response which represents the corrected $3.7 million savings indicated at the Technical Conference.[1] Toronto Hydro notes that this represents an updated version of the model that was filed as part of the response to interrogatory 1B-Staff-49 to account for the double declining aspect of Capital Cost Allowance ("CCA") calculations.

[1] Technical Conference Vol 5 (April 12, 2024) at page 32, lines 13-24.

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UNDERTAKING NO. JT5.16:

Reference(s): **1B-Staff-49**

To provide the sensitivity analysis on the NPV calculations, and run the CCA numbers after 2028.

RESPONSE:

Please see Appendix A to this response. The revised model continues to present an in-service date of 2025 for accounting and tax purposes to ensure comparability with the version of the model filed in response to undertaking JT5.15. However, as requested by OEB Staff, the calculation of the CCA has been adjusted to reflect the impacts of the phasing out of accelerated CCA, reflecting the maximum allowable CCA deduction, based on current tax rules and legislation, if the in-service date was in 2028 or beyond.

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UNDERTAKING NO. JT5.17:

Reference(s): **Exhibit 1B, Tab 4, Schedule 2**

To review and assess and report back on prioritization or the ability to prioritize and rank the four pilot project concept areas using the key considerations outlined in Exhibit 1B, Section 4.1.

RESPONSE:

Toronto Hydro included the project concept areas identified in Appendix A of Exhibit 1B, Tab 4, Schedule 2 because it believes that pilot projects in these areas could provide value from an innovation perspective. To be helpful in response to this undertaking, Toronto Hydro performed a high-level preliminary analysis to illustrate the relative ranking and prioritization of the four pilot project concepts based on a cursory review of the criteria outlined in the referenced evidence. This information is illustrative and should not be relied upon as determinative. A finalized ranking and prioritization will only be possible once Toronto Hydro scopes out the potential project details under each of these concept areas.

	EV Demand Response	**EV Commercial Fleets**	**Flexible Connections**	**Advanced Microgrids**
Business Value	Medium. Overnight charging under ULO rate already provides incentives for managed charging.	High. The grid impact of electrified fleet EVs can be significant.	High. Alternative to rejecting a large DER connections where the system is constrained.	To be evaluated on the facts

	EV Demand Response	EV Commercial Fleets	Flexible Connections	Advanced Microgrids
Feasibility	High. Toronto Hydro has experience with EVDR through the Elocity pilot project.	Medium. Toronto Hydro has experience with EVDR but not in a commercial fleet context.	To be evaluated on the facts	To be evaluated on the facts.
Scalability	High. Residential customers will tend to have more similar consumption patterns.	Medium. Commercial fleets tend to have more unique and distinct requirements.	Medium. Notice of proposal to amend DSC may require distributors to develop and offer this option.	Low. Based on current understanding of potential use cases.
External Funding	High. NRCan funding opportunity has been identified.	To be evaluated on the facts	To be evaluated on the facts	To be evaluated on the facts

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UNDERTAKING NO. JT5.18:

Reference(s): **LRAMVA Workform**

[placeholder]

RESPONSE:

Toronto Hydro notes that this undertaking was made as placeholder in response to a “subject to check” response to a request made by OEB Staff. The full scope of the undertaking is to confirm, if not provide, the final IESO EM&V reports that support the updates for the 2020-2022 lost revenues.

Toronto Hydro confirms that the requested information can be found in the following documents filed as part of the April 2, 2024 update:

- Appendix R [excel] – THESL_9_T02_S03_App R - Non-Retrofit Projects (Jun2023-Dec2023)_20240402
- Appendix S [excel] - THESL_9_T02_S03_App S - Retrofit Projects (Jun2023-Dec2023)_20240402

These appendices were included in addition to Appendices B to H previously submitted.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.19:

Reference(s): 3-VECC-25

To provide net forecasted customer additions (or total customer count) in the CSMUR, GS 1,000 to 4,999 kW and Large-Use rate classes, broken down between those known through first-hand information and those which are estimated; for the estimates, to provide formulas used to calculate the estimates.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request made by OEB Staff. The scope of the undertaking is to provide the high-level backup calculations for the customer numbers for the CSMUR, GS 1,000 to 4,999 kW and Large-Use rate classes and the derivation for the forecasted period.

An incremental CSMUR unit forecast was developed based on Toronto's suite metering market share historical data and the number of suites divided for commissioned retrofitting and new construction. Please refer to Appendix A for the incremental additions used in the CSMUR forecast.

Please refer to JT1.1.17, part a) for net forecasted customer additions in the GS 1,000 to 4,999 kW and Large-Use rate classes.

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UNDERTAKING NO. JT5.20:

Reference(s): **1B-Staff-54(d)**

To explain the change to the Non-Wires Solutions program in the context of the NPV calculation and whether it changes the PIM measure or the metric itself.

RESPONSE:

The change to the number of stations targeted by the LDR program did not impact the overall 30 MW target. As such, there are no downstream impacts to the Benefit-Cost Analysis (BCA), the NPV analysis or the PIM resulting from this change.

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UNDERTAKING NO. JT5.21:

Reference(s): 1B-Staff-34(c)

In reference to 1B-Staff-34, Part C, the table compares PIM targets. Provide or request Scott Madden to expand table to include TH's proposed PIM scorecard. Classify the proposed PIMs based on the categories in the table. Consider if its appropriate to put TH PIM against those in the IR in question, and provide or set out rationale for why not.

RESPONSE (PREPARED BY SCOTTMADDEN):

As an initial matter, Toronto Hydro’s performance incentive mechanism is unique and does not necessarily fit within the context of the categories “Penalty” and “Reward”. Penalty-only mechanisms generally impose financial consequences on utilities for failing to meet certain performance standards, targets, or regulations. Reward-only mechanisms generally provide financial incentives for meeting or exceeding certain targets or outcomes. Toronto Hydro’s mechanism provides an upfront discount to the approved ROE that can be earned back by achieving certain performance targets.

However, in the context of Penalty and Reward, Toronto Hydro’s mechanism more closely aligns with Penalty since the approved ROE can only be achieved – all other things the same – if the performance targets are met. In addition, there no opportunity to exceed the approved ROE. Toronto Hydro’s performance incentive mechanism is listed in Table 1 below.

Table 1: Jurisdictional Review of PIMs by Incentive Type

Jurisdiction	Utility	Penalty Only Performance Incentive	Reward Only Performance Incentive	Penalty and Reward Incentives	Total Metrics
Alberta	ATCO Electric	-	-	-	0
California	SDG&E	-	1	-	1
California	PG&E	-	1	-	1
Hawaii	Hawaiian Electric	-	3	2	5
Illinois	Ameren	-	-	1	1
Maine	Central Maine Power	6	-	-	6
Massachusetts	Eversource	7	1	-	8
Minnesota	Northern States Power Co.	-	-	-	0
New Jersey	PSE&G	-	-	-	0
New York	Con Edison	-	7	-	7
New York	National Grid	-	9	-	9
North Carolina	Duke Energy	1	2	-	3
Nova Scotia	Nova Scotia Power	-	-	-	0
Ohio	AEP	-	-	-	0
Pennsylvania	PECO	-	-	-	0
Rhode Island	Rhode Island Energy	4	1	-	5
UK RIIO	General Review	-	-	10	10
Vermont	Green Mountain Power	-	-	-	0
Ontario	Toronto Hydro	12	-	-	12

Table 2 below shows how Toronto Hydro’s Custom Scorecard outcome categories align with the incentive outcome categories of other utilities within the jurisdictional review.

Table 2: Jurisdictional Review of PIMs by Incentive Category

Jurisdiction	Utility	System Reliability & Resilience	Customer Service & Experience	Environment, Safety, & Governance	Efficiency & Financial Performance
Alberta	ATCO Electric				
California	SDG&E	✓			
California	PG&E	✓			
Hawaii	Hawaiian Electric	✓	✓	✓	✓
Illinois	Ameren				✓
Maine	Central Maine Power	✓			
Massachusetts	Eversource	✓			✓
Minnesota	Northern States Power Co.				
New Jersey	PSE&G				
New York	Con Edison	✓		✓	✓
New York	National Grid	✓		✓	✓
North Carolina	Duke Energy	✓	✓	✓	✓
Nova Scotia	Nova Scotia Power				
Ohio	AEP				
Pennsylvania	PECO				
Rhode Island	Rhode Island Energy	✓			✓
UK RIIO	UK RIIO	✓	✓	✓	✓
Vermont	Green Mountain Power				

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.22:

Reference(s): **1B-Staff-34(d)**

To ask ScottMadden to comment on trends of the PIMs within the scope of the scan it performed

RESPONSE (PREPARED BY SCOTTMADDEN):

Among the jurisdictions examined, ScottMadden did not find a trend regarding the compensation structure of performance incentive mechanisms and whether recent measures are more penalty or more reward focused.

ScottMadden did find that performance incentive measures are receiving increased attention for their ability to align expanded policy objectives with shareholder and customer interests. Traditionally, performance incentives have been established for utilities to achieve reliability metrics and program-based performance (e.g., achieved kWh savings, kW reduction). However, more recent performance incentives are providing additional earning opportunities for achieving expanded policy objectives, such as distributed energy resource expansion and utilization, renewables integration, beneficial electrification, and dynamic rate enrollment.

Jurisdictions have stated performance incentives are necessary to achieve desired policy outcomes include the Hawaii Commission, which stated “incentive mechanisms can achieve … objectives, such as incenting cost reduction, incenting achievement of policy goals, improving performance, integrating technological advances, supporting new types of customer choice, and encouraging a low-cost, customer-centric future."

In addition, the New York Commission noted that "outcome-based incentives are the most effective approach to address the mismatch between traditional revenue methods and modern electric system needs, while aligning utility shareholder interests with consumer interests."

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.23:

Reference(s): **Exhibit 1B, Tab 2, Schedule 1, Appendix A, Pg 7**

To ask ScottMadden to comment on the similarities and differences between Ofgem's uncertainty mechanisms and Toronto Hydro's proposed variance account; (b) to explain the degree to which other volume drivers were considered, and why the DRVA was chosen over that mechanism

RESPONSE (PREPARED BY SCOTTMADDEN):

Please see the table below for a comparison of the Ofgem uncertainty mechanisms to Toronto Hydro's proposed DRVA.

	Ofgem Uncertainty Mechanisms	Toronto Hydro DRVA	Comparison
Objectives	▪ Adjust distributor revenue allowances to changes in operating conditions outside of distributor company control	▪ Protects both ratepayers and the utility from structural unknowns in forecasted costs and revenues	▪ Generally consistent
Mechanism Type	▪ Volume-driven: adjusts allowances due to uncertainty about future demand levels (e.g., low carbon technology uptake) ▪ Pass-through: expenditure is outside company control (e.g., pension funding) ▪ Indexed: evolution of prices is unknown (e.g., inflation) ▪ Use-it-or-lose-it: adjusts allowances where a specific activity has to be done but costs are uncertain (e.g., improving reliability for worst-served customers)	▪ Demand-Related Expenditure Variance Subaccount – Due to policy, customer adoption, or technology market uncertainty ▪ Demand-Related Revenue Variance Subaccount – Result from weather-normalized variances in billing determinants (i.e. customer count, kWh and kVA).	▪ DRVA is generally consistent with volume-driven uncertainty mechanism

	Ofgem Uncertainty Mechanisms	Toronto Hydro DRVA	Comparison
	▪ Administrative Re-opener: need, timing, or scope of project is unclear (e.g., net-zero implementation)		
Adjustment Type	▪ Symmetrical	▪ Symmetrical	▪ Generally consistent
Cost Types	▪ For reopeners, both capital and O&M readjusted based on cost assessment ▪ For volume-driven mechanisms, unit rate of incremental capital funding determined at start of price control period – Incremental operational funding provided at a value of 10.8% of each unit of incremental capital provided	▪ Both capital and O&M for demand-related investments	▪ Generally consistent; incremental O&M funding in UK RIIO differs by uncertainty mechanism type
Adjustment Timing	▪ Automatic (pass-through, indexation, use-it-or-lose-it, volume-driven) ▪ During price control period after administrative review (reopeners)	▪ Next rebasing	▪ Ofgem mechanism provides for recovery/ refund within the plan while DRVA defers recovery/ refund until the end of the plan
Materiality Threshold	▪ No materiality threshold for automatic adjustments ▪ Materiality threshold of 0.5% of annual average base revenue for most reopener mechanisms	▪ $1 million materiality threshold	▪ Ofgem provides no materiality threshold for automatic adjustments and a percentage-based threshold for administrative adjustments, whereas the OEB has a $1 million materiality threshold

RESPONSE (PREPARED BY TORONTO HYDRO):

As noted in Exhibit 1B, Tab 2, Schedule 1 at page 35, due to a confluence of external factors (i.e., policy, technology and consumer behaviour changes) Toronto Hydro is entering a period of unprecedented change and transformation, as customers, communities and governments at all levels are actively embarking on an energy transition to mitigate the existential and economic impacts of climate change. Decarbonization is expected to create new roles for electricity, including as an energy source for transportation and building heating systems. While there is certainty that fundamental change is ahead, there are degrees of uncertainty about how that change will unfold (e.g., the pace and adoption of electrified technologies such as EVs and heat pumps; the role of low-emission gas; and the scale of local vs. bulk electricity supply).

In light of the uncertainty and potential for variability noted above, Toronto Hydro requires greater flexibility to manage demand-driven aspects of its plan in order to protect both the rate payers and the utility from structural unknowns in forecasted costs and revenues. The proposed DRVA provides Toronto Hydro the necessary flexibility using a regulatory mechanism (a variance account) that the utility and the OEB have ample experience with over the last two custom IRs.

At this early stage of the energy transition, a volumetric mechanism would be difficult to design and implement since the relationship between volumes and costs/revenues remains subject to structural uncertainties associated with the factors noted above, and higher degree of variability as Toronto Hydro (i) gains experience integrating new technologies into the grid, (ii) adapts to changing policies and customer behaviours, and (iii) develops advanced capabilities to analyze, predict and address these dynamic external factors into its planning and execution processes. For these reasons, a volumetric mechanism may not be able to effectively address the noted concerns with respect to uncertainty and variability in demand, and as a result could impair the utility's flexibility to: (i) protect customers from structural unknowns in forecasted costs and revenues, (ii) adapt to emerging business conditions related to energy transition, and (iii) take least regret actions to prepare the grid and its operations for a decarbonized and electrified future and provide near-and long-term value to ratepayers.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.24:

Reference(s): 1B-DRC-06, Part C

To comment or summarize how the governance framework and the selection of innovation projects or initiatives compares to the other jurisdictions that it reviewed in formulating this innovation fund proposal.

RESPONSE:

As described in the exchange leading up to this undertaking noted in the April 12, 2024, Technical Conference Transcript at page 64, line 27 to page 65, line 22, Toronto Hydro's jurisdictional scan assessed: (i) which jurisdictions/utilities have similar funds as part of their regulatory framework, (ii) what types of innovation form part of these funds, and (iii) how much funding is being allocated to investments in innovation through similar funds. The referenced research did not specifically consider the governance frameworks in other jurisdictions; however, Toronto Hydro's third-party expert Scott Madden did consider this information in the response to Undertaking JT3.36.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.25:

Reference(s): 1B-EP-23, Part E, Pg 3

To ask ScottMadden to provide the criteria it used to select jurisdictions or utilities in its review.

RESPONSE (PREPARED BY SCOTTMADDEN):

Criteria used to select jurisdictions/utilities in ScottMadden's review included:

- Jurisdictions that have passed mandates regarding climate/ clean energy goals
- Jurisdictions that have implemented elements of performance-based regulation
- Utilities that have proposed or implemented performance-based regulation in the context of meeting mandates regarding climate/ clean energy goals

It is important to note the review was not intended to be a jurisdiction-by-jurisdiction review of rate plans.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.26:

Reference(s): **1B-EP-23, Part E, Pg 3**

To ask ScottMadden to comment on whether there were utilities that were excluded that are in a similar stage to Toronto Hydro in the energy transition

RESPONSE (PREPARED BY SCOTTMADDEN):

ScottMadden's review did not specifically exclude any jurisdictions or utilities that met the criteria described in JT5.25.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.27:

Reference(s): 1B-EP-23, Part E, Pg 3

To ask ScottMadden to confirm that within the context of Ofgem, it relies heavily on its own analysis to set the revenue requirements, and that under RIIO-ED-2, Ofgem offers incentives to distributors who manage to present forecasts that do better than Ofgem's benchmark for cost categories for which Ofgem has its high confidence in forecasting.

RESPONSE (PREPARED BY SCOTTMADDEN):

Within the Ofgem UK-RIIO context, revenue requirements are largely based on Ofgem's assessment of each distribution company's analysis of expected costs over the price control period. However, we would not characterize it as heavily. Ofgem does use other information outside of a company's own analysis to set revenue requirements, including comparisons of plans from other electric distributors, international benchmarking evidence, and information on historical performance.

In RIIO-2, Ofgem presented the Business Plan Incentive (BPI) mechanism, which is designed to encourage efficient revenue requirements based on justified cost forecasts. Under BPI mechanism, companies present business plans that identify costs and outputs, such as service quality. The quality of the business plans is subject to rewards or penalties up to

+/-2% of the utility revenues.[1] The greater confidence that Ofgem has in the proposed costs, the higher the incentive rate.

[1] Jamasb, Tooraj. "Incentive Regulation of Electricity and Gas Networks in the UK: From RIIO-1 to RIIO-2." Economics of Energy & Environmental Policy, vol. 10, no. 2, Sept. 2021

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.28:

Reference(s): Exhibit 4

To confirm that 2 JA, JB, JC, and JD have been updated, and if not, to file updated versions.

RESPONSE:

Toronto Hydro confirms that it filed updated OEB Appendices 2-JA, 2-JB, 2-JC, and 2-L in response to interrogatory 4-SEC-89.[1]

[1] Toronto Hydro filed the OM&A Programs Table (OEB Appendix 2-JC) instead of the OM&A by USoA Table (OEB Appendix 2-JD) in accordance with section 2.4.2 of the OEB's Filing Requirements for Electricity Distribution Rate Applications (December 15, 2022).

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.29:

Reference(s): Exhibit 4

Within the System Access category, to provide the annual contributions by program (Customer and Generation Connections, Externally Initiated Plant Relocations and Expansion, Generation Protection Monitoring and Control, Load Demand, and Metering at that resolution) for the 2023 actual, and project it forward by any year that's affected by the April 2, or January 29 updates.

RESPONSE:

Toronto Hydro notes that the 2025-2029 Customer and Generation Connections (Exhibit 2B, Section E5.1) and Externally Initiated Plant Relocations and Expansion (2B, E5.2) investments plans were not affected by the January 29th and April 2nd updates or by the 2023 actuals and updated bridge. The table below provides the 2023-2029 capital contributions by program/segment updated for 2023 actuals and revised 2024 bridge. The 2025-2029 forecasts align with those provided in Section 4 of each program/segment.

Table 1: System Access Capital Contributions ($ Millions)

Program/Segment	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Customer Connections	(71.8)	(71.9)	(82.9)	(89.0)	(94.7)	(100.5)	(106.3)
Generation Connections	(0.1)	0.0	0.0	0.0	0.0	0.0	0.0
Externally Initiated Plant Relocations & Expansion	(68.6)	(75.6)	(81.1)	(61.8)	(46.1)	(46.7)	(48.6)
System Access Capital Contributions	**(140.4)**	**(147.5)**	**(164.0)**	**(150.7)**	**(140.7)**	**(147.2)**	**(154.9)**

There are no capital contributions forecasted for the Generation Protection, Monitoring and Control (2B, E5.5), Load Demand (2B, E5.3) or Metering (2B, E5.4) programs.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.30:

Reference(s): Exhibit 4

For the Station Renewal and IT/OT System programs, to provide the Capex data by segment, by year; similarly for 2023 and any year that may have been affected by the January 29 or April 2 updates.

RESPONSE:

Please see Table 1 and Table 2 below for the updates to the 2023-2024 segment-level capital expenditures for the Stations Renewal and IT/OT Systems programs, respectively. Toronto Hydro notes that there are no changes to the 2025-2029 forecasts for these programs since the application filed on November 17, 2023.

Table 1: Stations Renewal Program Historical & Forecast Program Costs ($ Millions)

Segments	Actual				Bridge	Forecast				
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Stations TS	12.0	16.7	18.8	9.6	19.5	31.1	31.1	30.0	25.0	16.8
Stations MS	11.5	12.4	2.4	3.3	12.0	10.2	11.3	13.4	17.0	18.4
Stations Control & Monitoring	4.7	3.1	5.1	6.9	8.1	11.9	12.1	13.5	13.1	14.2
Stations Ancillary and Battery	1.9	1.2	1.1	2.1	1.0	3.2	2.2	1.9	3.4	2.9
Total	**30.2**	**33.6**	**27.4**	**21.9**	**40.6**	**56.4**	**56.7**	**58.8**	**58.6**	**52.3**

In preparing the response to this undertaking, Toronto Hydro identified an error in Exhibit 2B, Section E8.4, Table 4 at pages 15-16. The 2022 actuals for Communication

Infrastructure was understated by $0.6 million and is corrected in the table below. This error was isolated and does not affect the total costs in that year or the amounts included in the OEB Appendices.

Table 2: IT/OT Historical & Forecast Program Costs ($ Millions)

Segments	Actual				Bridge	Forecast				
	2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
IT Hardware	11.6	15.1	14.9	17.3	12.0	17.5	19.8	22.6	18.1	20.3
IT Software	22.2	26.6	42.4	41.6	42.1	38.6	40.6	41.0	33.3	34.8
Communication Infrastructure	3.6	3.0	0.7	2.3	1.8	3.7	2.5	0.9	6.8	1.0
Total	**37.4**	**44.7**	**58.0**	**61.2**	**55.9**	**59.7**	**62.9**	**64.5**	**58.2**	**56.0**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.31:

Reference(s): 9-Staff-355

To provide an updated LRMVA using the original LRMVA threshold.

RESPONSE:

Please refer to Table 1 for a calculation of LRAMVA using the original LRAMVA threshold (the "Original LRAMVA Threshold"). Please note that the following CDM savings were excluded to complete this calculation: (a) the CFF wind-down adjustment to the LRAMVA threshold; and (b) 2018 CDM persistence in the threshold and 2018 actual CDM savings.[1]

Table 1: Summary of LRAMVA amounts using the Original LRAMVA Threshold

	Residential	CSMUR	GS<50kW	GS 50-999kW	GS 1000-4999kW	Large User
Original ($ M)	-$0.03	-$0.00	-$5.73	-$8.07	-$2.20	$3.23

The Original LRAMVA Threshold

The LRAMVA amounts in Table 1 are based on the Original LRAMVA Threshold which includes all of the Toronto Hydro CDM programs under the initial CFF plan (prior to the discontinuation of CFF), while the actual CDM savings to be used for the LRAMVA

[1] Toronto Hydro included 2018 CDM persistence in the modified threshold as this information was not included in the Original LRAMVA Threshold that the OEB approved in EB-2018-0165, due to the uncertainty related to CFF. This proposal aligns with VECC's position in EB-2018-0165, VECC Submission (August 28, 2019) at page 21.

calculations only includes programs that the utility continued to manage as contractually obligated under the CFF wind-down, creating an "apples to oranges" comparison. While the Original LRAMVA Threshold is consistent with what was previously approved, Toronto Hydro reiterates that using contrasting CDM assumptions does not provide a fair comparison of LRAMVA as described in Conservation and Demand Management Guidelines for Electricity Distributors.[2] Specifically the guidance that LRAMVA should capture variances of CDM activities undertaken by electricity distributors.

The Proposed Modified LRAMVA Threshold

The modified LRAMVA threshold as outlined in Exhibit 9, Tab 2, Schedule 3, page 3 (the "Modified LRMVA Threshold") was proposed because it addresses the impact of the Conservation First Framework's ("CFF") discontinuation. The Modified LRAMVA Threshold row includes programs that were fully discontinued, and those which the utility was contractually obligated to complete as part of the CFF wind-down, which would allow for a fairer comparison between a modified threshold and the actual CDM savings from the CFF wind-down period. It also includes 2018 CDM persistence, which was only excluded from the original threshold due to the uncertainty related to CFF at the time.

[2] EB-2021-0106, Conservation and Demand Management Guidelines for Electricity Distributors, Section 8, at page 26.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.32:

Reference(s): **Clearspring Working Papers**

In Clearspring's working papers, to review the values for approximately 30 entries in the field called alloc and their associated formulas, to make corrections and adjustments as deemed necessary; to comment on findings and provide them to PEG.

RESPONSE (PREPARED BY CLEARSPRING):

The “alloc” field is a calculated ratio that takes a proportion of A&G expenses and allocates those expenses to the total cost amount within the study. This is useful when the sample contains several utilities with G, T, and D functions. Clearspring took the approach of not making data adjustments within the ratio calculation when calculating the allocator.

In deciding not to make adjustments, there are 28 observations out of the 1,642 total observations that are either negative or higher than 100%. If these 28 values are changed to the prior year value (or the next year value for observations in the year 2000), a minor change in the results occurs. Rather than Toronto Hydro having a benchmark score of -22.9% during the 2025 to 2029 CIR period, the score changes to -21.9%.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.33:

Reference(s): Clearspring Model

In Clearspring's model, the O&M-based scope variable, to review the values for approximately three companies, to review, comment, provide updates.

RESPONSE (PREPARED BY CLEARSPRING):

The O&M-based scope variable is a calculated ratio that measures the level of D functions relative to G, T, and D within each observation. Clearspring took the approach of not making data adjustments within the ratio calculation when calculating the variable.

In deciding not to make adjustments, there are 3 observations/values out of the 1,642 total observations that are higher than 100%. If these 3 values are changed to the prior year value, a minor change in the results occurs. Rather than Toronto Hydro having a benchmark score of -22.9% during the 2025 to 2029 CIR period, the score changes to -23.3%.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.34:

Reference(s): **Clearspring Working Papers**
1B-Staff-67

Within the Clearspring working papers and with reference to 1B-Staff-67a, distribution substation data, to review the data and comment on whether there are problems in the counting methods; whether corrections would improve the performance of Toronto Hydro; whether the corrected data could be provided in a timely manner; and to provide any other commentary or alternative models that could be informative.

RESPONSE (PREPARED BY CLEARSPRING):

As Clearspring stated in 1B-Staff-67a, there are hundreds of thousands of addresses and observation lines regarding the construction of the substation variables. In reality the number is well over one million data lines. Clearspring undertook extensive data processing efforts to calculate the substation variables with a view of improving the model specification. Clearspring did this utilizing formulas and made a good faith effort in calculating the variables and provided those formulas and all the data in our working papers. It is not feasible in the very short amount of time since this undertaking was requested, nor worthwhile in Clearspring's view, to examine the data line-by-line. Examining every line would take many weeks, if not months, of work. Clearspring is of the view that its data processing approach was reasonable and the models are enhanced by the inclusion of the substation variables.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.35:

Reference(s): **Clearspring Working Paper**

To clarify and confirm Toronto Hydro's coverage area.

RESPONSE (PREPARED BY CLEARSPRING):

The Clearspring data for Toronto Hydro's service area came from GIS mapping from information subscribed to from Platt's. The 642 km squared number cited by PEG is from the OEB Yearbook data reporting. If the 642 km number is inserted into the model for Toronto Hydro, the benchmark score moves from -22.9% to -27.9%.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.36:

Reference(s): Clearspring Working Paper

To review the variable construction and the interaction between logged and unlogged.

RESPONSE (PREPARED BY CLEARSPRING):

Regarding the interaction term with the percentage overhead and forestation, Clearspring constructed this the same way as we previously did, as contained in the Hydro One Joint Report issued by Clearspring and PEG. We logged the forestation variable and then multiplied that by the percentage of overhead (not logged). While this construction of the variable makes intuitive sense to Clearspring by modifying the elasticity on the forestation variable by the proportion of overhead assets, we note that modifying the variable to also take the natural log of the percentage of overhead assets would create a minor change in the results. Rather than the reported -22.9% benchmark score, when both components are logged the result becomes -20.9%.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.37:

Reference(s): 1B-Staff-60

To provide the full list of instances for the three scale variables in 1B-Staff-60, part b.

RESPONSE (PREPARED BY CLEARSPRING):

The custom elasticities are provided in the Excel file “Dataset Dx Custom Elasticities JT5.37”. The elasticities are found in columns B, C, and D. This file is provided on a confidential basis.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.38:

Reference(s): 1B-Staff-102

To clarify the response to 1B-Staff-102c, whether the congested urban variable referred to cities or metro areas.

RESPONSE (PREPARED BY CLEARSPRING):

As far as Clearspring recalls, it was city populations above 200,000 that originally served as the criterion to be included in the analysis, as referred to in my report in the last Toronto Hydro proceeding [EB-2018-0165]. The vast majority of the congested urban core areas were contained in cities with populations well above 200,000.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.39:

Reference(s): 1B-STAFF-75J

To give the applicant's view of the causes of Toronto Hydro's such poor SAIFI and good SAIDI scores

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not fully capture the request made by OEB Staff (PEG). The scope of the undertaking is to provide insights from an engineering perspective on underlying causes of Toronto Hydro's SAIFI and SAIDI performance relative to the benchmark in the context of the reliability benchmarking study conducted by Clearspring.

Toronto Hydro's strong SAIDI performance reflects the distributor's commitment over the years to delivering safe and reliable power to its customers while minimizing the duration of interruptions. This commitment is evident not only in the econometric reliability benchmarking study produced by Clearspring, but also when comparing SAIDI trends with those of other large distributors within the Province of Ontario, as shown in 2B-Staff-245. As evident through Customer Engagement, Toronto Hydro's customers also prioritize the need to continue to address the duration of outages when it comes to reliability preferences. From an engineering and operational perspective, Toronto Hydro attributes its strong SAIDI performance over the years to historical investments in renewal and system enhancement efforts. Particularly, the deployment of remote-operable switches (also known as SCADA controlled switches) and investments in enhancements to Toronto

Hydro's Network Management System (NMS) have had significant impacts on minimizing outage duration. SCADA controlled switches provide operational efficiencies, enabling power system controllers to perform remote switching for fault isolation and restoration. Historically, restoration crews on the ground had to perform these tasks manually, which prolonged outages and restoration times. For more information, please see response to 1B-Staff-98.

In regard to higher SAIFI performance relative to the econometric benchmark, Toronto Hydro views this as largely a reflection of its distribution system (e.g. age, condition, topology, existence of legacy equipment, etc.) and its operating environment. As outlined in the Executive Summary (Exhibit 1B, Tab 1, Schedule 1), Toronto Hydro operates in a complex urban environment within the City of Toronto due to the dense nature of the city's population (4,428 people per sq. kilometer), coupled with a growing tree canopy consisting of approximately 11.5 million trees. This requires approximately 15,000 circuit kilometers of overhead conductors and 13,800 circuit kilometers of underground cable to service the city's 630 square kilometers. These realities of the distribution system result in a high volume of short-duration high-impact interruptions. On average, between 2018 to 2022, 23% of SAIFI contribution (excluding MEDs and Loss of Supply) are associated with interruptions lasting less than 5 minutes.

A large share of SAIFI contribution to Toronto Hydro's distribution system originates from the Horseshoe region, which includes feeders that service thousands of customers. Due to the nature of these feeders (length, topology, and customer density), interruptions that occur along the feeder trunk – i.e. system faults downstream of the station circuit breaker and upstream of expulsion or current limiting fuses – result in a high SAIFI impact, interrupting all customers served from the feeder. Furthermore, the realities of Toronto Hydro's operating context can prevent the utility from constraining certain trunk level outages to less than one minute in duration, meaning that a higher proportion of large, but still very short, outages are counted against SAIFI as sustained interruptions. For example, Toronto Hydro makes extensive use of “hold-offs” to ensure employee and third-party safety when working on or near lines. These hold-offs prevent automatic breaker reclosing under fault conditions. Also, Toronto Hydro does not have control authority over transmitter-owned equipment (including feeder circuit breakers) for certain transformer stations in the Horseshoe region, which in turn prolongs restoration times due to incremental coordination requirements with the transmitter. Please see response to 2B-EP-27 for more information on distribution operation and protection practices, and 2B-Staff-162, part (c) for design differences between the Downtown Core and Horseshoe region.

Additionally, Toronto Hydro’s distribution system currently lacks certain advanced technologies aimed at improving system reliability. These include, but are not limited to, the deployment of mid-line reclosers along distribution feeders and the implementation of Fault Location, Isolation, and Service Restoration (‘FLISR’) or Distribution Automation (‘DA’). For more details on Toronto Hydro’s plans within the 2025-2029 rate period for mid-line recloser implementation and other strategic investment initiatives that are designed to improve reliability and resiliency of the distribution system over the long term, please refer to Section E7.1 and D5.2.1. For more details on it’s FLISR implementation, please refer to Section D5.2.1.2 and D5.3.2.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.40:

Reference(s): **Exhibit 1B, Tab 3, Schedule 3, Appendix A, Page 23**

Toronto Hydro and Clearspring to comment on declines in THESL's total cost efficiency in 2010 and 2011.

RESPONSE PREPARED BY CLEARSPRING:

In the two years of 2010 and 2011, the Company's costs in the total cost benchmarking study increased by an average annual rate of 9.0%. This total cost increase outpaced the total cost model benchmarks for those years. The model benchmarks estimated an average annual increase of 3.3% during those two years.

RESPONSE PREPARED BY TORONTO HYDRO:

Toronto Hydro respectfully disagrees with the characterization of its 2010 to 2011 cost performance as a decline in cost efficiency. It is Toronto Hydro's understanding that the costs underpinning the Total Costs values undergo a series of normalizations, and as such is unable to comment on the trends using those data points. However, Toronto Hydro is able to comment on capital expenditure and OM&A trends between 2009 and 2011 based on data disclosed in its 2011 EDR (EB-2010-0142) and 2015-2019 CIR (EB-2014-0116) Applications.

<u>Capital Expenditures</u>

The increase in capital expenditures between 2009 and 2010 is primarily attributed to emerging requirements associated with:

- Stations Expansion (Copeland TS project, known as Bremner TS at the time);
- The need to address worst performing feeders (i.e. FESI-7); and
- Safety requirements by replacing and upgrading handwells to reduce the risk of contact voltage.

It is also attributed to incremental requirements to convert smart meters in 2010 and 2011 and to replace underground direct buried cables staring in 2010.

OM&A Expenses

The increases in OM&A costs between 2009 and 2011 were driven by Administrative and Other Costs, in part related to internal resources to support the safe and efficient delivery of the capital and operational work programs over that time. Toronto Hydro notes that its headcount increased by about 200 FTE in that period. A more detailed analysis with respect to the specific drivers for the OM&A increase over this period could not be performed within the timeframe of responding to this undertaking.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

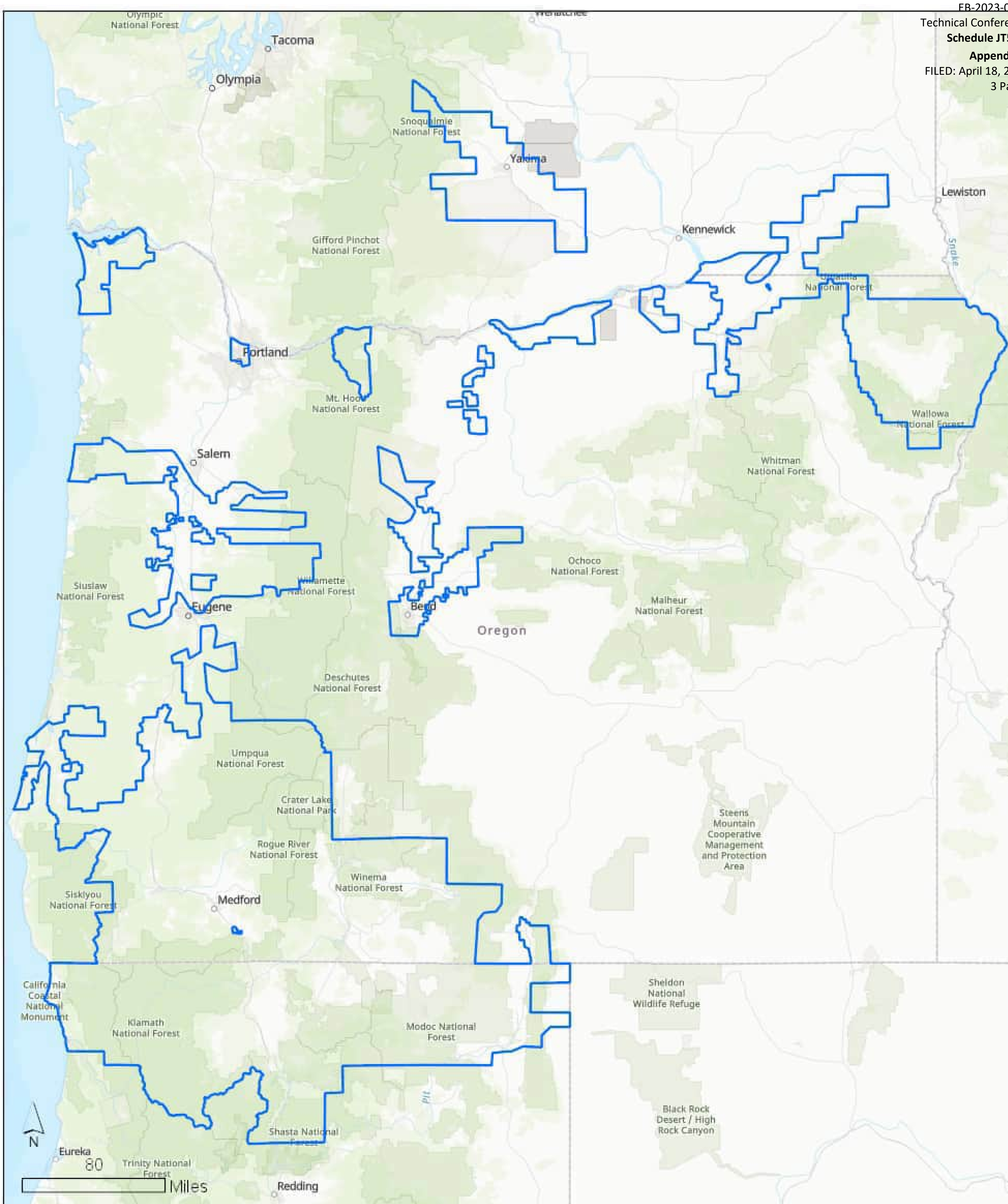
UNDERTAKING NO. JT5.41:

Reference(s): Clearspring Working Paper

To file the two maps related to the congested urban variables.

RESPONSE (PREPARED BY CLEARSPRING):

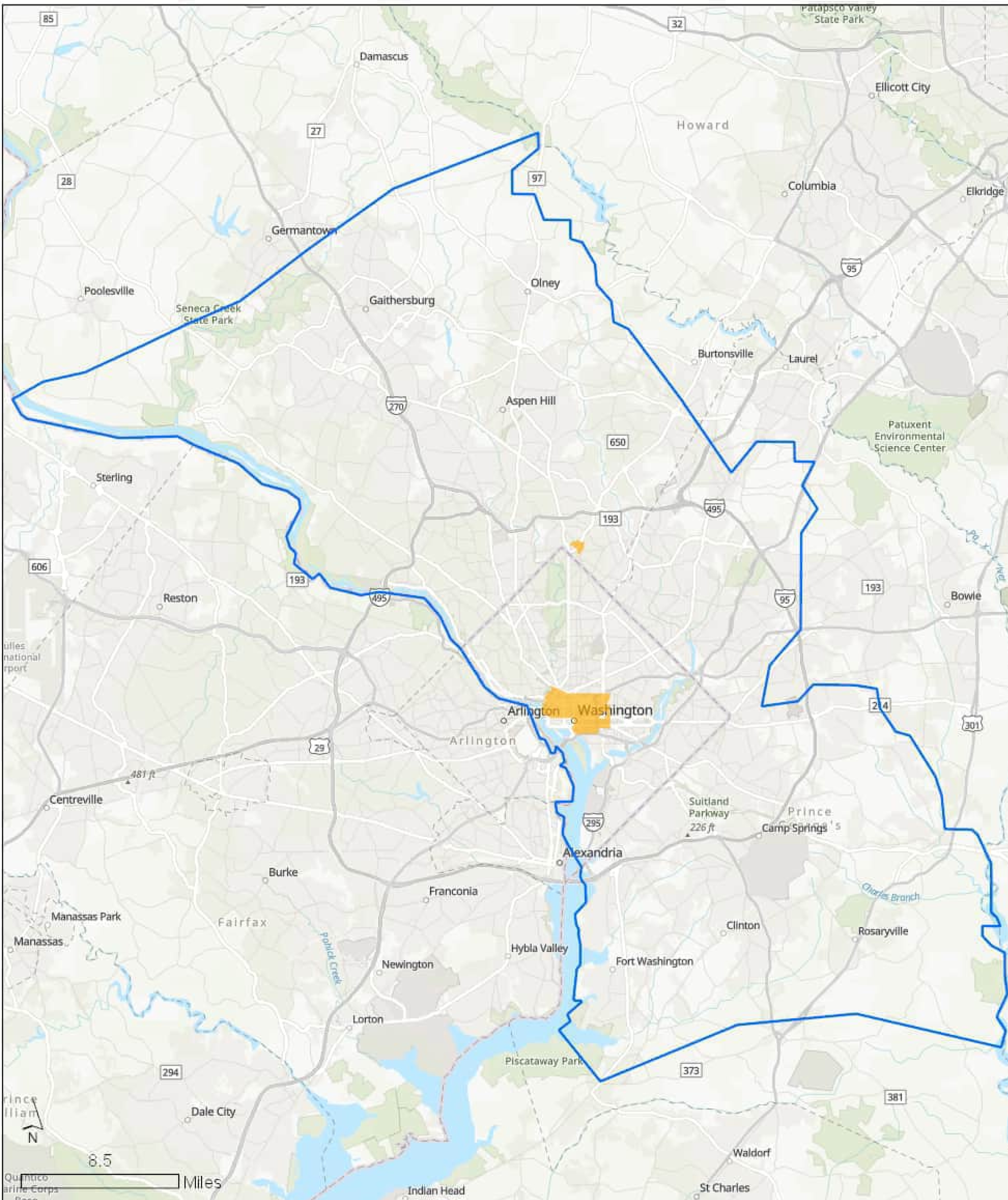
Clearspring examined our files and we have the maps for Potomac Electric Power and PacifiCorp. Regarding PacifiCorp, there are two maps because the company is a merged entity serving the historic territories of Pacific Power and Rocky Mountain Power. The three maps are provided.



Congested Urban
Service Territory

Percent Congested: 0.0026%

PACIFIC POWER

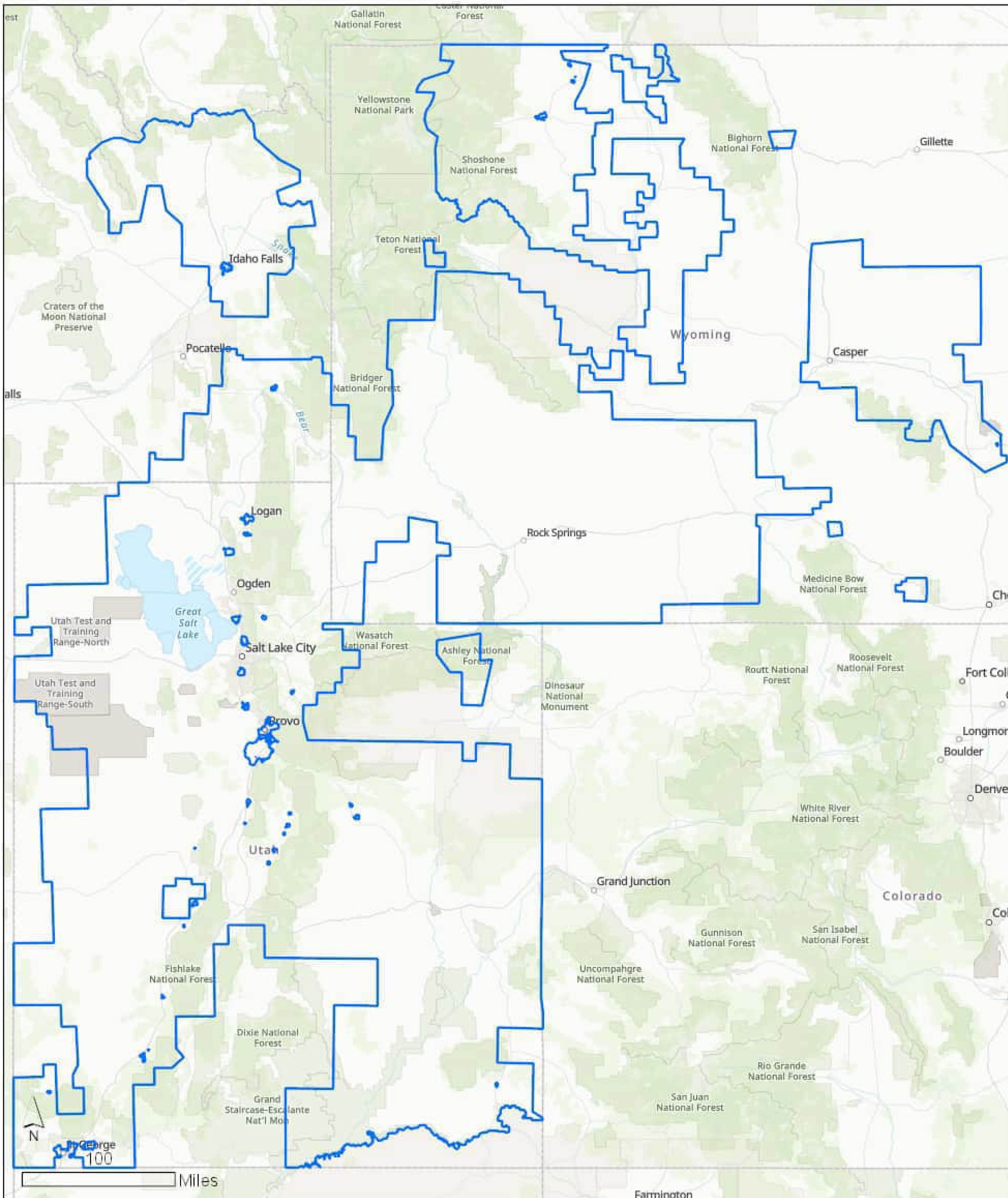


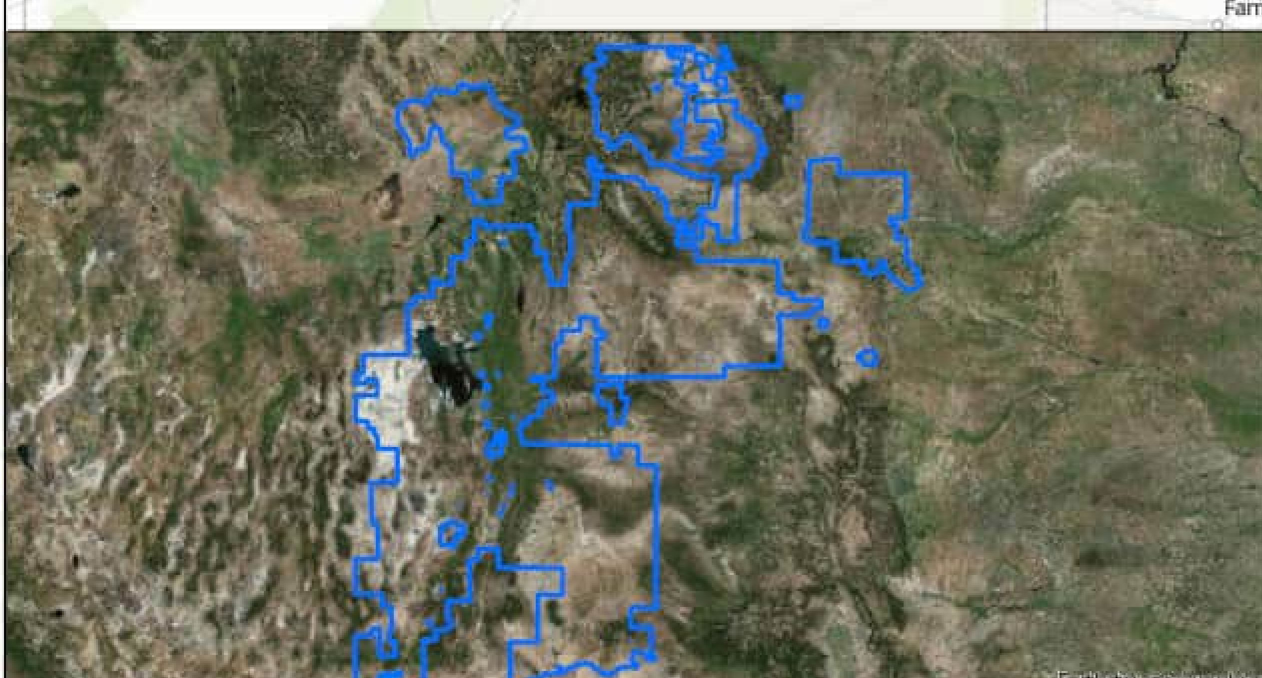
Congested Urban

Service Territory

Percent Congested: 0.6452%

POTOMAC ELECTRIC POWER CO.





Congested Urban

Service Territory

Percent Congested: 0.0000%

ROCKY MOUNTAIN POWER

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT5.42:

Reference(s): **NA**

To update study results based on the evidentiary updates.

RESPONSE (PREPARED BY CLEARSPRING):

We have updated the study results as requested based on the April 2, 2024 updates. The evidentiary updates produce only a slight change in the total cost benchmarking results. The 2025-2029 result for Toronto Hydro moves from a benchmark score of -22.9% to -22.4%. Table 1 found in the Clearspring report has been updated and is provided below.

Table 1 Toronto Hydro's Total Cost Performance 2005-2029

Year	% Difference from Total Cost Benchmark
2005	-62.1%
2006	-62.9%
2007	-59.3%
2008	-56.5%
2009	-54.5%
2010	-48.2%
2011	-43.1%
2012	-45.2%
2013	-41.6%
2014	-39.5%
2015	-38.1%
2016	-33.9%
2017	-30.7%
2018	-28.8%
2019	-27.6%
2020	-29.4%
2021	-27.6%
2022	-26.8%
2020-2022 average score	**-28.0%**
2023	-25.5%
2024	-24.6%
2025	-23.5%
2026	-22.6%
2027	-22.4%
2028	-22.0%
2029	-21.3%
2025-2029 average score	**-22.4%**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT5.43:

Reference(s): **1B-SEC-27**

To revisit the response to 1B-SEC-27, and comment on any material methodological changes.

RESPONSE (PREPARED BY CLEARSPRING):

Clearspring provided a list of material methodological changes in Section 2 of the current report along with the other two sources cited in the response to 1B-SEC-27. Clearspring is not aware of any additional material methodological changes since the last Toronto Hydro study not listed and discussed in those sources.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT5.44:

Reference(s): 1B-SEC-27

(ref: 1B-SEC-27d) (a) for each year of the plan, that's the hydro one (sic) 2025 to 2029, can you provide the dollar increase in total costs to the benchmark for; a, each additional megawatt of peak demand; and b, each additional customer; (b) for each year of the Toronto Hydro plan, can you please provide the percentage increase in total costs in the benchmark for each: a, one percent increase in peak demand; and b, 1 percent increase in customers.

RESPONSE (PREPARED BY CLEARSPRING):

The 2025 to 2029 dollar increase in the total cost benchmark when adding one additional megawatt of peak demand to Toronto Hydro is provided in the following table. The peak demand variable is a 10-year rolling average of the prior ten years of system peak demands. Therefore, for the variable to be increased by one additional megawatt requires a hypothetical increase by one megawatt over all ten prior years.

	Dollar Increase in Total Cost Benchmark
2025	$ 197,617
2026	$ 203,182
2027	$ 211,225
2028	$ 208,050
2029	$ 227,603

The 2025 to 2029 dollar increase in the total cost benchmark when adding one additional customer to Toronto Hydro is not distinguishable in the results as the econometric benchmarking software due to the small change in total costs resulting from adding just one customer. To compensate for this and provide useful information, we provide the dollar impact from the 1% change in customers and then divided by the total change in customers to provide a per customer estimate.

	Dollar Increase in Total Cost Benchmark
2025	$ 650.14
2026	$ 684.46
2027	$ 714.88
2028	$ 754.17
2029	$ 788.50

The 2025 to 2029 percentage increase in the total cost benchmark when increasing the peak demand variable by one percent for Toronto Hydro is provided in the following table. The peak demand variable is a 10-year rolling average of the prior ten years of system peak demands. Therefore, for the variable to be increased by one percent requires a hypothetical increase by one percent over all ten prior years.

	% Change in Total Cost Benchmark
2025	0.59%
2026	0.58%
2027	0.58%
2028	0.57%
2029	0.56%

The 2025 to 2029 percentage increase in the total cost benchmark when increasing the peak demand variable by one percent for Toronto Hydro is provided in the following table.

	% Change in Total Cost Benchmark
2025	0.36%
2026	0.37%
2027	0.37%
2028	0.37%
2029	0.37%

The estimates provided above are calculated from the econometric total cost model coefficients. These coefficients are based on the estimated cost impacts of a typical utility. The actual costs of a specific utility may vary based on specific conditions and system needs that may or may not be related to a change in peak demands or customers.