

1 **DEFERRAL AND VARIANCE ACCOUNTS**

2

3 Toronto Hydro utilizes deferral and variance accounts (“DVA”) in accordance with the  
4 Accounting Procedures Handbook (“APH”), and other directions issued by the OEB from time  
5 to time. This schedule summarizes Toronto Hydro’s DVA balances as detailed in the  
6 continuity scheduled in Exhibit 9, Tab 2, and provides a detailed description of the accounts  
7 proposed for disposition in this application through rate riders as presented in Exhibit 9, Tab  
8 3.<sup>1</sup> The evidence also identifies the new Group 2 accounts that Toronto Hydro proposes to  
9 establish for the 2025-2029 rate term,<sup>2</sup> in addition to the accounts the utility proposes to  
10 continue in the next period.

11

12 **1. SUMMARY OF DVA BALANCES**

13 A detailed continuity of account balances in the format provided by the OEB, including  
14 carrying costs, is presented in Exhibit 9, Tab 2, Schedule 1. Table 1 below summarizes the  
15 principal balances and carrying charges as of December 31, 2022, notes which accounts  
16 Toronto Hydro is putting forward for disposition in this application, and identifies which  
17 accounts the utility proposes to continue in the 2025-2029 rate period.

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<sup>1</sup> Appendix B to this schedule provides the 2020-2024 Draft Accounting Orders approved in the last rebasing application (EB-2018-0165, Draft Rate Order, Schedule 18 (January 21, 2020)).

<sup>2</sup> Toronto Hydro proposes to establish four new Group 2 DVA accounts for the 2025-2029 rate period. Please refer to section 9 of this schedule for more information about these accounts.

1 **Table 1: Summary of DVA Balances (\$ Millions)**

	Principal Balance as of Dec 31, 2022	Carrying Charge Balance as of Dec 31, 2022	Balances as of Dec 31, 2022	Proposed for Disposition (Yes/No)	To Be Continued (Yes/No)
<b>Group 1 Accounts</b>					
Retail Settlement Variance Account ("RSVA") <sup>3</sup>	165.6	2.8	168.3	No	Yes
Disposition and Recovery/Refund of Regulatory Balances ("RARA")	(7.3)	(2.0)	(9.4)	No	Yes
Smart Meter Entity Charge	(2.6)	0	(2.6)	No	Yes
<b>Group 2 Accounts</b>					
Capital-Related Revenue Requirement ("CRRVA") <sup>4</sup>	(74.4)	(5.3)	(79.7)	No	No
Customer Choice Initiative Costs	0.1	0	0.1	Yes	No
Excess Expansion Deposits	(7.2)	(0.1)	(7.2)	Yes	Yes
Externally Driven Capital Variance Account ("EDCVA")	(0.3)	0	(0.3)	Yes	No <sup>5</sup>
Gain on Sale of Properties	1.5	0	1.5	Yes	Yes
Impact for USGAAP Deferral Account	(28.8)	0	(28.8)	Yes	Yes
Pension & OPEB Forecast Accrual versus Actual Cash Payment Differential Carrying Charges	0	0	0	No	Yes
PILs and Tax Variances – CCA Changes <sup>6</sup>	(11.6)	(0.4)	(12.0)	Yes	Yes
THESL Wireless Attachment Costs & Revenues	(1.7)	0	(1.7)	Yes	Yes
Wireline Pole Attachment Revenue Variance	1.1	0	1.1	Yes	No

<sup>3</sup> Includes Account 1588 – Power (RSVA<sub>Power</sub>) and Account 1589 Global Adjustment (RSVAGA)

<sup>4</sup> Balance relates to 2015-2019 activity which was approved for clearance in 2020 CIR.

<sup>5</sup> Toronto Hydro proposes to track that types of variances that are currently captured in the EDCVA in the new the Demand Related Variance Account ("DRVA"). Please refer to section 9.2 for further details.

<sup>6</sup> Balance relates to 2015-2019 activity which was approved for clearance in 2020 CIR.

	Principal Balance as of Dec 31, 2022	Carrying Charge Balance as of Dec 31, 2022	Balances as of Dec 31, 2022	Proposed for Disposition (Yes/No)	To Be Continued (Yes/No)
Renewable Generation Connection Funding Adder Deferral Account – Provincial Rate Protection Payment Variances	(3.0)	0	(3.0)	Yes	Yes
Local Initiatives Program Costs	0	0	0	No	Yes
Lost Revenue Adjustment Mechanism (“LRAM”) Variance Account (“LRAMVA”)	0	0	0	Yes	Yes
Gains on Sale of Properties related to the Operating Centres Consolidation Program (“OCCP”)	0	0	0	Yes	Yes
Useful Life Changes	0	0	0	Yes	No
Ultra-Low Overnight (“ULO”) Implementation Costs	0	0	0	Yes	No
Green Button Initiative Costs	0	0	0	Yes	No
50/60 Eglinton Proceeds of Sale Deferral Account <sup>7</sup>	0	0	0	Yes	Yes
Carillion Insolvency Payments Receivable Account	0	0	0	No	Yes
Getting Ontario Connected Act Variance Account	0	0	0	Yes	Yes
<b>Total Balance</b>	<b>31.2</b>	<b>(5.1)</b>	<b>26.1</b>		

1

2 Toronto Hydro expects the following accounts to have balances in 2024 or beyond, as  
 3 outlined Summary of Proposed DVA dispositions:

- 4 1. 1568 – subaccount - LRAM Variance Account (“LRAMVA”)  
 5 2. 1508 – subaccount – Gains on Sale of Properties related to the OCCP  
 6 3. 1508 – subaccount – Useful Life Changes  
 7 4. 1508 – subaccount – Ultra-Low Overnight Rate Costs

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<sup>7</sup> Toronto Hydro seeks approval to create of this deferral account to capture and dispose additional proceeds received from the sale of 50/60 Eglinton. Please refer to section 9.4 for more information.

- 1 5. 1508 – subaccount – Green Button Initiative Costs
- 2 6. 1508 – subaccount – 50/60 Eglinton Proceeds of Sale Deferral Account
- 3 7. 1508 – subaccount – Getting Ontario Connected Act Variance Account
- 4 8. Account 1588 – Power (RSVA<sub>Power</sub>) and Account 1589 Global Adjustment (RSVA<sub>GA</sub>)
- 5 Enhancement Model Changes
- 6

### 7 **1.1 Group 1 Accounts**

8 Below is a complete list of Toronto Hydro’s Group 1 accounts:

- 9 • RSVA includes the following OEB Accounts:
  - 10 ○ 1580 – Wholesale Market Service Charges (RSVA<sub>WMS</sub>)
  - 11 ○ 1584 – Retail Transmission Network Charge (RSVA<sub>NW</sub>)
  - 12 ○ 1586 – Retail Transmission Connection Charge (RSVA<sub>CN</sub>)
  - 13 ○ 1588 – Power (RSVA<sub>Power</sub>)
  - 14 ○ 1589 – Global Adjustment (RSVA<sub>GA</sub>)
  - 15 ○ 1550 – Low Voltage Variance Account
- 16 • 1595—RARA: Disposition and Recovery/Refund of Regulatory Balances contains
- 17 residual amounts related to clearance of DVAs previously approved by the OEB for
- 18 recovery through rate riders
- 19 • 1551 – Smart Metering Entity (“SME”) Charge
- 20

21 The OEB’s Chapter 2 Filing Requirements from December 15, 2022 require all distributors to

22 complete the GA Analysis Workform for each year that has not previously been approved by

23 the OEB for disposition. This information can be found in Exhibit 9, Tab 2, Schedule 2.

24 With respect to Global Adjustment (“GA”) charges, Toronto Hydro confirms that

25 Independent Electricity System Operator (“IESO”) GA charges are prorated into Regulated

1 Price Plan (“RPP”) and non-RPP amounts. Values in the RSVA Global Adjustment account  
2 1589 reflect the non-RPP portions only.

3

#### 4 **1.2 Group 2 Accounts (Other Regulatory Asset)**

5 Below is a complete list of Toronto Hydro’s Group 2 (Other Regulatory Asset) accounts.

- 6 • 1508 – subaccount - Capital Related Revenue Requirement (“CRRRVA”)
- 7 • 1508 – subaccount - Customer Choice Initiative
- 8 • 1508 – subaccount - Excess Expansion Deposits
- 9 • 1508 – subaccount - Externally Driven Capital Variance Account (“EDCVA”)
- 10 • 1508 – subaccount - Gain on Sale 2020 Decision (Gain on Sale of Properties)
- 11 • 1508 – subaccount - Impact for USGAAP Approval
- 12 • 1522 – Pension & OPEB Forecast Accrual versus Actual Cash Payment Differential
- 13 Carrying Charges
- 14 • 1592 – PILs and Tax Variances – Capital Cost Allowance (“CCA”) Changes
- 15 • 1508 – subaccount – THESL Wireless Attachments Costs and Revenues
- 16 • 1508 – subaccount - Wireline Pole Attachment Revenue Variance
- 17 • 1533 – Renewable Generation Connection Funding Adder Deferral Account, sub
- 18 account – Provincial Rate Protection Payment Variances
- 19 • 1508 – subaccount - Local Initiatives Program
- 20 • 1568 – subaccount - LRAM Variance Account (“LRAMVA”)
- 21 • 1508 – subaccount – Gain on sale of Properties related to OCCP Bonus Payment
- 22 (variable consideration)
- 23 • 1508 – subaccount - Useful Life Changes
- 24 • 1508 - subaccount - Ultra-Low Overnight Rate Costs
- 25 • 1508 – subaccount - Green Button Initiative Costs
- 26 • 1508 – subaccount - 50/60 Eglinton Bonus Payment

- 1       • 1508 – subaccount - Carillion Insolvency Payments Receivable Account
- 2       • 1508 – subaccount – Getting Ontario Connected Act (GOCA) Variance Account

3

4       **2. CARRYING CHARGES**

5       Toronto Hydro applied carrying charges to specific accounts using the OEB’s prescribed  
 6       interest rates summarized in Table 2 below. For the periods after 2023 Q3, Toronto Hydro  
 7       applied the 2023 Q3 as a forecast. Toronto Hydro intends to update these rates for the actual  
 8       approved rates at the time of disposition of these accounts.

9

10

**Table 2: Interest on Carrying charges**

<b>OEB Interest Rates Applied Calculation of Carrying Charges</b>			
Quarter	Annual %	Quarter	Annual %
Q1 2019	2.45%	Q3 2021	0.57%
Q2 2019	2.18%	Q4 2021	0.57%
Q3 2019	2.18%	Q1 2022	0.57%
Q4 2019	2.18%	Q2 2022	1.02%
Q1 2020	2.18%	Q3 2022	2.20%
Q2 2020	2.18%	Q4 2022	3.87%
Q3 2020	0.57%	Q1 2023	4.73%
Q4 2020	0.57%	Q2 2023	4.98%
Q1 2021	0.57%	Q3 2023	4.98%
Q2 2021	0.57%		

11

12       **3. PLANNED DISPOSITION OF REGULATORY ASSETS**

13       The Report of the Board on Electricity Distributors Deferral and Variance Account Review  
 14       Initiative (“EDDVAR”) indicates “at the time of rebasing, all accounts should be reviewed and  
 15       disposed of unless otherwise justified by the distributor or as required by a specific OEB

1 decision or guideline.”<sup>8</sup> To that end, the Chapter 2 Filing Requirements specify what  
2 information distributors must file with respect to DVA reviews and dispositions. This  
3 information is provided in the sections that follow.

4

5 In section 4 of this schedule, Toronto Hydro sets out the accounts it proposes to clear  
6 beginning January 1, 2025, and in section 7, the utility identifies the proposed recovery  
7 method for each account. The amounts proposed for clearance are aligned with the  
8 balances reflected in the audited financial statements for the fiscal year ended December  
9 31, 2022, and also include forecasted principal activity and carrying costs calculated to  
10 December 2024. Continuity schedules for all accounts proposed for disposition are provided  
11 in Exhibit 9, Tab 2, Schedule 1.

12

#### 13 **4. REGULATORY ASSET ACCOUNTS PROPOSED FOR DISPOSTION**

##### 14 **4.1 Account 1508 - subaccount - Customer Choice Initiative Costs**

15 On September 8, 2020, the OEB adopted final amendments (EB-2020-0152) to the Standard  
16 Supply Service Code (“SSSC”), effective October 13, 2020, which enabled electricity  
17 consumers on the Regulated Price Plan to opt out of time-of-use prices and to elect instead  
18 to be charged on the basis of tiered pricing. In response to comments on the proposed  
19 amendments, the OEB approved the establishment of a generic deferral account in which  
20 licensed, rate-regulated distributors could record their costs associated with implementing  
21 the customer choice initiative.

22

23 To comply with the customer choice initiative, Toronto Hydro implemented a complex  
24 solution requiring configuration and coding changes to the following: (1) the Customer  
25 Information System (“CIS”) to automate the billing for the new pricing option, the (2)

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<sup>8</sup> EB-2008-0046.

1 Customer Self-Service portal to enable customer opt-ins/opt-outs for different pricing  
 2 options, and (3) development of an online calculator to provide customers insight on future  
 3 bill amounts based on each customer’s billing history.

4

5 The amount proposed for clearance is \$0.6 million debit (recovery) from customers, based  
 6 on the cumulative capital revenue requirement associated with these expenditures as of  
 7 December 31, 2024, at the time of rebasing. Table 3 below shows the revenue requirement  
 8 calculation.

9

10 **Table 3: Revenue Requirement for Customer Choice Initiative (\$ Millions)**

Revenue Requirement Calculation	Actual			Forecast		Total
	2020	2021	2022	2023	2024	
Return on Equity		0.0	0.0	0.0	0.0	0.1
Interest	-	0.0	0.0	0.0	0.0	0.0
Depreciation	-	0.0	0.2	0.2	0.2	0.5
PILS	-	(0.3)	0.1	0.1	0.1	(0.1)
<b>Revenue Requirement</b>	-	<b>(0.2)</b>	<b>0.3</b>	<b>0.3</b>	<b>0.2</b>	<b>0.6</b>

11

12 **4.2 Account 1508 - subaccount - Excess Expansion Deposits**

13 In the 2020-2024 Rate Application (EB-2018-0165), the OEB approved the establishment of  
 14 an Excess Expansion Deposits deferral account.<sup>9</sup> Pursuant to the Distribution System Code  
 15 (“DSC”), Toronto Hydro may collect an expansion deposit from a customer who wants to  
 16 connect to the distribution system, if Toronto Hydro must expand its system (i.e. construct  
 17 new facilities or increase the capacity of existing facilities) in order to connect the customer.  
 18 During the Customer Connection Horizon specified in the Offer-to-Connect (“OTC”) contract,  
 19 the utility is obliged to annually return the expansion deposit to the customer in proportion

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<sup>9</sup> EB-2018-0165, Decision and Order (December 19, 2019) at page 185



1 to the actual connections (for residential developments) or actual demand (for commercial  
 2 and industrial developments) materialized in the year. If the forecasted  
 3 connections/demand do not materialize during the specified Customer Connection Horizon,  
 4 utilities retain the excess portion of the expansion deposit. Although section 3.2.23 of the  
 5 DSC provides that the utility does not have to return any remaining portions of the expansion  
 6 deposit to the customer beyond the Customer Connection Horizon, Toronto Hydro proposed  
 7 in the last rate application that the balance be returned to the ratepayers in order to protect  
 8 their interests.

9

10 Table 4 presents the excess expansion deposit balances through to December 31, 2023  
 11 including carrying charges. Toronto Hydro requests the continuation of this account in the  
 12 2025-2029 rate period.

13

14 **Table 4: Excess Expansion Deposits (\$ Millions)**

	Principal Balance as at Dec 31	Carrying Charge Balance	Total Balance as at Dec 31
<b>2020</b>	(14.0)	(0.5)	(14.5)
<b>2021</b>	(6.3)	0.1	(6.2)
<b>2022</b>	(7.2)	0.0	(7.2)
<b>2023</b>	(7.7)	(0.4)	(8.1)

15

16 **4.3 Account 1508 - subaccount - Externally Driven Capital Variance Account (“EDCVA”)**

17 In the 2015-2019 Rate Application, Toronto Hydro requested (and the OEB approved) an  
 18 Externally Driven Capital Variance Account to capture differences between the forecasted  
 19 revenue requirement amounts included in rates related to capital expenditure for third party  
 20 initiated relocation and expansion projects, and the actual revenue requirement associated

1 with these types of projects.<sup>10</sup> The continuation of this account was approved by the OEB in  
 2 the 2020-2024 Rate Application, with a modification to include variances from derecognition  
 3 related to the projects tracked in the account.<sup>11</sup> Variances tracked in this account flow from  
 4 capital work undertaken as part of the Externally Initiated Plant Relocations and Expansions  
 5 program (“Externally Driven Capital”).<sup>12</sup>

6

7 Table 5 outlines the variances between the planned capital expenditures that formed the  
 8 basis of the revenue requirement approved to be collected through rates in the current  
 9 2020-2024 period, and the actual and forecasted capital expenditures over the current rate  
 10 period related to Externally Driven Capital.

11

12 **Table 5: 2020-2024 Externally Driven Capital Expenditure (“CAPEX”) Variances**  
 13 **(\$ Millions)**

	Actual			Forecast		Total
	2020	2021	2022	2023	2024	
Planned CAPEX	11.4	20.8	4.6	4.7	4.5	46.1
Actual/Forecast CAPEX	8.7	9.3	12.9	15.2	8.2	54.3
<b>Variance</b>	<b>(2.7)</b>	<b>(11.5)</b>	<b>8.3</b>	<b>10.5</b>	<b>3.7</b>	<b>8.2</b>

14

15 Table 6 below presents the variances between the planned in-service additions that formed  
 16 the basis of the revenue requirement approved to be collected through rates in the current  
 17 2020-2024 period, and actual and forecasted in-service additions over the current rate  
 18 period related to work as part of the Externally Initiated Plant Relocations and Expansions  
 19 program. Table 7 outlines the Revenue Requirement impacts resulting from the variances in  
 20 Table 6.

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<sup>10</sup> EB-2014-0116, Decision and Order (December 29, 2015) at page 50.

<sup>11</sup> EB-2018-0165, Decision and Order (December 19, 2019) at page 196.

<sup>12</sup> Exhibit 2B, Section E5.2.

1 **Table 6: 2020-2024 Externally Driven Capital In-Service Additions (“ISA”) Variances**  
 2 **(\$ Millions)**

	Actual			Forecast		Total
	2020	2021	2022	2023	2024	
Planned ISA	11.4	20.8	4.6	4.7	4.5	46.1
Actual/Forecast ISAs	11.3	9.6	9.1	23.7	11.7	65.5
<b>In-Service Additions Variance</b>	<b>(0.0)</b>	<b>(11.2)</b>	<b>4.5</b>	<b>19.1</b>	<b>7.1</b>	<b>19.4</b>

3

4 **Table 7: 2020-2024 Externally Driven Capital Revenue Requirement (\$ Millions)**

Revenue Requirement Calculation	Actual			Forecast		Total
	2020	2021	2022	2023	2024	
Rate Base	0.3	(5.2)	(9.0)	1.8	14.2	N/A
Return on equity	0.0	(0.2)	(0.4)	0.1	0.5	0.1
Interest	0.0	(0.1)	(0.2)	0.1	0.3	0.0
Depreciation	(0.6)	(0.1)	0.7	1.2	0.4	1.6
PILs	(0.2)	0.4	0.4	(0.4)	(0.3)	(0.1)
<b>Revenue Requirement</b>	<b>(0.8)</b>	<b>0.0</b>	<b>0.4</b>	<b>1.0</b>	<b>0.8</b>	<b>1.6</b>

5

6 Due to continued growth and infrastructure development in the city, there were a number  
 7 of major projects that were either not anticipated, or were larger and more complex than  
 8 anticipated, including the Port Lands Flood Protection Project, the John Street Revitalization,  
 9 and the Wellington Street Revitalization. Incremental costs with respect to these projects  
 10 are due to factors outside of Toronto Hydro’s control, namely (i) expanded project scopes  
 11 driven by third-party requirements, and (ii) significant inflationary pressures.<sup>13</sup>

12

13 With the total number of transit and infrastructure projects expected to increase in the  
 14 2025-2029 rate period, Toronto Hydro continues to need a high-degree of flexibility to

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<sup>13</sup> Please see Exhibit 1B, Tab 3, Schedule 3 at pages 12-13.

1 manage Externally Driven Capital.<sup>14</sup> However, as noted below, Toronto Hydro seeks approval  
 2 to record variances related to Externally Driven Capital, along with variances in other  
 3 demand-related expenditures such as Customer Connections, as part of a new consolidated  
 4 Demand-Related Variance Account (“DRVA”). For more information about the proposed  
 5 DRVA, please refer to Exhibit 1B, Tab 2, Schedule 1, section 3.2.3.

6

7 **4.4 Account 1508 - subaccount - Gain on Sale of Property Variance Account**

8 In Toronto Hydro’s 2020-2024 Rate Application (EB-2018-0165), the OEB established an  
 9 account to track the variance related to gains on the disposition of utility property.<sup>15</sup>

10

11 Toronto Hydro owns a small number of properties with the potential to be designated as  
 12 surplus, to be disposed of if the property is not suitable for future grid expansion.<sup>16</sup> In 2021,  
 13 Toronto Hydro sold one of these properties resulting in an actual net gain of \$1.6 million.  
 14 Table 8 shows the calculation for the symmetrical difference between the \$1.0 million gain  
 15 embedded in rates and the actual gain net of tax for the sale of the property mentioned  
 16 above. The amount proposed for clearance is a \$3.7 million debit (recovery) from customers.  
 17 Toronto Hydro requests the continuation of this account in the 2025-2029 rate period.

18

19 **Table 8: Gain on Sale of Property Variance (\$ Millions)**

Gain on Sale (excluding carrying charges)	Actual			Forecast		Total
	2020	2021	2022	2023	2024	
Gain on Sale embedded in rates	1.0	1.0	1.0	1.0	1.0	5.0
Actual/Forecast Gain on Sale	0.0	1.6	0.0	0.0	0.0	1.6
<b>Variance</b>	<b>1.0</b>	<b>(0.6)</b>	<b>1.0</b>	<b>1.0</b>	<b>1.0</b>	<b>3.4</b>
<b>Carrying Charges</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.1</b>	<b>0.2</b>	<b>0.3</b>

<sup>14</sup> Exhibit 2B, Section E5.2.4.2.

<sup>15</sup> EB-2018-0165, Decision and Order (December 19, 2019) at page 2 and at page 188;

<sup>16</sup> For more details, please refer to Exhibit 2B, Section D6 at page 5

Gain on Sale (excluding carrying charges)	Actual			Forecast		Total
	2020	2021	2022	2023	2024	
<b>Total Proposed for Clearance</b>						<b>3.7</b>

1

2 **4.5 Account 1508 - subaccount - Impact for USGAAP Deferral Account**

3 This account captures the impact of the change in accounting for Other Pension and  
 4 Employment Benefits (“OPEB”) as a result of transitioning to a different accounting  
 5 framework. No carrying charges were applied to the balance in this account.

6

7 In its Decision and Order (EB 2012-0079) issued on June 7, 2012, the OEB approved the use  
 8 of account 1508 to capture the difference related to OPEB arising from transitioning from  
 9 Canadian Generally Accepted Accounting Principles (“CGAAP”) to United States GAAP (“US  
 10 GAAP”) on January 1, 2012. In its Decision and Order (EB 2014-0116) issued on December  
 11 29, 2015, the OEB accepted Toronto Hydro’s request to continue using this deferral account  
 12 to capture the impact of accounting differences related to OPEB arising from its transition  
 13 from US GAAP to International Financial Reporting Standards (“IFRS”) on January 1, 2015.  
 14 The differences relate mainly to changes in the accounting treatment of actuarial gains and  
 15 losses arising from updated actuarial assumptions and experience adjustments being  
 16 recognized in other comprehensive income, but never amortized into profit or loss under  
 17 IFRS.

18

19 On September 14, 2017, the OEB issued its final report on the *Regulatory Treatment of*  
 20 *Pension and Other Post-employment Benefits (OPEBs) Costs*,<sup>17</sup> stating that utilities may  
 21 propose disposition of this particular account if the gains and losses that are tracked in this  
 22 account do not substantially offset over time.

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<sup>17</sup> EB-2015-0040, Report of the Board, Regulatory Treatment of Pension and Other Post-employment Benefits (OPEBs) Costs (September 14, 2017).

1 In the 2020-2024 Rate Application, the OEB approved the use of the corridor approach to  
2 determine the balance in the account for disposition.<sup>18</sup> Under the corridor approach,  
3 actuarial gains and losses, to the extent that they fall outside a corridor of 10% of the higher  
4 of the plan asset or benefit obligation value, would get amortized to rates over a period not  
5 exceeding the expected average remaining service life (“EARSL”) of the plan participants. As  
6 at December 31, 2018, the balance in this account was \$48.1 million (debit balance). Of this  
7 balance, the OEB approved the recovery of \$6.4 million, calculated under the corridor  
8 approach, over a 10-month period commencing on March 1, 2020.

9

10 As at December 31, 2022, the balance in this account was \$28.8 million (credit balance).  
11 Toronto Hydro is seeking disposition of a portion of this balance, specifically \$1.7 million,  
12 determined using the corridor approach, consistent with the methodology approved in the  
13 2020-2024 Rate Application.

14

15 Toronto Hydro expects that the OPEB plans will continue to experience actuarial gains or  
16 losses as a result of changes in actuarial assumptions, particularly the discount rate, in the  
17 future. To record these expected changes, Toronto Hydro requests the continuation of this  
18 account in the 2025-2029 rate period.

19

#### 20 **4.6 Account 1592 – PILs and Tax Variances – CCA Changes**

21 In a letter to all rate-regulated electricity and natural gas utilities dated July 25, 2019, the  
22 OEB established a separate sub-account of Account 1592 - PILs and Tax Variances - CCA  
23 Changes specifically for the purposes of tracking the impact of changes in capital cost  
24 allowance (“CCA”) rules.<sup>19</sup> Pursuant to this letter, the OEB directed electricity distributors to

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<sup>18</sup> EB-2018-0165, Decision and Order (December 19, 2019) at page 182.

<sup>19</sup> Accounting Direction Regarding Bill C-97 and Other Changes in Regulatory or Legislated Tax Rules for Capital Cost Allowance (July 25, 2019).

1 use this sub-account to record the impact of the Bill C-97 CCA rule changes as well as any  
2 future CCA changes instituted by relevant regulatory or taxation bodies.

3

4 As discussed in Exhibit 6, Tab 2, Schedule 1, Toronto Hydro confirms that the revenue  
5 requirement impact of the Accelerated CCA rules introduced by Bill C-97 (“Accelerated CCA  
6 rule”) were reflected in the approved 2020-2024 rates, and the entire 2018 and forecasted  
7 2019 revenue requirement impact of the Accelerated CCA rule changes was recorded within  
8 the new sub-account of Account 1592. The impact recorded in the new sub-account of  
9 Account 1592 was approved for disposition starting on January 1, 2023, and was trued-up  
10 as part of the application for rates and other charges effective January 1, 2023.<sup>20</sup> Any  
11 forecasting variances over 2020-2024 period will be captured in the Capital Related Revenue  
12 Requirement Variance Account (CRRRVA) (as discussed in paragraph 5.2 in this Schedule).

13

14 As discussed in in Exhibit 6, Tab 2, Schedule 1, in Bill C-19, a new rule was introduced and  
15 received Royal Assent in June 2022, where immediate expensing would be available for  
16 “eligible property” acquired by a Canadian Controlled Private Corporation (“CCPC”) on or  
17 after April 19, 2021, and that becomes available for use before January 1, 2024, up to a  
18 maximum amount of \$1.5 million per taxation year. CCA deducted under this rule is allowed  
19 as long as the total CCA deduction does not exceed the capital cost of the eligible property.  
20 The PILs impact on the revenue requirement of these new immediate expensing rules to  
21 equal \$0.54 million (i.e. \$1.5 million x income tax rate of 26.5%, then divided by the gross-  
22 up factor (1 - 26.5%) per taxation year from 2021 to 2023. The total impact on those years  
23 is \$1.6 million and \$0.2 million of carrying charges is expected to be calculated on the  
24 balance by December 31, 2024. Toronto Hydro seeks clearance of a \$1.8 million credit

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<sup>20</sup> EB-2022-0065, Decision and Rate Order (December 8, 2022) at page 15.

1 balance. Toronto Hydro requests the continuation of this account in the 2025-2029 rate  
2 period.

3

4 **4.7 Account 1508 - subaccount - Wireless Attachments**

5 This account tracks costs and revenues associated with wireless pole attachments.  
6 Revenues recorded in this deferral account are the actual revenues received through the  
7 negotiated contracts with wireless carriers, as well as the one-time revenues collected  
8 directly to cover the one-time costs, such as any make-ready costs incurred by Toronto  
9 Hydro to accommodate an attachment on its pole. Costs recorded in the deferral account  
10 are one-time costs incurred. Table 9 shows the details of the actual and forecasted costs and  
11 revenues included in this account. Toronto Hydro seeks clearance of a \$3.6 million credit  
12 balance. Toronto Hydro requests the continuation of this account in the 2025-2029 rate  
13 period.

14

15 **Table 9: Wireless Attachment Costs and Revenues (\$ Thousands)**

	Actual			Forecast		Total
	2020	2021	2022	2023	2024	
Wireless Attachment Costs	253.2	130.1	200.3	42.4	-	626.1
Wireless Attachments Revenues	(823.5)	(832.8)	(648.1)	(802.2)	(846.9)	(3,953.4)
Wireless Attachment Costs – carrying charges	(0.4)	1.7	9.5	30.3	31.2	72.2
Wireless Attachments Revenues – carrying charges	5.7	(6.4)	(34.6)	(129.5)	(170.5)	(335.4)
<b>Total</b>	<b>(564.9)</b>	<b>(707.4)</b>	<b>(472.9)</b>	<b>(859.0)</b>	<b>(986.2)</b>	<b>(3,590.5)</b>

16

17



**4.8 Account 1508 - subaccount - Wireline Pole Attachment Revenue Variance Account**

On December 16, 2021, the OEB issued an Order (EB-2021-0302) establishing a new pole attachment charge and methodology starting in 2022,<sup>21</sup> and directed distributors to record variances between the newly approved OEB charge and the charge embedded in their underlying rates. This account tracks the difference between the wireline pole attachment rate (\$44.50) approved by the OEB on an interim basis in the utility’s 2021 Rate Application (EB-2020-0288) and the charge approved by the OEB in EB-2021-0302 (\$34.76).

**Table 10: Wireline Pole Attachment Rate Variances**

Wireline Pole Attachment	Actual			Forecast		Total
	2020	2021	2022	2023	2024	
Number of Attachment Embedded in Rate (a)	113,630	113,630	113,630	113,630	113,630	
Pole Attachment Charge Embedded in Rates <sup>1</sup> (b)	\$44.50	\$44.50	\$44.50	\$44.50	\$44.50	
Wireline Pole Attachment revenue embedded in Rates (\$ Millions) (c = a x b)	\$5.1	\$5.1	\$5.1	\$5.1	\$5.1	\$25.5
Actual/Forecast Pole Attachment Charge <sup>1</sup> (d)	\$44.50	\$44.50	\$34.76	\$34.76	\$34.76	
Actual/Forecast Wireline Pole Attachment revenue embedded in Rates (\$ Millions) (e = a x d)	\$5.1	\$5.1	\$4.0	\$4.0	\$4.0	\$22.2
<b>Variance (\$ Millions) (c – e)</b>			<b>\$1.1</b>	<b>\$1.1</b>	<b>\$1.1</b>	<b>\$3.3</b>
<b>Carrying Charges (\$ Millions)</b>			<b>\$0</b>	<b>\$0.1</b>	<b>\$0.1</b>	<b>\$0.2</b>
<b>Total Forecast for Clearance (\$ Millions)</b>						<b>\$3.5</b>

**4.9 Account 1533 – Renewable Generation Connection Funding Adder Deferral Account, Sub-account Provincial Rate Protection Payment Variances**

In its 2015-2019 rate application (EB-2014-0116), Toronto Hydro requested (and the OEB approved) the Renewable Enabling Investments Provincial Rate Protection Recovery Variance Account.<sup>22</sup> The continuation of this account was approved by the OEB in the 2020-

<sup>21</sup> EB-2021-0302, Decision and Order (December 16, 2021) at page 3.

<sup>22</sup> EB-2014-0116, Decision and Order (December 29, 2015) at page 51.

1 2024 Rate Application.<sup>23</sup> This account tracks the difference between the 2020-2024 revenue  
2 requirement associated with Renewable Enabling Improvements (“REI”) investments  
3 funded through Provincial Rate Protection and collected through payments from the IESO,<sup>24</sup>  
4 and the revenue requirement associated with actual REI investments over this period as  
5 detailed in Exhibit 2A, Tab 5, Schedule 1.

6

7 To address the distribution level constraints, Toronto Hydro planned to undertake a number  
8 of REI investments over the 2020-2024 period as part of its Generation Protection,  
9 Monitoring and Control (“GPMC”) program (Exhibit 2B, Section E5.5)<sup>25</sup> and its Non-Wires  
10 Solutions program (formerly Energy Storage Systems).<sup>26</sup> However, due to the following  
11 changes and challenges, some of the planned expenditures did not materialize:

12

- 13 • **Generation Protection, Monitoring and Control:** Capital expenditures are forecast  
14 to be 18 percent lower than planned primarily due to a slower rate of REI projects  
15 over the current rate period than forecasted and technical challenges in undertaking  
16 station bus-tie reactors in co-ordination with the transmitter.
- 17 • **Energy Storage:** As detailed in Exhibit 2B, Section E7.2, capital expenditures are  
18 forecast to be 79 percent lower than planned due to challenges in finding a cost-  
19 effective site for an ESS installation and supply chain constraints related to the  
20 procurement of ESS technology.

21

22 As a result of the factors summarized above, Toronto Hydro forecasts the balance in this  
23 account to be \$7.4 million (credit) at the end of 2024. Table 11 below presents the details:

---

<sup>23</sup> EB-2018-0165, Decision and Order (December 19, 2019) at pages 118-119.

<sup>24</sup> Exhibit 2A, Tab 6, Schedule 1

<sup>25</sup> EB-2018-0165, Exhibit 2B, Section E5.5

<sup>26</sup> EB-2018-0165, Exhibit 2B, Section E7.2

1 **Table 11: REI Variance Account (\$ Millions)**

	Actual			Forecast		Total
	2020	2021	2022	2023	2024	
Approved Revenue Requirement	1.5	2.2	2.6	3.0	3.3	<b>12.6</b>
Actual/Forecast Revenue Requirement	0.8	1.3	1.3	1.3	0.6	<b>5.3</b>
<b>Variance Account Balance</b>	<b>(0.8)</b>	<b>(0.9)</b>	<b>(1.3)</b>	<b>(1.7)</b>	<b>(2.6)</b>	<b>(7.4)</b>

2

3 Toronto Hydro requests the continuation of this variance account in the 2025-2029 rate  
 4 period to track variances related to REI investments as outlined in Exhibit 2A, Tab 5, Schedule  
 5 1.

6

7 **4.10 Account 1568 – Lost Revenue Adjustment Mechanism (“LRAM”) Variance Account**  
 8 **(“LRAMVA”)**

9 In the 2023 Rate Application (EB-2022-0065), the OEB approved the deferral of Toronto  
 10 Hydro’s LRAMVA balances until its next rebasing application, in order to enable the utility to  
 11 propose a modified LRAMVA threshold to account for the discontinuation of Conservation  
 12 First Framework programs. In this application, Toronto Hydro seeks clearance of the 2020-  
 13 2022 LRAMVA balances for the debit balance of \$5.6 million.<sup>27</sup> Evidence supporting this  
 14 request is outlined in Exhibit 9, Tab 2, Schedule 3. Toronto Hydro requests the continuation  
 15 of this account in the 2025-2029 rate period.

16

17 **4.11 Account 1508 - subaccount - Gains on Sale of Properties related to the Operating**  
 18 **Centres Consolidation Program (“OCCP”)**

19 In 2018, Toronto Hydro disposed of its property at 5800 Yonge, resulting in a giveback to  
 20 customers in the current 2020-2024 rate period of \$73.7 million based on the fair market

---

<sup>27</sup> Toronto Hydro notes that the balances in the LRAMVA were not reported in RRR or AFS filings because the utility did not have sufficient information at the time to estimate the balances in the account.

1 value payment that it received for this property.<sup>28</sup> The gain on sale of 5800 Yonge was  
2 recorded in Account 1508 subaccount Variance Account for Gains on Sale of Properties  
3 Related to the Operating Centres Consolidation Program (“OCCP”), established by the OEB  
4 in the 2015-2019 rate application.<sup>29</sup>

5

6 In addition to the fair market value of this property, a variable consideration (“bonus  
7 payment”) was incorporated into the Agreement of Purchase and Sale (“APS”) based on the  
8 potential increase in gross floor area as a result of zoning bylaw applications submitted by  
9 the purchaser. The increase in gross floor area was achieved and Toronto Hydro intends to  
10 return this variable consideration (bonus payment) to ratepayers to offset rate pressures in  
11 the 2025-2029 period, through the OCCP variance account. The amount proposed for  
12 clearance is a \$33.4 million credit to customers.

13

14 Toronto Hydro requests the continuation of this variance account in the 2025-2029 period  
15 as there may be further variable consideration available to the utility under the APS.

16

#### 17 **4.12 Account 1508 - subaccount - Useful Life Changes Variance Account**

18 In accordance with the OEB’s decision in the 2020-2024 Rate Application (EB-2018-0165),  
19 Toronto Hydro completed a Depreciation Study which is filed at Exhibit 2A, Tab 2, Schedule  
20 1, Appendix D. Toronto Hydro adopted the changes in asset useful lives resulting from the  
21 study as of January 1, 2023. In anticipation of an overall net decrease to its depreciation  
22 expense, Toronto Hydro proposed and the OEB approved as part of the 2023 Rate  
23 Application (EB-2022-0065) a new variance account to track depreciation impacts related to  
24 expected changes to the financial useful lives of its capital assets. The OEB determined that

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<sup>28</sup> EB-2018-0165, Draft Rate Order (January 28, 2020) at page 31.

<sup>29</sup> EB-2014-0116, Decision and Rate Order (March 1, 2016), Appendix E at pages 6-8.

1 it was appropriate to establish a new account to the benefit of customers, and  
 2 *“commend[ed] Toronto Hydro for bringing forward this proposal during its Custom IR term,*  
 3 *such that the new account may be effective January 1, 2023.”* In approving this account, the  
 4 OEB accepted Toronto Hydro’s offer to address the merits of different calculation  
 5 approaches in its rebasing application, and approved a second account to record carrying  
 6 charges on the Useful Life Change variance account. The OEB stated that the second account  
 7 was being established on a provisional basis, to enable the consideration of carrying charges  
 8 on the variance account based on the calculation approach approved at rebasing.<sup>30</sup>

9  
 10 Appendix B to this schedule details the calculation of the change in depreciation based on:  
 11 (i) Toronto Hydro’s proposed revenue requirement impact approach and (ii) the  
 12 methodology of Account 1576 – CGAAP Accounting Changes, which OEB Staff proposed as  
 13 an alternative in EB-2022-0065. Table 12 below presents a summary comparing both  
 14 approaches:

15  
 16 **Table 12: Comparison of Calculation Approaches for the Useful Life Changes Variance**  
 17 **Account (\$ Millions)**

	2024 DVA Balance
Approach 1: Toronto Hydro's proposed approach	(136.5)
Approach 2: Account 1576 approach	(128.9)

18  
 19 As presented in Appendix B, Toronto Hydro’s proposed methodology captures all the capital  
 20 related revenue requirement impacts (i.e. return on equity, deemed interest, depreciation,  
 21 and PILs) as a result of the change in depreciation in 2023 and 2024. OEB staff’s proposed  
 22 Account 1576 approach captures the net change in property, plant, and equipment (“PP&E”)

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<sup>30</sup> EB-2022-0065, Decision and Order (December 8, 2022) at pages 21-22.

1 and a return on rate base component calculated based on the number of years of rate rider  
2 disposition. The key difference is the consideration of PILs impacts in Toronto Hydro’s  
3 proposed approach, as well as the application of carrying charges to the balance in the  
4 account, both of which drive a higher balance to the benefit of customers. For these reasons,  
5 the utility proposes to calculate the impact of the useful life changes per the first approach  
6 in the table above which yields a balance for clearance of \$136.5 million (credit).

7

8 **4.13 Account 1508 - subaccount - Ultra-Low Overnight Rate Costs**

9 On October 18, 2022 (EB-2022-0160), the OEB proposed amendments to the Standard  
10 Supply Service Code and the Regulated Price Plan (“RPP”) Manual to implement a new  
11 optional ultra-low overnight (“ULO”) price plan for electricity consumers on the RPP. The  
12 Notice stated that the OEB would allow distributors to track the revenue requirement  
13 impacts of their material costs of implementing the ULO option in a deferral account.<sup>31</sup> On  
14 March 2, 2023, the OEB issued Accounting Order (001-2023) authorizing electricity  
15 distributors to establish two sub-accounts to Account 1508 – Other Regulatory Assets to  
16 track ULO implementation costs and relevant carrying charges.<sup>32</sup>

17

18 In order to implement the ULO price plan option for customers, Toronto Hydro expects to  
19 incur and capitalize by the end of the 2020-2024 period approximately \$2 million in capital  
20 expenditures. The project involved a highly complex solution with a compressed timeline  
21 including configuration and coding changes to the utility’s (1) Customer Information System  
22 (“CIS”) to automate a new billing model with new rates configuration, (2) Customer Self-  
23 Service portal to enable customers to opt in to or opt out of the new pricing plan, (3) online

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<sup>31</sup> EB-2022-0160, Ontario Energy Board, Notice of Proposal to Amend the Standard Supply Service Code and the Regulated Price Plan Manual (October 18, 2022) at page 6.

<sup>32</sup> EB-2022-0160, Ontario Energy Board, Accounting Order (001-2023) for the Establishment of a Deferral Account to Record Impacts Arising from Implementing the Ultra-Low Overnight (ULO) Regulated Price Plan Option (March 2, 2023).

1 calculator to provide customers billing estimates between different pricing options, and (4)  
 2 meter data management systems to integrate customer usage data into the solution.  
 3 The amount proposed for clearance is based on the expected cumulative capital revenue  
 4 requirement associated with these expenditures as of December 31, 2024, at the time of  
 5 rebasing. Table 13 below presents the revenue requirement calculation.

6

7 **Table 13: Revenue Requirement for Ultra-Low Overnight Rate Costs (\$ Millions)**

Revenue Requirement Calculation	Actual			Forecast		Total
	2020	2021	2022	2023	2024	
Return on Equity	-	-	-	0.0	0.1	0.1
Interest	-	-	-	0.0	0.0	0.1
Depreciation	-	-	-	0.0	0.4	0.4
PILS	-	-	-	(0.7)	0.2	(0.5)
<b>Revenue Requirement</b>	-	-	-	<b>(0.6)</b>	<b>0.7</b>	<b>0.1</b>

8

9 **4.14 Account 1508 - subaccount - Green Button Initiative Costs**

10 As noted in accounting order 003-202 issued on November 1, 2021 (EB-2021-0183), the OEB  
 11 established a generic deferral account<sup>33</sup> for rate regulated distributors to record the  
 12 incremental costs directly attributable to the implementation of the Green Button initiative,  
 13 in a manner that accords with the requirements set out in Ontario Regulation 633/21 made  
 14 under the *Electricity Act, 1998*.<sup>34</sup>

15

16 In order to implement the Green Button initiative, Toronto Hydro expects to incur and  
 17 capitalize by the end of the 2020-2024 period approximately \$1.1 million in capital  
 18 expenditures for a solution that requires in-depth coding and configuration changes to the  
 19 utility's (1) Customer Self-Service Portal to enable the registration process for customers and

<sup>33</sup> EB-2021-0183, OEB Letter re Green Button Implementation (October 12, 2021) at page 4.

<sup>34</sup> SO 1998, c 15, Sched A.

1 third-party energy consultants, and (2) Customer Information System (“CIS”) and meter data  
2 management systems to extract customer electricity consumption data and to integrate  
3 with third-party data custodian system. The amount proposed for clearance is based on the  
4 expected cumulative capital revenue requirement associated with these expenditures as of  
5 December 31, 2024, at the time of rebasing. Table 14 below presents the revenue  
6 requirement calculation.

7

8 **Table 14: Revenue Requirement for Green Button Initiative (\$ Millions)**

Revenue Requirement Calculation	Actual			Forecast		Total
	2020	2021	2022	2023	2024	
Return on Equity	-	-	-	-	0.0	0.0
Interest	-	-	-	-	0.0	0.0
Depreciation	-	-	-	-	0.2	0.2
PILS	-	-	-	-	(0.3)	(0.3)
<b>Revenue Requirement</b>	-	-	-	-	<b>(0.1)</b>	<b>(0.1)</b>

9

10 **4.15 Account 1588 – Power (RSVA<sub>Power</sub>) and Account 1589 Global Adjustment (RSVA<sub>GA</sub>)**  
11 **Enhancement Model Changes**

12 The balances within Account 1588 and Account 1589 were last approved on a final basis for  
13 year-end 2021 in Toronto Hydro’s 2023 Rate Application (EB-2022-0065). In the 2024 Rate  
14 Application (EB-2023-0054), Toronto Hydro excluded the balances within Accounts 1588 and  
15 1589 from its proposed RSVA clearances due to the need to further analyze the 2021  
16 principal adjustment. This matter is related to the “actual” component of the 2021 principal  
17 adjustment of Account 1588 and does not impact any audited balances.

18

19 When preparing the 2024 Rate Application, the utility found that the 1588 balance was  
20 higher than usual (and above the threshold in GA Workform) and investigated the causes,  
21 finding that \$5.7 million of the variance was related to reporting model enhancements. As



1 customer billing dates do not always align with fiscal period dates, Toronto Hydro uses a  
2 model to allocate billings into their respective periods to get a proxy for “actual” billings by  
3 period, which is used in calculating principal adjustments. In 2022, the utility enhanced the  
4 model to more accurately allocate billings to their periods. These enhancements include  
5 improved estimation logic by using actual meter data reads and improved logic to validate  
6 larger rate classes (rate classes billed on kVA load) which improve data accuracy by utilizing  
7 actual meter read data currently available in the metering systems.

8

9 The enhancements noted above were implemented in 2022, after Toronto Hydro received  
10 approval in EB-2022-0065 to dispose of the 2021-year end balances in Account 1588 and  
11 Account 1589. As part of its analysis for the 2024 Application, Toronto Hydro recalculated  
12 the 2021 Account 1588 balance using the enhanced model and found it to be higher by \$5.7  
13 million. To enable the OEB to deal with this matter efficiently and to provide Toronto Hydro  
14 additional time to assess the implications of recovering the \$5.7 million (i.e. by including it  
15 in the 2022 reversal of 2021 principal adjustments), Toronto Hydro proposed to defer the  
16 review and disposition of Accounts 1588 and 1589 to this application.

17

18 Toronto Hydro hereby seeks OEB approval to clear the 2022 balances in Accounts 1588 and  
19 1589 effective January 1, 2025, as provided in the continuity schedule at Exhibit 9, Tab 2,  
20 Schedule 1, which includes the reversal of the \$5.7 million principal adjustment amount from  
21 2021. This reversal is in line with the OEB’s expectation that all principal adjustment amounts  
22 are reversed in the following year per the Global Adjustment (“GA”) Analysis Workform and  
23 the February 21, 2019 Accounting Guidance.<sup>35</sup> Toronto Hydro submits that this request does  
24 not represent a correction of an error (per the OEB’s October 31, 2019 letter regarding

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<sup>35</sup> Accounting Procedures Handbook Update, Accounting Guidance Related to Commodity Pass-Through Accounts 1588 & 1589 (February 21, 2019) at pages 34-38.

1 adjustments to correct for errors after disposition) because it clearly relates to an  
2 enhancement of the model rather than an error in the utilities accounting records.<sup>36</sup>  
3 Nonetheless, the utility has been transparent in disclosing and explaining the matter in  
4 alignment with OEB expectations. Similarly, Toronto Hydro submits that this proposal does  
5 not represent an adjustment to an account balance that was previously approved by the  
6 OEB on a final basis, since Toronto Hydro only seeks to reverse the principal adjustment in  
7 the GA Analysis Workform according to the OEB's expectations, and does not propose to  
8 change any 2021 balances or do anything outside of normal processes. In the alternative  
9 that the OEB is inclined to view this as an adjustment, Toronto Hydro submits that it should  
10 nonetheless be approved in accordance with the February 21, 2019 Accounting Guidance  
11 and the GA Analysis Workform.

12

13 Toronto Hydro confirms that all principal adjustment amounts prior to 2021 were reversed  
14 in the following year and the utility has not made any adjustments to DVA balances that  
15 were previously approved by the OEB on a final basis. DVA balances prior to 2021 are not  
16 impacted by the above principal adjustment reversal since these have been reversed year-  
17 over-year in the Global Adjustment ("GA") Analysis Workform.

18

19 The updated balances for Accounts 1588 and 1589 clearance are reflected in the Group 1  
20 DVA Continuity Schedule provided in Exhibit 9, Tab 2, Schedule 1 and the revised GA Analysis  
21 Workform is available in Exhibit 9, Tab 2, Schedule 2.

22

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<sup>36</sup> OEB Letter Re: Adjustments to Correct for Errors in Electricity Distributor "Pass-Through" Variance Accounts After Disposition (October 31, 2019).

1 **4.16 Account 1508 – subaccount – Getting Ontario Connected Act (“GOCA”) Variance**

2 **Account**

3 On October 31, 2023, the OEB established a generic, industry-wide variance account to  
4 record incremental costs of locates resulting from the implementation of Bill 93 (*Getting*  
5 *Ontario Connected Act, 2022*), with an effective date of April 1, 2023.<sup>37</sup> As this decision was  
6 released just weeks before Toronto Hydro submitted its application to the OEB, the utility  
7 intends to file supplemental evidence to forecast the balances that it expects in this account  
8 over the current rate period.

9

10 As discussed in further detail in the Customer Operations program in Exhibit 4, Tab 2,  
11 Schedule 8, there remains a great degree of uncertainty regarding the full extent of locates-  
12 driven costs that Toronto Hydro may need to incur during the 2025-2029 rate period to  
13 achieve compliance with the legislative and regulatory requirements governing locates. For  
14 example, the Government of Ontario may introduce further legislative changes, or there  
15 may be additional material costs of coming into compliance with the performance standards  
16 set out in Ontario Regulation 87/23 made under the *Ontario Underground Infrastructure*  
17 *Notification System Act, 2012* (“OUINSA”),<sup>38</sup> which is enforced by Ontario One Call. Given  
18 these conditions, Toronto Hydro requests continuation of the GOCA account in the 2025-  
19 2029 rate period. The continuation of this account is in the best interests of ratepayers given  
20 the uncertainty that remains with respect to the locates regime in Ontario, as it allows  
21 Toronto Hydro to remain in compliance with its legal obligations under the OUINSA during  
22 the next rate term, without having to provision in its forecast of 2025-2029 rates for a higher  
23 recovery of locates costs as set out in the alternative scenario outlined in the Customer  
24 Operations program.

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<sup>37</sup> EB-2023-0143

<sup>38</sup> SO 2012, c 4.

1 **5. REGULATORY ASSET ACCOUNTS THAT ARE NOT PROPOSED FOR DISPOSTION**

2 **5.1 All RSVA Accounts except 1588 and 1589**

3 Toronto Hydro proposed to clear most of the RSVA accounts for 2022 amounting to a \$108.2  
4 million (debit) recovery from customers as part of Toronto Hydro’s 2024 Rate Application,  
5 including Account 1550 – Low Voltage Variance Account, Account 1580 – Wholesale Market  
6 Services, Account 1584 – Network, Account 1586 – Connection. As discussed above, Toronto  
7 Hydro did not request the disposition of the 2022 balances in Account 1588 – Power and  
8 Account 1589 – Global Adjustment through the 2024 Rate Application and is seeking to clear  
9 those balances through this application.

10 Through the discovery phase of this proceeding, Toronto Hydro intends to update the  
11 evidence to support the clearance of the RSVA accounts for the 2023 period. However,  
12 Toronto Hydro notes that it will not be proposing to dispose any residual balances in Account  
13 1595 as any sub-accounts that have not already been approved for disposition will not meet  
14 the 2-year requirement for 2025 disposition.

15

16 **5.2 Account 1508 – subaccount - Capital Related Revenue Requirement (“CRRRVA”)**

17 The Capital-Related Revenue Requirement Variance Account (CRRRVA) records the variance  
18 between the capital-related revenue requirement included in rates and the actual capital-  
19 related revenue requirement (excluding balances captured in the Externally Driven Capital  
20 Variance Account).<sup>39</sup> The CRRRVA is an asymmetrical account in that it only records for  
21 disposition variances that result in a credit (refund) to customers.

22

23 As noted in Exhibit 2A, Tab 1, Schedule 1, over the current rate period, Toronto Hydro’s  
24 actual and forecasted in-service additions (“ISAs”) are approximately 1.1 percent higher

---

<sup>39</sup> EB-2018-0165, Decision and Order (December 19, 2019) at page 193. In accordance with the OEB decision at page 43, the 2020-2024 CRRRVA includes derecognition expenses.

1 (\$33.3 million) than the planned ISAs that formed the basis of the capital-related revenue  
2 requirement approved by the OEB in setting 2020 to 2024 rates.<sup>40</sup>

3

4 For information purposes, Toronto Hydro notes that if this account were symmetrical, the  
5 balance would be a \$48 million debit (collectible) from customers. Table 15 below provides  
6 a summary of the supporting calculation for this hypothetical scenario.

7

8 **Table 15: Example of CRRRVA Calculation if the Account were Symmetrical (\$ Millions)**

	Actuals			Forecast		Total
	2020	2021	2022	2023	2024	
Capital-Related RR (Rate Order, Feb 12, 2020 - Table 7)	525.8	563.1	575.4	627.2	664.8	2,956.3
RR impact from the application of stretch factor to capital funding	-	(4.7)	(9.8)	(15.0)	(20.6)	(50.1)
Capital-Related RR in Approved 2020-2024 Rates	525.8	558.3	565.6	612.3	644.2	2,906.2
Sub-account 1508 - Externally Driven capital Variance Account	(0.8)	0.0	0.4	1.0	0.8	1.6
Sub-account 1508 - Customer Choice Initiatives Capital Variance Account	-	(0.2)	0.3	0.3	0.2	0.6
Sub-account 1508 - Green Button Initiative Capital Variance Account	-	-	-	-	(0.1)	(0.1)
Sub-account 1508 - Ultra-Low Overnight Rate Costs Variance Account	-	-	-	(0.6)	0.7	0.1
Sub-account 1508 - Useful Life Changes Variance Account	-	-	-	(62.4)	(68.5)	(130.9)
Other Adjustments	5.5	(0.6)	(2.9)	(5.6)	(1.5)	(5.2)
Capital-Related RR in Approved Rates eligible for CRRRVA	530.5	557.6	563.4	544.9	575.9	2,772.0
Actual Historic & Forecast Bridge Capital-Related RR	532.5	558.1	586.4	551.8	591.4	2,820.3
<b>Sub-account 1508 - CRRRVA</b>	<b>2.1</b>	<b>0.6</b>	<b>23.0</b>	<b>7.0</b>	<b>15.5</b>	<b>48.1</b>

Note: Rounding variances may exist

<sup>40</sup> Please refer to Exhibit 2A, Tab 1, Schedule 1 for more information.

1 Toronto Hydro proposes to discontinue this account in the 2025-2029 rate period as it has  
2 proven over the last two custom rate periods (i.e. 2015-2019 and 2020-2024) its ability to  
3 deliver multi-year capital programs within very reasonable margins of variance, as shown  
4 above. To protect customers against utility overearnings, Toronto Hydro proposes to  
5 continue the Earnings Sharing Mechanism approved in the last rate application and  
6 described below in section 5.7. Furthermore, the utility proposes to continue to track  
7 variances in capital expenditures that have a higher degree of sensitivity or variability due  
8 to external factors through the proposed Demand-Related Variance Account (“DRVA”)  
9 outlined in section 9.2.

10

11 **5.3 Account 1522 – Pension & OPEB Forecast Accrual versus Actual Cash Payment**  
12 **Differential Carrying Charges**

13 In May 2015, the OEB commenced an industry-wide consultation on rate-regulated utility  
14 pensions and OPEBs (EB-2015-0040). The final report, entitled Regulatory Treatment of  
15 Pension and OPEB Costs and issued on September 14, 2017, established the following  
16 accounts to track the difference between the forecasted OPEB accrual amount collected in  
17 rates and the actual cash payments made, with the calculation of the carrying charges based  
18 on the cumulative differential credit balance (the cumulative accrual amount exceeds the  
19 cumulative cash payments):<sup>41</sup>

- 20 1) Account 1522, Pension & OPEB Forecast Accrual versus Actual Cash Payment  
21 Differential;
- 22 2) Account 1522, Pension & OPEB Forecast Accrual versus Actual Cash Payment  
23 Differential Contra Account; and

---

<sup>41</sup> EB-2015-0040 Regulatory Treatment of Pension and Other Post-employment Benefits (OPEBs) Costs (September 14, 2017) at page 21.

1           3) Account 1522, Pension & OPEB Forecast Accrual versus Actual Cash Payment  
2           Differential Carrying Charges.

3

4           As at December 31, 2022, there was no material balance in Account 1522, Pension & OPEB  
5           Forecast Accrual versus Actual Cash Payment Differential Carrying Charges.

6

7           In the last rate application, the OEB asked Toronto Hydro to gather information starting in  
8           2020 to calculate the accrual OPEB amount based on the annual depreciation associated  
9           with its cumulative undepreciated capitalized OPEB costs in rate base.<sup>42</sup>

10

11           Toronto Hydro notes that while an estimate has been provided for actual depreciation, high  
12           level assumptions were necessary to arrive at the result. In-service additions in a given year  
13           typically consist of a portion of Construction Work In-Progress (“CWIP”) from prior years and  
14           current year capital expenditures being placed in service. Given that OPEB costs are a  
15           component within labour costs capitalized over several programs, it cannot be tracked until  
16           placed in service posing practical limitations for identifying OPEB in CWIP related to projects  
17           that span multiple years. To address this limitation, the estimated in-service additions which  
18           are used to calculate OPEB related depreciation each year are assumed to be equal to the  
19           estimated capital expenditures associated with the OPEB accruals in that same year. While  
20           this approach calculates depreciation on a portion of current year capital expenditures in a  
21           given year that may not have yet been placed in-service, it directionally offsets the  
22           depreciation on current year in-service additions of prior year CWIP that has not been  
23           separately estimated.

---

<sup>42</sup> EB-2018-0165, Decision and Order (December 19, 2019) at page 187.

1 **Table 16: Estimated Forecast vs. Actual Cumulative Depreciation of OPEB Costs**  
 2 **(\$ Millions)**

	2020	2021	2022
Estimated Forecast Cumulative Depreciation of OPEB costs capitalized starting in 2020 <sup>43</sup>	0.1	0.2	0.4
Estimated Actual Cumulative Depreciation of OPEB costs capitalized starting in 2020	0.2	0.4	0.5

3

4 **5.4 Account 1551 – Smart Metering Entity Charges**

5 In its role as the Smart Metering Entity (“SME”), the IESO manages the development of the  
 6 meter data management/repository (“MDM/R”) to collect, manage, store, and retrieve  
 7 information related to the metering of customers’ use of electricity in Ontario.

8

9 Effective May 1, 2013, the Smart Metering Entity charge levied and collected by the SME  
 10 from all distributors identified in the OEB’s annual Yearbook of Electricity Distributors was  
 11 set at \$0.788 per month for each Residential and General Service <50 kW customer for each  
 12 distributor. The Smart Metering Entity charge was in effect from May 1, 2013 to October  
 13 31, 2018. On March 1, 2018, the OEB issued its Decision and Order (EB-2017-0290)  
 14 approving a new Smart Metering Entity charge of \$0.57 per month for each Residential and  
 15 General Service <50 kW customer, effective from January 1, 2018 to December 31, 2022.

16

17 The previously approved Smart Metering Entity charge of \$0.788 per month was collected  
 18 for the first three months of 2018 and resulted in an accumulated credit of \$0.66 per smart  
 19 meter.

---

<sup>43</sup> EB-2018-0165, Interrogatory Response, U-Staff-196 (June 11, 2019) at page 4. Table 2 provides the accrual versus cash tracking methodology effective January 1, 2020. Consistent with Toronto Hydro’s 2020-2024 rate setting approach for OM&A, 2021-2024 OPEB costs were determined by escalating the 2020 approved amounts by inflation minus the stretch factor (I-X) and therefore, differ slightly from those included in U-Staff-196.



1 Toronto Hydro records in Account 1551 amounts paid to the IESO through the Smart  
2 Metering Entity charge and amounts recovered from customers through the distribution  
3 Rate Rider for Smart Metering Entity Charge. Toronto Hydro proposed to clear the Smart  
4 Metering Entity Charges account for 2022 amounting to a \$2.2 million credit (refund) to  
5 customers as part of Toronto Hydro’s 2024 Rate Application (EB-2023-0054).

6

7 **5.5 Account 1508 – subaccount - Local Initiatives Program**

8 In a letter to all rate-regulated electricity distributors dated May 28, 2021 (EB-2021-0106),  
9 the OEB established a new deferral account for distributors partnering with the IESO in its  
10 Local Initiatives Program (“LIP”) to track incremental costs incurred through this partnership.  
11 The OEB further detailed that eligible distributor costs to be recorded in this account may  
12 potentially include activities such as procurement support, providing access to data,  
13 supporting evaluation, measurement, and verification activities, and supporting marketing  
14 and outreach activities, but shall not include the cost of resources procured through the LIP.  
15 As at December 31, 2022, there was no material balance in the LIP deferral account. Toronto  
16 Hydro intends to apply for the disposition of the balance in this account in the next rebasing  
17 application, if the balance is material.

18

19 **5.6 Account 1508 – subaccount - Carillion Insolvency Payments Receivable Account**

20 In the 2020-2024 Rate Application (EB-2018-0165), the OEB established a deferral account  
21 to record the revenue requirement impact of a reduction to rate base associated with  
22 payments from Carillion (the general contractor for the Copeland Phase 1 project) to  
23 Toronto Hydro resulting from the ongoing insolvency litigation, including any prudently  
24 incurred expenses with respect to the litigation and recovery of any amount rewarded. As  
25 the insolvency litigation is still ongoing, there is no balance in this account as of year-end  
26 2022. Toronto Hydro intends to update this evidence if the insolvency litigation concludes

1 while the record for this application remains open. Otherwise, Toronto Hydro requests the  
 2 continuation of this account in the 2025-2029 period.

3

4 **5.7 Earnings Sharing Mechanism (“ESM”)**

5 In the 2020-2024 Rate Application (EB-2018-0165), the OEB approved a cumulative,  
 6 asymmetrical Earnings Sharing Mechanism (“ESM”) variance account using a Return on  
 7 Equity (“ROE”) based calculation with all earnings in excess of 100 basis points over the  
 8 approved ROE shared 50:50 with ratepayers.

9

10 Table 17 below provides a summary of Toronto Hydro’s calculations to substantiate that as  
 11 of year-end 2022, there is no balance in this account. Given the under earnings in the last  
 12 three years,<sup>44</sup> Toronto Hydro does not expect to have any balance in the ESM by the end of  
 13 the rate period.

14

15 **Table 17: 2020-2022 ESM Calculations**

		2020	2021	2022
Cumulative Adjusted NI	A=NICY+NIPY	107.1	239.5	385.4
Cumulative Actual Deemed Equity	B=EQ <sub>CY</sub> +EQ <sub>PY</sub>	1,813.6	3,683.6	5,646.4
ROE Cumulative	C=A/B	5.90%	6.50%	6.83%
ROE Approved	D	8.52%	8.52%	8.52%
<b>ROE Over (Under)</b>	<b>E=C-D</b>	<b>(2.62%)</b>	<b>(2.02%)</b>	<b>(1.69%)</b>

16

17 As directed by the OEB, Table 18 below presents the utility’s ESM calculation for 2019.<sup>45</sup>

---

<sup>44</sup> Please see Exhibit 1B, Tab 3, Schedule 3 for more information about deemed versus actual regulatory ROE over the 2020-2022 period.

<sup>45</sup> EB-2018-0165, Decision and Order (December 19, 2019) at page 182. Note the 2019 ESM was also previously reported through RRR. The 2015-2018 ESM calculations can be found in EB-2018-0165, Exhibit U, Tab 9, Schedule 1 at page 14.

1 **Table 18: 2019 ESM Calculation**

		<b>2019</b>
OM&A <sup>a</sup>	<i>A</i>	268.0
Revenue Offsets <sup>a</sup>	<i>B</i>	(56.5)
<b>Unadjusted non-capital revenue requirement (“Non-CRRR”)</b>	<i>C=A+B</i>	<b>211.5</b>
<u>RRR Adjustments</u> <sup>b</sup>		
Depreciation expense related to non-regulated assets (renewable energy investment)	<i>D</i>	(0.2)
Non-recoverable expenses – donations and meals	<i>E</i>	(0.4)
<b>Subtotal</b>	<i>F=C+D+E</i>	<b>210.9</b>
<u>Adjustments for items not included in rates</u>		
Amortization of 2014 balance in DVA account 1575 – IFRS USGAAP Transitional PP&E Amounts <sup>c</sup>	<i>G</i>	<b>6.6</b>
Amortization of capital contributions (deferred revenue) <sup>d</sup>	<i>H</i>	<b>5.9</b>
Past Service Costs	<i>I</i>	<b>(14.9)</b>
<b>Actual non-CRRR items for ESM purposes</b>	<i>J=F+G+H+I</i>	<b>208.5</b>
<b>Less: non-CRRR embedded in rates</b> <sup>e, f</sup>	<i>K</i>	<b>211.4</b>
<b>Non-CRRR difference</b>	<i>L=J-K</i>	<b>(3.0)</b>
Deemed equity portion of actual rate base <sup>g</sup>	<i>M</i>	1,751.8
Non-CRRR difference	<i>N=L/M</i>	(0.17%)
ESM threshold	<i>O</i>	1.00%
ESM test result	<i>N compared to O</i>	Within threshold

*Rounding variances may exist.*

<sup>a</sup> Source: RRR 2.1.7 - trial balance.

<sup>b</sup> Source: RRR 2.1.5.6 - Appendices 1 and 2.

<sup>c</sup> Source: RRR 2.1.7 - trial balance account 4310, reported as revenue offsets.

<sup>d</sup> Source: RRR 2.1.7 - trial balance account 4245, reported as revenue offsets.

<sup>e</sup> EB-2014-0116, Decision and Order (29<sup>th</sup> Dec, 2015) at page 49.

<sup>f</sup> 2019 non-CRRR was determined by escalating the 2015 non-CRRR amount by the inflation and X factors (i.e. ‘1-X’) in each year. 2015 non-CRRR was from EB-2014-0116, Draft Rate Order Update (February 29, 2016), Table 2 at page 6.

<sup>g</sup> Source: RRR 2.1.5.6 - ROE Summary.

2

3 To continue to protect customers against the risk of utility over-earnings, Toronto Hydro  
4 requests the continuation of the ESM in the 2025-2029 period. For more information, please  
5 refer to the Rate Framework evidence in Exhibit 1B, Tab 2, Schedule 1.

1 **6. SUMMARY OF PROPOSED DVA DISPOSITIONS**

2 Tables 19 and 20 below summarize Toronto Hydro’s proposed disposition of regulatory  
3 assets and liabilities.

4

5 **Table 19: Summary of Proposed Dispositions – Group 1 Accounts (\$ Millions)**

	Principal Balance as of Dec 31, 2023 (Forecast)	Carrying Charge Balance as of Dec 31, 2023 (Forecast)	Balances as of Dec 31, 2023 (Forecast)
<b>Group 1 Accounts</b>			
Account 1588 – Power (RSVA <sub>Power</sub> ) Enhancement Model Changes <sup>46</sup>	22.8	1.6	24.4
Account 1589 Global Adjustment (RSVA <sub>GA</sub> ) Enhancement Model Changes	(7.4)	(0.5)	(7.9)

6

7 **Table 20: Summary of Proposed Dispositions – Group 2 Accounts (\$ Millions)**

	Principal Balance as of Dec 31, 2024 (Forecast)	Carrying Charge Balance as of Dec 31, 2024 (Forecast)	Balances as of Dec 31, 2024 (Forecast)	Incremental carrying charges due to rate smoothing (Forecast)	Balances including the incremental carrying charges (Forecast)
<b>Group 2 Accounts</b>					
Customer Choice Initiative	0.6	0.0	0.6	0.1	0.6
Excess Expansion Deposits	(7.7)	(0.8)	(8.5)	-	(8.5)
Externally Driven Capital Variance Account (“EDCVA”)	1.5	0.1	1.6	0.1	1.7
Gain on Sale 2020 Decision (Gain on Sale of Properties)	3.4	0.3	3.7	0.3	4.1
Green Button Initiative Costs	(0.1)	(0.0)	(0.1)	-	(0.1)
Impact for USGAAP Deferral	(1.7)	0.0	(1.7)	-	(1.7)

---

<sup>46</sup> Includes \$5.7 million principal adjustment reversal

	Principal Balance as of Dec 31, 2024 (Forecast)	Carrying Charge Balance as of Dec 31, 2024 (Forecast)	Balances as of Dec 31, 2024 (Forecast)	Incremental carrying charges due to rate smoothing (Forecast)	Balances including the incremental carrying charges (Forecast)
LRAM Variance Account ("LRAMVA") <sup>47</sup>	5.0	0.6	5.6	-	5.6
Operating Centers Consolidation Program ("OCCP") Bonus Payment	(31.3)	(2.0)	(33.4)	-	(33.4)
50/60 Eglinton Bonus Payment	(9.6)	(0.6)	(10.2)	(0.5)	(10.7)
PILs and Tax Variances – CCA Changes	(1.6)	(0.2)	(1.8)	-	(1.8)
Wireless Attachments	(3.3)	(0.3)	(3.6)	(0.2)	(3.8)
Wireline Pole Attachment Revenue Variance	3.3	0.2	3.5	0.3	3.8
Ultra-Low Overnight Rate Costs	0.1	0.0	0.1	-	0.1
Useful Life Changes	(130.5)	(6.0)	(136.5)	(2.6)	(139.1)
Renewable Generation Connection Funding Adder Deferral Account – Provincial Rate Protection Payment Variances	(7.4)	0.0	(7.4)	-	(7.4)
<b>Total Balance</b>	<b>(179.3)</b>	<b>(8.7)</b>	<b>(188.1)</b>	<b>(2.4)</b>	<b>(190.5)</b>

1

2 Toronto Hydro confirms that it has not made any adjustments to previously approved DVAs.

3 With the exception of the LRAMVA,<sup>48</sup> the balances proposed for clearance match the

4 account balances filed in the RRR as of 2022-year end, forecasted to the end of 2024.

<sup>47</sup> Assuming OEB approval of the LRAM calculation methodology and variance account clearance as proposed in Exhibit 9, Tab 2, Schedule 3.

<sup>48</sup> Toronto Hydro notes that the balances in the LRAMVA were not reported in RRR or AFS filings because, as noted in the OEB's Decision in EB-2022-0065, the utility did not have sufficient information at the time those filings to estimate the balances in the account.

1 **7. DVA ALLOCATION AND RECOVERY METHOD**

2 Toronto Hydro proposes to allocate the DVA balances to the customer classes based on the  
 3 methodologies described in the OEB’s EDDVAR report. For accounts where the EDDVAR  
 4 report indicated allocation was to be determined on a case-by-case basis, Toronto Hydro has  
 5 proposed an allocator. For each of the accounts requested for clearance, the following table  
 6 shows the proposed rate class allocator.

7

8 **Table 21: Proposed Rate Class Allocator**

Account	Allocator
Customer Choice Initiative	2022 Number of RPP Customers
Excess Expansion Deposits	2022 Distribution Revenue
Externally Driven Capital Variance Account (“EDCVA”)	2022 Distribution Revenue
Gain on Sale 2020 Decision (Gain on Sale of Properties)	2022 Distribution Revenue
Green Button Initiative Costs	2022 Distribution Revenue
Impact for USGAAP Deferral	2022 Distribution Revenue
LRAM Variance Account (“LRAMVA”)	LRAMVA Model
Operating Centers Consolidation Program (“OCCP”) Bonus Payment	2022 Distribution Revenue
50/60 Eglinton Bonus Payment	2022 Distribution Revenue
PILs and Tax Variances – CCA Changes	2022 Distribution Revenue
Wireless Attachments	Forecast 2025 Revenue Offsets
Wireline Pole Attachment Revenue Variance	Forecast 2025 Revenue Offsets
Ultra-Low Overnight Rate Costs	2022 Number of RPP Customers
Useful Life Changes	2022 Distribution Revenue
Innovation Fund	2022 Distribution Revenue

9

10 **8. DEVELOPMENT OF RATE RIDERS**

11 In accordance with the previous rate applications, Toronto Hydro puts forward a single fixed  
 12 rate rider for those classes that are charged a fully fixed distribution rate (Residential and

1 Competitive Sector Multi-Unit Residential), and a single volumetric rate rider for all other  
2 classes for the clearance of all DVA amounts.

3

4 Toronto Hydro proposes various recovery periods for specified DVA accounts, beginning  
5 January 2025, in order to minimize and smooth out the bill impacts to all affected customers.  
6 More details on rate smoothing can be found in Exhibit 8, Tab 1, Schedule 1.

7 The derivation of the rate riders is shown in Exhibit 9, Tab 3, Schedule 1. The impacts of all  
8 proposed rate riders combined with the distribution rate changes are found in Exhibit 8, Tab  
9 6, Schedule 1.

10

11 Toronto Hydro is proposing to collect the amount allocated to the Innovation Fund through  
12 a rate rider over the 2025-2029 period. Details regarding the deferral account are provided  
13 in section 9.3 below and details regarding the Innovation Fund are provided in Exhibit 1B,  
14 Tab 4, Schedule 2.

15

## 16 **9. NEW DEFERRAL AND/OR VARIANCE ACCOUNTS**

17 As part of the Custom Rate Framework outlined in Exhibit 1B, Tab 2, Schedule 1, Toronto  
18 Hydro seeks approval for the following new Deferral and Variance Accounts: (1) the  
19 Performance Incentive Mechanism Deferral Account, (2) Demand Related Variance Account  
20 (“DRVA”), and (3) the Innovation Fund Variance Account. In addition, Toronto Hydro seeks  
21 approval to establish the 50/60 Eglinton Proceeds of Sale Deferral Account to dispose  
22 additional proceeds received from the sale of 50/60 Eglinton. Draft Accounting Orders for  
23 these accounts are provided in Appendix C to this schedule.

1 **9.1 Performance Incentive Mechanism Deferral Account (“PIM-DA”)**

2 Toronto Hydro seeks approval of a new deferral account – the Performance Incentive  
3 Mechanism Deferral Account (“PIM-DA”) – to record earnings related to the achievement of  
4 Performance Incentive Mechanism (“PIM”) as part of the Custom Rate Framework. The  
5 amounts recorded in this account would be reviewed in the next rebasing application for  
6 2030 rates, if the PIM is approved and the targets set on the 2025-2029 Custom Scorecard  
7 are achieved (or expected to be achieved) by the end of the rate period (i.e. 2029).<sup>49</sup>

8

9 **9.2 Demand Related Variance Account (“DRVA”)**

10 As customers, communities and governments at all levels are actively embarking on an  
11 energy transition to mitigate the existential and economic impacts of climate change, there  
12 is a greater role for electricity to play in the day-to-day energy needs of Toronto consumers  
13 to power previously non-electric energy uses (e.g. transportation and building heating  
14 systems). While there is certainty that fundamental change is ahead, there are degrees of  
15 uncertainty about how that change will unfold (e.g. the pace and adoption of electrified  
16 technologies such as EVs and heat pumps; the role of low-emission gas; and the scale of local  
17 vs. bulk electricity supply). To reconcile the impact of these emerging conditions throughout  
18 the 2025-2029 rate period, Toronto Hydro seeks approval to establish a new symmetrical  
19 variance account to protect ratepayers and the utility from structural unknowns in  
20 forecasted costs and revenues during this time of unprecedented change and  
21 transformation in the economy and energy system.

22

23 Subject to OEB approval, Account 1508 – Demand-Related Variance Account (DRVA) would  
24 record: (i) the demand-driven revenue requirement impacts arising from variances in actual  
25 versus forecast capital and operational expenditures for certain demand-based programs;

---

<sup>49</sup> Please refer Exhibit 1B, Tab 3, Schedule 1 to review the 2025-2029 Custom Scorecard proposal.



1 and (ii) the revenue impacts arising from variances in forecast versus actual weather-  
2 normalized billing determinants (customer count, kWh and kVA) over the rate period. To  
3 that end, the account would consist of two subaccounts:

- 4 1. The *Expenditure Variance* subaccount would record the symmetrical revenue  
5 requirement impacts, including PILs, arising from the variance between the forecast  
6 expenditures for the 2025-2029 period and actual expenditures related to the  
7 following capital and operations programs: Customer Connections, Customer  
8 Operations, Stations Expansion, Load Demand, Non-Wires Solution, Generation  
9 Protection Monitoring and Control and Externally-Initiated Plant Relocations &  
10 Expansions (collectively “Demand-Related Investments”).
- 11 2. The *Revenue Variance* subaccount would record the revenue impacts resulting from  
12 weather-normalized variances in billing determinants (e.g. customer count and billed  
13 demand).

14

### 15 **9.3 Innovation Fund Variance Account (“IFVA”)**

16 As detailed in Exhibit 1B, Tab 4, Schedule 2, Toronto Hydro proposes to create a \$16 million  
17 Innovation Fund to enable the utility to overcome real and practical challenges of pursuing  
18 innovation during the 2025-2029 rate term, and advance the OEB’s objectives with respect  
19 to facilitating innovation in the electricity sector. Toronto Hydro proposes to collect the  
20 amount allocated to the Innovation Fund through a rate rider (rather than through base  
21 rates) in order to provide transparency to ratepayers on the bill and flexibility to the utility  
22 to determine how the funds should be allocated across capital and operational expenditures  
23 on the basis of the selected pilot projects. The utility also proposes to establish a new  
24 symmetrical variance account to record variances between the amounts collected by the  
25 Innovation Fund rate rider and the actual costs incurred to execute selected pilot projects  
26 as part of the Innovation Fund.

1 **9.4 50/60 Eglinton Proceeds of Sale Deferral Account**

2 In the 2020-2024 rate application (EB-2018-0165), Toronto Hydro requested approval to  
3 clear forecasted net gains on the sale of property at 50/60 Eglinton Avenue through a rate  
4 rider without a deferral or variance account.<sup>50</sup> The OEB accepted the disposition of relevant  
5 amounts, noting that although the proposed refund of the proceeds of sale from the Eglinton  
6 property and other amounts is appropriate, the OEB may not permit in the future the  
7 disposition of a regulatory balance without an approved account.<sup>51</sup>

8  
9 In addition to the sale proceeds previously refunded to ratepayers, Toronto Hydro received  
10 a variable consideration (bonus payment) from the purchaser, based on the terms of the  
11 relevant agreement of purchase and sale, which stipulate additional consideration to the  
12 utility where the purchaser achieves an increase in gross floor area as a result of zoning by-  
13 law applications. Toronto Hydro intends to return this variable consideration (bonus  
14 payment) to ratepayers in the 2025-2029 period.

15  
16 With regard to the OEB's comments in the last decision, Toronto Hydro requests approval  
17 to establish a deferral account to record the variable consideration amounts received during  
18 the 2020-2024 rate period and clear the account balance in respect of such amounts, which  
19 is currently estimated to be a \$10.2 million credit to customers. Toronto Hydro intends to  
20 also record in the account any potential variable consideration amounts further received in  
21 the 2025-2029 rate period.

---

<sup>50</sup> EB-2018-0165, Exhibit 8, Tab 1, Schedule at page 11.

<sup>51</sup> EB-2018-0165, Decision and Order (December 19, 2019) at page 183.

1     **DRAFT ACCOUNTING ORDERS**

2

3     **1. NEW VARIANCE AND DEFERRAL ACCOUNTS – DRAFT ACCOUNTING ORDERS**

4

5     **Deferral Account for Excess Expansion Deposits – Draft Accounting Order**

6     Toronto Hydro shall establish an account to record any excess expansion deposits as a  
7     credit to the variance account.

8

9     Carrying charges will apply to the opening balances in the accounts (exclusive of  
10     accumulated interest) at the OEB-approved rate for deferral and variance accounts.

11

12     In the next rebasing application, Toronto Hydro will apply to clear the balances in this  
13     account to ratepayers.

14

15     Toronto Hydro will establish the following deferral accounts to record the amounts  
16     described above:

- 17         • Account 1508, Other Regulatory Assets, Subaccount Excess Expansion Deposits  
18         • Account 1508, Other Regulatory Assets, Subaccount Excess Expansion Deposits  
19             Carrying Charges

20

21     Toronto Hydro will use the following account to record the OEB-approved rate rider  
22     associated with the Excess Expansion Deposits being cleared to ratepayers:

- 23         • Account 1508 Other Regulatory Assets, Subaccount Excess Expansion Deposits  
24             (Rate Rider Account)

1 The sample accounting entries for the deferral accounts are provided below.

2 A. To record the excess expansion deposits to the deferral account:

- 3 ○ Dr. 2210 Customer Deposits / 2335 Non-Current Customer Deposits
- 4 ○ Cr. 1508 Other Regulatory Assets, Subaccount Excess Expansion Deposits

5 B. To record the carrying charges in subaccount Excess Expansion Deposits

6 Account:

- 7 ○ Dr. 6035 Other Interest Expense
  - 8 ○ Cr. 1508 Other Regulatory Assets, Subaccount Excess Expansion Deposits
- 9 Carrying Charges

10

11 **Variance Account for Gain on Sale of Property – Draft Accounting Order**

12 Toronto Hydro shall establish an account to track the variance in actual gains on sale of  
13 utility property from the \$1.0 million amount included in base rates as part of 2020  
14 Revenue Offsets. Toronto Hydro will track the symmetrical difference between the \$1.0  
15 million gain embedded in rates and the actual gains net of tax in a given year.

16

17 Carrying charges will apply to the opening balances in the accounts (exclusive of  
18 accumulated interest) at the OEB-approved rate for deferral and variance accounts.

19

20 In the next rebasing application, Toronto Hydro will apply to clear the balances in this  
21 account to ratepayers.

22

23 Toronto Hydro will establish the following variance accounts to record the amounts  
24 described above:

- 25 ● Account 1508, Other Regulatory Assets, Subaccount Property Gain
  - 26 ● Account 1508, Other Regulatory Assets, Subaccount Property Gain Variance
- 27 Account Carrying Charges

1 The sample accounting entries for the variance accounts are provided below.

2 A. To record amounts in the Property Gain Variance Accounts:

- 3 ○ DR/CR 4080 Distribution Services Revenue
- 4 ○ CR/DR 1508 Other Regulatory Assets, Subaccount Property Gain

5

6 B. To record the carrying charges in subaccount Property Gain Variance Account:

- 7 ○ DR 6035 Other Interest Expense / CR 4405 Interest and Dividend Income
- 8 ○ CR/DR 1508 Other Regulatory Assets, Subaccount Property Gain Carrying
- 9 Charges

10

11 **Deferral Account for Carillion Insolvency Payments Receivable – Draft Accounting**

12 **Order**

13 Toronto Hydro shall establish a deferral account to record the revenue requirement  
14 impact of a reduction to rate base associated with payments from Carillion to Toronto  
15 Hydro resulting from the ongoing insolvency litigation. The account will also record any  
16 prudently incurred expenses with respect to the litigation and recovery of any amount  
17 rewarded. At the time of the next rebasing, Toronto Hydro will remove the amount  
18 related to the litigation payment from rate base on a permanent basis and close this  
19 account.

20

21 Carrying charges will apply to the opening balances in the account (exclusive of  
22 accumulated interest) at the OEB-approved rate for deferral and variance accounts.

23

24 In the next rebasing application, Toronto Hydro will apply to clear the balances in this  
25 account to ratepayers.

1 Toronto Hydro will establish the following deferral accounts to record the amounts  
2 described above:

- 3 • Account 1508, Other Regulatory Assets, Subaccount Carillion Insolvency  
4 Payments Receivable Account
- 5 • Account 1508, Other Regulatory Assets, Subaccount Carillion Insolvency  
6 Payments Receivable Account Carrying Charges

7

8 The sample accounting entry for the deferral accounts are provided below.

- 9 A. To record the revenue requirement on the insolvency payment in the Carillion  
10 Insolvency Payments Receivable Account:
  - 11 ○ DR 4080 Distribution Services Revenue
  - 12 ○ CR 1508 Other Regulatory Assets, Subaccount Carillion Insolvency Payments  
13 Receivable Account
- 14 B. To record any litigation incurred expenses relating to the Carillion Insolvency in  
15 the Carillion Insolvency Payments Receivable Account:
  - 16 ○ DR 1508 Other Regulatory Assets, Subaccount Carillion Insolvency Payments  
17 Receivable Account
  - 18 ○ CR XXXX Operating, Maintenance and Administration Expenses (various  
19 accounts – depends on type of expense)
- 20 C. To record the carrying charges in subaccount Carillion Insolvency Payments  
21 Receivable Account:
  - 22 ○ DR 6035 Other Interest Expense
  - 23 ○ CR 1508 Other Regulatory Assets, Subaccount Carillion Insolvency Payments  
24 Receivable Account Carrying Charges

1 **2. UPDATE TO EXISTING VARIANCE AND DEFERRAL ACCOUNTS – DRAFT**

2 **ACCOUNTING ORDERS**

3

4 **Variance Account for Externally Driven Capital – Draft Accounting Order**

5 The OEB approved the continuation of a variance account related to third party-initiated  
6 relocation and expansion projects (“externally driven capital work”). This account  
7 captures variances from the approved revenue requirement associated with externally  
8 driven capital work embedded in rates, including variances in derecognition expenses  
9 related to externally driven capital work. The account shall be symmetrical and  
10 amounts recorded or recordable in this account shall not be recorded in the Capital-  
11 Related Revenue Requirement Variance Account.

12

13 Carrying charges will apply to the opening revenue requirement balances in the account  
14 (exclusive of accumulated interest) at the OEB-approved rate for deferral and variance  
15 accounts.

16

17 In the next rebasing application, Toronto Hydro will apply to clear the balances in this  
18 account to ratepayers.

19

20 Toronto Hydro will establish the following variance accounts to record the amounts  
21 described above:

- 22 • Account 1508, Other Regulatory Assets, Subaccount THESL Externally Driven  
23 Revenue Requirement
- 24 • Account 1508, Other Regulatory Assets, Subaccount THESL Externally Driven  
25 Revenue Requirement Carrying Charges

- 1 The sample accounting entries for the variance accounts are provided below.
- 2 A. To record balance in the Externally Driven Capital Variance Account:
- 3 ○ DR 1508 Other Regulatory Assets, Subaccount THESL Externally Driven
- 4 Revenue Requirement
- 5 ○ CR 4080 Distribution Services Revenue
- 6 B. To record the carrying charges in subaccount THESL Externally Driven Revenue
- 7 Requirement:
- 8 ○ DR 1508 Other Regulatory Assets, Subaccount THESL Externally Driven
- 9 Revenue Requirement Carrying Charges
- 10 ○ CR 4405 Interest and Dividend Income

11

12 **Earnings Sharing Mechanism (“ESM”) Variance Account – Draft Accounting Order**

13 The OEB approved a cumulative, asymmetrical ESM using a ROE-based calculation. The

14 ESM will be cumulative in that it will be based on an evaluation of overall earnings at the

15 end of the 2020-2024 rate period term, and it will be asymmetrical in that there will be

16 no sharing (i.e. collection) of cumulative under-earnings from rate payers.

17

18 At the end of the 2020-2024 rate period, the ROE-based calculation will determine if

19 there were any cumulative over-earnings associated with actual net income of the

20 regulated utility after specific adjustments (e.g. out of period items) as reported under

21 the Reporting and Record Keeping Requirements (“RRR”) during the rate period.

22 Cumulative over-earnings in excess of 100 basis points of the approved ROE of 8.52%

23 will be shared 50:50 with ratepayers. The ratepayer’s share of any eligible earnings will

24 be grossed up for any tax impacts and credited to this account.

25

26 Carrying charges will apply to the opening balances in the account (exclusive of

27 accumulated interest) at the OEB-approved rate for deferral and variance accounts.



1 Toronto Hydro will apply to clear any balances in this account to ratepayers in the next  
2 rebasing application.

3

4 Toronto Hydro will establish the following variance accounts to record the amounts  
5 described above:

- 6 • Account 1508, Other Regulatory Assets, Subaccount Earnings Sharing  
7 Mechanism Variance Account
- 8 • Account 1508, Other Regulatory Assets, Subaccount Earnings Sharing  
9 Mechanism Variance Account Carrying Charges

10

11 The sample accounting entry for the variance accounts are provided below.

12 A. To record amounts resulting from the operation of the ESM:

- 13 ○ DR 4080 Distribution Services Revenue
- 14 ○ CR 1508 Other Regulatory Assets, Subaccount Earnings Sharing Mechanism  
15 Variance Account

16 B. To record the carrying charges in subaccount Earnings Sharing Mechanism  
17 Variance Account:

- 18 ○ DR 6035 Other Interest Expense
- 19 ○ CR 1508 Other Regulatory Assets, Subaccount Earnings Sharing Mechanism  
20 Variance Account Carrying Charges

1 **APPENDIX C: DRAFT ACCOUNTING ORDERS**

2

3 **Demand-Related Variance Account (“DRVA”) – Draft Accounting Order**

4 Toronto Hydro requests a symmetrical variance account (Account 1508 – Demand-Related  
5 Variance Account) that consist of two subaccounts, as follows:

6

7 • The Demand-Related Revenue Variance subaccount will record revenue variances  
8 between forecast and actual weather-normalized billing determinants.

9

10 • The Demand-Related Expenditure Variance subaccount will record the symmetrical  
11 revenue requirement impacts, including PILs, arising from the variance between the  
12 forecast expenditures for the 2025-2029 rate period and actual expenditures related  
13 to the following programs: Customer Connections (Exhibit 2B, Section E5.1), Stations  
14 Expansion (Exhibit 2B, Section E7.4), Load Demand (Exhibit 2B, Section E5.3), Non-  
15 Wires Solution (Exhibit 2B, Section E7.2), Customer Operations (Exhibit 4, Tab 2,  
16 Schedule 8), Generation Protection Monitoring and Control (Exhibit 2B, Section E5.5)  
17 and Externally-Initiated Plant Relocations & Expansions (Exhibit 2B, Section E5.2)  
18 (collectively, “Demand-Related Investments”).

19

20 Carrying charges will apply to the opening balances in the account (exclusive of accumulated  
21 interest) at the OEB-approved rate for deferral and variance accounts.

22

23 At a later date, Toronto Hydro will apply to clear the balances in this account to ratepayers.  
24 Toronto Hydro will establish the following Variance Accounts to record the amounts  
25 described above:

1 Demand-Related Revenue Variance subaccount

- 2       • Account 1508, Other Regulatory Assets, Subaccount Demand-Related Revenue  
3       Variance Account  
4       • Account 1508, Other Regulatory Assets, Subaccount Demand-Related Revenue  
5       Variance Account Carrying Charges  
6

7 Demand-Related Expenditure Variance subaccount

- 8       • Account 1508, Other Regulatory Assets, Subaccount Demand-Related Expenditure  
9       Variance Account  
10       • Account 1508, Other Regulatory Assets, Subaccount Demand-Related Expenditure  
11       Variance Account Carrying Charges  
12

13 The sample accounting entries for the variance accounts are provided below:  
14

15 Demand-Related Revenue Variance subaccount

16       A. To record the difference between the cumulative Demand-Related Revenue included  
17       in rates and the actual Demand-Related Revenue over the CIR period:

- 18               • DR/CR 4080 Distribution Services Revenue  
19               • CR/DR 1508 Other Regulatory Assets, Subaccount Demand-Related Revenue  
20               Variance Account  
21

22       B. To record the carrying charges in subaccount Demand-Related Revenue Variance  
23       Account:

- 24               • DR/CR 6035 Other Interest Expense  
25               • CR/DR 1508 Other Regulatory Assets, Subaccount Demand-Related Revenue  
26               Variance Account Carrying Charges

1 *Demand-Related Expenditure Variance subaccount*

2 A. To record the difference between the cumulative Demand-Related Expenditure  
3 included in rates and the actual Demand-Related Expenditure over the CIR period:

- 4 • DR/CR 4080 Distribution Services Revenue
- 5 • CR/DR 1508 Other Regulatory Assets, Subaccount Demand-Related  
6 Expenditure Variance Account

7

8 B. To record the carrying charges in subaccount Demand-Related Expenditure Variance  
9 Account:

- 10 • DR/CR 6035 Other Interest Expense
- 11 • CR/DR 1508 Other Regulatory Assets, Subaccount Demand Related  
12 Expenditure Variance Account Carrying Charges

13

14

15 **Innovation Fund Variance Account – Draft Accounting Order**

16 Toronto Hydro requests a symmetrical variance account (Account 1508 – Innovation Fund  
17 Variance Account) to record variances between the revenue collected by the Innovation  
18 Fund rate rider and the actual costs incurred (on a revenue requirement basis) to undertake  
19 the selected innovation pilot projects.

20

21 Carrying charges will apply to the opening balances in the account (exclusive of accumulated  
22 interest) at the OEB-approved rate for deferral and variance accounts.

23 At a later date, Toronto Hydro will apply to clear the balances in this account to ratepayers.

24

25 Toronto Hydro will establish the following Variance Accounts to record the amounts  
26 described above:

- 1       • Account 1508, Other Regulatory Assets, Subaccount Innovation Fund Variance
- 2       Account
- 3       • Account 1508, Other Regulatory Assets, Subaccount Innovation Fund Variance
- 4       Account Carrying Charges

5

6       The sample accounting entry for the variance accounts are provided below.

7

8       A. To record the difference between the Innovation Fund included in the rate rider and  
9       actual revenue requirement over the CIR period:

- 10           • DR/CR 4080 Distribution Services Revenue
- 11           • CR/DR 1508 Other Regulatory Assets, Subaccount Innovation Fund Variance
- 12           Account

13

14       B. To record the carrying charges in subaccount Innovation Fund Variance Account:

- 15           • DR/CR 6035 Other Interest Expense
- 16           • CR/DR 1508 Other Regulatory Assets, Subaccount Innovation Fund Variance
- 17           Account Carrying Charges

18

19       **Performance Incentive Mechanism Deferral Account – Draft Accounting Order**

20       Toronto Hydro requests a deferral account (Account 1508 – Performance Incentive  
21       Mechanism Deferral Account (“PIM-DA”) to record revenue earned by the utility for  
22       achieving set targets on the 2025-2029 Custom Scorecard as outlined in Exhibit 1B, Tab 3,  
23       Schedule 1.

24

25       Carrying charges will apply to the opening balances in the account (exclusive of accumulated  
26       interest) at the OEB-approved rate for deferral and variance accounts.

1 At a later date, Toronto Hydro will apply to clear the balances in this account to ratepayers.

2

3 Toronto Hydro will establish the following Deferral Accounts to record the amounts  
4 described above:

- 5 • Account 1508, Other Regulatory Assets, Subaccount Performance Incentive  
6 Mechanism Deferral Account (PIM-DA)
- 7 • Account 1508, Other Regulatory Assets, Subaccount Performance Incentive  
8 Mechanism Deferral Account (PIM-DA) - Carrying Charges

9

10 The sample accounting entry for the variance accounts are provided below.

11

12 A. To record revenue earned by the utility by achieving set targets on the 2025-2029  
13 Custom Scorecard:

- 14 • DR 1508 Other Regulatory Assets, Subaccount Performance Incentive  
15 Mechanism Deferral Account (PIM-DA) Account
- 16 • CR 4080 Distribution Services Revenue

17 B. To record the carrying charges in subaccount Performance Incentive Mechanism  
18 Deferral Account:

- 19 • DR 1508 Other Regulatory Assets, Subaccount Performance Incentive  
20 Mechanism Deferral Account (PIM-DA) - Carrying Charges
- 21 • CR 6035 Other Interest Expense

22

23 **50/60 Eglinton Proceeds of Sale Deferral Account – Draft Accounting Order**

24 Toronto Hydro requests a deferral account (Account 1508 – 50/60 Eglinton Proceeds of Sale  
25 Deferral Account) to record and dispose of additional proceeds received from the sale of

1 property at 50/60 Eglinton Avenue based on the forecasted net gains on the sale grossed up  
2 for the Payment in Lieu (“PILs”) tax savings.

3

4 Toronto Hydro will establish the following to record the amounts described above:

- 5 • Account 1508, Other Regulatory Assets, Subaccount 50/60 Eglinton Avenue
- 6 • Account 1508, Other Regulatory Assets, Subaccount 50/60 Eglinton Avenue -  
7 Carrying Charges

8

9 Carrying charges will apply to the opening balances in the account (exclusive of accumulated  
10 interest) at the OEB-approved rate for deferral and variance accounts.

11

12 The sample accounting entries for the variance accounts are provided below.

13 A. Record the actual variable considerations received, net of taxes:

- 14 • DR 1005 Cash
- 15 • CR 4355 Gain on Disposition of Utility and Other Property
- 16 • CR 2294 Accrual for Taxes, “Payments in Lieu of Taxes”, etc.

17 B. Record the reclassification of additional proceeds, net of taxes, received from the  
18 sale of 50/60 Eglinton:

- 19 • DR 4355 Gain on Disposition of Utility and Other Property
- 20 • CR 1508 Other Regulatory Assets, Subaccount 50/60 Eglinton Avenue

21

22 C. Record the carrying charges in subaccount 1508 Other Regulatory Assets,  
23 Subaccount 50/60 Eglinton Avenue:

- 24 • CR 1508, Other Regulatory Assets, Subaccount 50/60 Eglinton Avenue -  
25 Carrying Charges

- 1                   • DR 6035 Other Interest Expense

2

3                   2025 and Future Years Entries

4                   D. Record transfer of balance in subaccount 1508 Other Regulatory Assets, Subaccount  
5                   50/60 Eglinton Avenue to account 1595-RARA, upon approval from OEB

- 6                   • DR 1508 Other Regulatory Assets, Subaccount 50/60 Eglinton Avenue  
7                   • CR 1595 RARA- Subaccount 50/60 Eglinton Avenue - Approved Principal  
8                   • DR 1508, Other Regulatory Assets, Subaccount 50/60 Eglinton Avenue -  
9                   Carrying Charges  
10                  • CR 1595 RARA- Subaccount 50/60 Eglinton Avenue – Approved Carrying  
11                  Charges

12

13                  E. Record the distribution of the rate rider to customers upon approval from the OEB.  
14                  The offsetting credit will be applied to Account 1100 Customer Accounts Receivable  
15                  since the ratepayers’ bills should be reduced by the rate rider refund:

- 16                  • DR 4080 Distribution Services Revenue  
17                  • CR 1100 Customer Accounts Receivable  
18                  • DR 1595 RARA- Subaccount 50/60 Eglinton Avenue - Approved Principal  
19                  • DR 1595 RARA- Subaccount 50/60 Eglinton Avenue – Approved Carrying  
20                  Charges  
21                  • CR 4080 Distribution Services Revenue

22

23                  F. Record the actual PILs tax savings materialized, which is being given back to  
24                  ratepayers. The PILs tax savings is the result of the rate rider cash refund to  
25                  customers:

- 26                  • DR 2294 Accrual for Taxes, “Payments in Lieu of Taxes”, Etc.



- 1           • CR 6110 Income Taxes
- 2           • DR 4080 Distribution Services Revenue
- 3           • CR 1595 RARA- Subaccount 50/60 Eglinton Avenue - Approved Principal

4

5           G. Record the carrying charges on the remaining balance in account 1595 RARA-  
6           Subaccount 50/60 Eglinton Avenue - Approved Principal:

- 7           • DR 6035 Other Interest Expense
- 8           • CR 1595 RARA- Subaccount 50/60 Eglinton Avenue – Carrying Charges

1 **LOST REVENUE ADJUSTMENT MECHANISM VARIANCE ACCOUNT (LRAMVA)**

2

3 In its 2023 Rate Application (EB-2022-0065), the OEB approved Toronto Hydro’s proposal to  
 4 defer the clearance of the 2020 and 2021 LRAMVA balances, and any future balances within  
 5 the 2020-2024 rate period available at the time to this rebasing application. In accordance  
 6 with that decision, Toronto Hydro hereby seeks clearance of the 2020-2022 LRAMVA  
 7 balances for the savings from Conservation First Framework (“CFF”) programs only.  
 8 Additionally, this schedule includes the proposed adjustment to the LRAMVA threshold to  
 9 account for the discontinuation of CFF programs.

10

11 The methodology applied to clear the balances in the LRAMVIA is consistent the OEB’s  
 12 Chapter 2 of the OEB’s Filing Requirements for Electricity Distribution Rate Applications  
 13 (December 15, 2022), and with the methodology previously approved by the OEB in the 2021  
 14 Rate Application (EB-2020-0057).

15

16 Table 1 below provides a summary of the principal amount and carrying charges by rate  
 17 class, and the resulting rate riders. Toronto Hydro proposes to clear the LRAMVA balance  
 18 over a 60-month period, beginning January 1, 2025, in order to effect rate-smoothing. Rate  
 19 riders were not developed for the Residential and Competitive Sector Multi-Unit Residential  
 20 (CSMUR) rate classes as the eligible amounts were insignificant.

21

22 **Table 1: LRAMVA Summary (\$ Millions)**

Rate Class	Principal for Clearance (\$)	Carrying Charges (\$)	Total for Clearance (\$)	Proposed Rate Rider (\$/kWh or \$/kVA)
Residential	(0.0)	(0.0)	<b>(0.1)</b>	-
CSMUR	(0.0)	(0.0)	<b>(0.0)</b>	-
GS<50kW	(1.2)	(0.1)	<b>(1.3)</b>	<b>(0.00011)</b>

Rate Class	Principal for Clearance (\$)	Carrying Charges (\$)	Total for Clearance (\$)	Proposed Rate Rider (\$/kWh or \$/kVA)
<b>GS 50-999kW</b>	3.0	0.4	<b>3.4</b>	<b>0.0288</b>
<b>GS 1000-4999kW</b>	0.8	0.1	<b>0.9</b>	<b>0.0195</b>
<b>Large User</b>	2.5	0.3	<b>2.7</b>	<b>0.1346</b>

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16  
17

Toronto Hydro seeks approval to dispose of balances associated with the following:

- Incremental first-year lost revenues for 2020, 2021 and 2022; and
- Lost revenues in 2020-2022 resulting from Conservation and Demand Management (CDM) savings persistence from the years 2018 through 2021.

Where applicable, the 2020-2022 lost revenues are based on actual CDM savings reported in the Participation and Cost Reports for the period of January 1, 2018 to April 15, 2019, and actual CFF savings for projects that were completed during the 2018-2022 period in accordance with Toronto Hydro’s contractual obligations. These reports are filed as Appendices A to G to this schedule.<sup>1</sup>

Toronto Hydro determined the proposed amounts for clearance based on the most recent CDM input assumptions available at the time of program evaluation and using version 8.0 (2024) of the OEB’s LRAMVA Workform. A copy of the LRAMVA Workform is filed at Tab 2, Schedule 3.

---

<sup>1</sup> Note that due to the size and nature of these documents, Toronto Hydro has filed this report and the Excel-based supporting documents (Appendices A-G) in Excel format only.

1 **1. MODIFIED LRAMVA THRESHOLD**

2 The modified LRAMVA threshold that forms that basis of the 2020-2022 LRAMVA clearance  
 3 proposed includes changes with respect to two items: 1) the impact of CFF wind-down; and  
 4 2) the 2018 CDM persistence. Each of these items is discussed below.

5

6 Table 2 provides the original threshold approved by the OEB in EB-2018-0165 and the  
 7 modified LRAMVA threshold that the utility applied for the LRAMVA calculations in this  
 8 application reflecting the impacts of CFF wind-down and including 2018 CDM persistence.

9

10 **Table 2: LRAMVA Threshold**

	Residential	CSMUR	GS<50kW	GS 50-999kW	GS 1000-4999kW	Large User
	MWh	MWh	MWh	MW	MW	MW
<b>Original<sup>2</sup></b>	28,027	3,607	48,831	458	128	144
<b>Modified</b>	79,894	6,443	60,610	376	112	131

11

12 **1.1 CFF Wind-Down Adjustment**

13 In EB-2018-0165, the OEB approved Toronto Hydro’s most recent load forecast and the  
 14 related Conservation and Demand Management (“CDM”) forecast for rate-making purposes  
 15 during the period when the CFF was revoked by the Ministry of Energy, Northern  
 16 Development and Mines and the future direction on LRAMVA was still unknown.<sup>3</sup> The result  
 17 is that the LRAMVA thresholds approved in the last application (EB-2018-0165) include all of  
 18 the Toronto Hydro CDM programs under the CFF, while the actuals to be used for the  
 19 LRAMVA calculations include only those programs that the utility continued to manage post-

---

<sup>2</sup> EB-2018-0165, Exhibit U, Tab 3, Schedule 1, Appendix E - CDM LF to LRAM Reconciliation

<sup>3</sup> EB-2018-0165, Decision and Order (December 19, 2019) at page 127.

1 CFF as contractually obligated under the CFF wind-down.<sup>4</sup> Calculating LRAMVA amounts  
2 using these mismatched versions of the CDM values would be inappropriate. To reconcile  
3 these changes in the calculation of the LRAMVA, Toronto Hydro proposes a modified  
4 LRAMVA threshold.

5  
6 The modified LRAMVA threshold only accounts for Toronto Hydro programs that were fully  
7 discontinued and those which the utility was contractually obligated to complete as part of  
8 the CFF wind-down. In other words, the modified threshold excludes programs that were  
9 transferred to the IESO. To achieve this, Toronto Hydro removed programs that were  
10 transferred to the IESO by deducting Toronto Hydro's estimated savings for each of these  
11 programs from original threshold approved by the OEB in EB-2018-0165. To estimate  
12 Toronto Hydro's savings portion of the programs that were transferred to the IESO, Toronto  
13 Hydro utilized the following approach:

- 14
- 15 • Divide Toronto Hydro's 2015-2017 verified savings (as set out in the IESO's 2017 Final  
16 Verified Annual CDM Program Results Report)<sup>5</sup> by the equivalent provincial total to  
17 estimate the utility's contribution to total provincial savings as a percentage.
  - 18 • Apply the percentage derive above to the provincial savings per program as outlined  
19 in the IESO's 2019-2020 Interim Framework,<sup>6</sup> to estimate the utility's portion of the  
20 savings.

---

<sup>4</sup> Minister's Directive, Discontinuation of the Conservation First Framework (March 21, 2019) and Minister Letter to Further Extend Conservation First Framework (December 9, 2021)

<sup>5</sup> Provided in Appendix A of this schedule.

<sup>6</sup> <https://www.ieso.ca/en/Sector-Participants/Energy-Efficiency/2019-2020-Interim-Framework>

1 **1.2 2018 CDM Persistence**

2 Toronto Hydro proposes to include 2018 CDM persistence in the modified threshold for  
3 calculating the 2020-2022 LRAMVA as this information was not included in the threshold  
4 that the OEB approved in EB-2018-0165, due to the uncertainty related to CFF.<sup>7</sup>

5

6 **2. CONSERVATION FIRST FRAMEWORK (“CFF”) ACTUAL SAVINGS**

7 In the absence of final verified annual CDM program results to quantify 2020-2022 LRAMVA,  
8 and as specified in the OEB’s Chapter 3 filing requirements, Toronto Hydro used the  
9 following information to determine the LRAMVA balances:

10

- 11 1. IESO’s 2017 Final Verified Annual LDC CDM Program Results Report (Tab 2, Schedule  
12 3, Appendix A)
- 13 2. The IESO’s Participation and Cost Reports for January 1, 2018 through April 15, 2019  
14 (Tab 2, Schedule 3, Appendix B);<sup>8</sup> these reports include incremental first-year energy  
15 savings<sup>9</sup>
- 16 3. The Detailed Project-Level Savings the IESO relied upon to generate the Participation  
17 and Cost Reports (Tab 2, Schedule 3, Appendix C)<sup>10</sup>
- 18 4. Third-party Measurement and Verification Reports for specific projects under the  
19 Process and System Upgrades Program and Monitoring and Targeting Program,  
20 which is not captured in the IESO’s Participation and Cost Reports (Tab 2, Schedule  
21 3, Appendices H-M)

---

<sup>7</sup> This proposal aligns with VECC’s position in EB-2018-0165, VECC Submission (August 28, 2019).

<sup>8</sup> Toronto Hydro has filed the reports in Excel format.

<sup>9</sup> Incentives for projects paid up to the end of February 2019 were settled with the IESO by March 15, 2019 and the energy savings and demand reduction of these projects were included in the Participation and Cost Report issued by the IESO in April 2019. This was the final Participation and Cost Report issued by the IESO.

<sup>10</sup> Toronto Hydro has filed the report in Excel format.

1 5. Project-level savings related to CFF wind-down programs up to December 31, 2022  
2 concluded during the 2018-2022 period which Toronto Hydro was contractually  
3 obligated to complete. For the Retrofit Projects (Tab 2, Schedule 3, Appendices D and  
4 G), energy savings and demand reductions are based on the list of projects for which  
5 Toronto Hydro paid incentives to customers and which had their status updated to  
6 “Project Closed” in CDM-IS system post March 1, 2019. For non-Retrofit CFF Projects  
7 (Tab 2, Schedule 3, Appendices E and F), savings are based on the list of projects for  
8 which Toronto Hydro has paid incentives and submitted project-level details to the  
9 IESO.

10

11 The rate class allocations were determined as follows:

12

13 1. **Residential Programs:** With the exception of the Instant Discount Program, Toronto  
14 Hydro allocated 100 percent of residential program savings to the Residential rate  
15 class. For the Instant Discount Program, the utility allocated 95 percent of savings to  
16 the Residential rate class and 5 percent to the CSMUR rate class, as these customers  
17 also qualify for this program. This allocation is an estimate based on Toronto Hydro’s  
18 professional judgement, and is consistent with the utility’s previous OEB-approved  
19 LRAM submissions.

20 2. **Business and Low-Income Programs:** Due to the termination of the CFF, Toronto  
21 Hydro no longer tracks project information submitted to the IESO by rate class. The  
22 utility used the most recent available data from its internal project management  
23 system to derive the rate class allocations. For the 2018-2022 rate class allocations,  
24 Toronto Hydro used a weighted average of available historical savings.

25 3. **Process Systems and Upgrades (“PSU”) Program and Monitoring and Targeting**  
26 **Program:** Toronto Hydro used customer and corresponding rate class information to

1 determine rate class allocations for savings related to the reports prepared by  
2 ClearResult Canada Inc.

3

4 Actual CDM savings in the LRAMVA workform are listed as verified or unverified savings.  
5 Verified savings refer to CDM savings approved in Toronto Hydro's 2018-2019 LRAMVA filing  
6 (EB-2020-0057). Unverified savings refer to CDM savings that have been completed but not  
7 submitted in any previous LRAMVA filings.

8

9 Toronto Hydro confirms that the calculated savings persistence and net-to-gross factors  
10 used to derive net savings by program are based on the 2017 Final Verified Annual LDC CDM  
11 Program results.



Toronto Hydro-Electric System Limited  
14 Carlton Street  
Toronto, Ontario M5B 1K5



## **Third Party Evaluation Reports**

This document includes the following third party evaluation reports:

### **Monitoring & Targeting Program:**

- #601752
- #601753

### **Process and Systems Upgrades Program:**

- #600501
- #601267
- #601461
- #601491
- #601583



# Monitoring & Targeting Program - ANNUAL REPORT

- Oct 15, 2021

## A schematic of the system and the location of the installed meters

- Please reference “-Location of Monitoring Devices.pdf”

## Confirmation of installation and proper operation

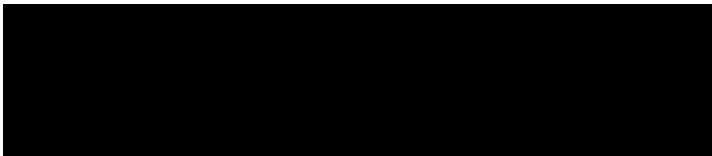
- Please reference “2020-06-10-NoticeOfOperation-.pdf”

## Consumption data for 12 months

- For interval & totalized electricity, water & gas consumption information, please reference:
  - o “Utility\_Budget\_Tracker\_FY22\_ON-MoreLife.xlsx”
  - o “NA-CA-ON-1-0005\_IFE-Main-Breaker\_2021\_09.xlsx”
  - o “FY20, FY21 and FY22\_HeatMap\_Na-CA-ON-1-0005.xlsx”
  - o “Screen Shot – Energy Dashboard – 1, 2, 3 and 4.jpg”

## List of action items/ projects/ plan to capture required savings of at least 0.2 MW and 0.2 MW x Facility Load Factor x 8760 hours;

- Non Agricultural Lighting LED Retrofit – Completed June 2021
  - o Cost: \$40,187
  - o Consumption Savings: 111,892 kWh/yr
  - o Demand Savings: 20.895 kW
  - o Estimated Financial Savings: >\$14,327/yr
  - o Retrofit Incentive: \$8,358
  - o Payback without incentive: ~3 years
  - o Payback with incentive: ~2.2 years
- Load Shifting & Balancing
  - o Moving Grow Light Schedule to Nighttime/Off-Peak Hours to take advantage of lower Make-Up-Air external temp/humidity and improve HVAC efficiency & GA Critical Peak performance. Balance 12 hour flowering light cycles to smooth demand throughout the day & change labour, fertigation & post harvest scheduling/process to suit. Completed as part of R&D facility conversion Dec 2020-Mar 2021.
    - Cost: ~\$85,000 per year – Additional Labour cost to spread out shifts outside of 8am – 6pm. \$25,000 internal staff time to re-program Agricultural, Fertigation & Building Controls systems
    - Facility Peak Demand reduced FY 2020: 2045 kW, FY 21: 1845 kW, FY 22: 1313 kW. **Total Demand Savings: 732 kW.**
    - Facility Total Energy Consumption:
      - FY 20: 9,133,838 kWh (Actual, 12 mos)



- FY 21: 7,308,081 kWh (Actual, 11 mos), 7,972,452 kWh (pro-rated, 12 mos)
- FY 22: 3,004,761 kWh (Actual, YTD), 7,211,426 kWh
- **Total Annual Consumption Savings: 1,922,411 kWh/yr**

- LED Clone Carts – Non-Incended, Completed Feb 2019. Replace 400 W HPS agricultural lights & clone trays with custom built LED Clone Cards. 24-7-365 Operation.
  - 28kW Demand Savings
  - 248 MWh/yr Savings
  - CLAIMED AS NON-INCIDENTED SAVINGS UNDER ENERGY MANAGER PROGRAM
  - Cost: ~\$45,000
  - Savings: ~22,000/year
  - Payback: ~2.1 years

**Details on proposed action items / projects such as costs, timeline, payback, potential savings:**

- See above

**Project plan and Estimated Savings for implementation of identified projects with a pay back of less than one year**

- Projects Completed, M&T Program requirements COMPLETE. See above.

**Partial or major equipment or operational changes to the process within the last year.**

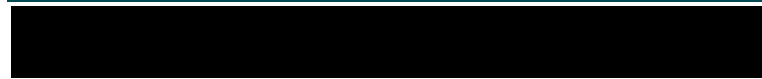
- LED Retrofit – Non Agricultural Lighting – changed T8 Fluorescents throughout the building in non-grow licensed areas to LED linear bulbs. SaveOnEnergy Retrofit Program Project 197278.
- In late 2020 and early 2021, the facility’s use changed from a production facility growing cannabis for sale to the market under the name [REDACTED] R&D facility – the primary facility providing R&D services to [REDACTED]. While the grow rooms are still operating at capacity, the experiments & grow methods tested have a goal of reducing energy, water, nutrient & pest control inputs. In addition, the grow lighting schedule for 12 hour light cycle flower rooms was switched to a more balanced schedule, as evidenced by facility heat maps for FY 22 vs FY 21 or FY 20. Mom & Veg room light cycles were shifted from a schedule that coincided with the hottest and most humid times of day to a schedule that avoids these peak hours, decreasing the temp & humidity of Make Up Air and reducing energy used to cool the mom, clone, veg and flower rooms. The Monitoring & Targeting System quantified the financial benefits of the schedule changes & allows the facility to test efficacy of lower energy intensity grow methods.
- In 2019, Clone growing was done using 400 W HPS lamps & T8 Fluorescents. LED Clone carts were built and saved 28 kW of demand & 243 MWh/yr. These are NOT eligible as M&T project savings, though the savings were verified using installed M&T assets, because they were claimed as non-incended savings within [REDACTED] [REDACTED] 2020 Final Energy Manager Program report to the IESO.





CONSERVATION FIRST FRAMEWORK: MONITORING AND TARGETING PROGRAM

# Monitoring and Targeting 2<sup>nd</sup> Annual Report Review



**Project ID:** Toronto-MT-601753

October 18, 2022

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited

**Prepared by:**

CLEARresult

393 University Avenue, Suite 1622, Toronto, ON M5G 1E6

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# Monitoring and Targeting 2<sup>nd</sup> Annual Report Review

## 1. General Information

Facility Name/Location	[REDACTED]
M&T System In-service Date	9/24/2019 (MM/DD/YYYY)
File Identification	Toronto-MT-601753
M&T Annual Report Review Start Date	12/5/2019 (MM/DD/YYYY)
Date of Submission of M&T Report Review	10/18/2022 (MM/DD/YYYY)
Duration of Technical Review <sup>1</sup> (business days)	40
Local Distribution Company (LDC)	Toronto Hydro-Electric System Limited (Toronto Hydro)
LDC Representative	[REDACTED]
Technical Reviewer	[REDACTED]

## 2. Technical Assessment

The Technical Reviewer has completed the review of [REDACTED] 2<sup>nd</sup> Annual Report. [REDACTED] has exceeded their Energy Savings Target but has not achieved their Peak Demand Savings Target.

[REDACTED] has achieved Peak Demand Savings totaling 129 kW and Annualized Electricity Savings totaling 1,253 MWh/year between September 24, 2019 and September 23, 2021, which represents 65% of their 200 kW and 106% of their 1,186 MWh Savings Target, respectively. See Section 4.3 for details.

## 3. Documentation Completeness

[REDACTED] provided all required documentation, including:

- Drawings and annotated photographs of the M&T System showing installed meter locations,
- Electricity consumption data for the past 24 months,
- Confirmation of M&T system installation,
- Details on projects and project plans are sufficient for the Technical Reviewer to assess their achieved electricity savings, and

<sup>1</sup> Net of Participant's Information Request response time

- Equipment and operational changes over the last 24 months have been the result of the M&T System.

## 4. Savings Target Progress

[REDACTED] has exceeded their second-year Annualized Electricity Savings Target but has not achieved their Peak Demand Savings Target.

### 4.1. ELECTRICITY SAVINGS TARGETS

In the M&T Application Review, the Technical Reviewer used monthly billing data from October 2016 to September 2017, as provided by [REDACTED] to calculate their Energy and Peak Demand Savings Target, as depicted in Table 1 below.

**Table 1: Savings Targets**

Description	Value	Unit
Actual Annual Electricity Consumption of Facility (AA)	16,983	MWh
One-Hour Facility Annual Peak (FAP)	2,863	kW
Facility Load Factor (FLF = AA ÷ [FAP × 8,760 hrs])	0.677	-
Energy Savings Target (0.2 × FLF × 8,760 hrs)	1,186	MWh
Peak Demand Savings Target (As specified in Program Rules)	200	kW

### 4.2. IMPLEMENTED AND PLANNED PROJECTS

[REDACTED] provided a list of implemented projects, listed in Table 2.

**Table 2: Implemented Projects**

Project Name	Completion Date
Demand Controlled Ventilation	July 2019
Ontario Kitchen Peak Demand	November 2019
Variable Frequency Drive (VFD)	January 2020
Chiller Refurbishment	May 2020
Elevator Standby Package	June 2021
Elevator Regenerative Package	June 2021

### 4.3. TECHNICAL REVIEW OF ELECTRICITY SAVINGS

[REDACTED] has completed non-incented projects at their Facility. The Technical Reviewer created an adjusted baseline model using sub-meter data in order to verify savings of eligible completed projects. This is an IPMVP Option C M&V methodology.



## Baseline Energy Consumption Model

The Facility comprises a single building. Monthly electricity consumption data was available for the baseline period of September 1, 2018, to August 31, 2019. In order to adjust the baseline period energy to reporting period conditions, the Technical Reviewer created a regression model between the monthly electricity consumption, cooling degree-days (CDD), and heating degree-days (HDD) for the Baseline period.

The energy model characteristics are summarized in Table 3.

**Table 3: Characteristics of the Energy Model**

Variable	Model Independent Variables	Unit of Measure	t-value	p-value
A	Cooling Degree-Days (Balance Point of 18°C)	°C-day	3.43	<0.05
B	Heating Degree-Days (Balance Point of 15°C)	°C-day	-4.12	<0.05
<b>Baseline Time Resolution</b>	Monthly	<b>Model R<sup>2</sup> value</b>	0.90	
<b>Model Start Date</b>	1-Sep-18	<b>Model End Date</b>	31-Aug-19	
<b>Weather Data Source</b>	Environment Canada Outdoor average air temperature for Climate ID 6158359 (Toronto City Centre Station)			
<b>Model Equation (kWh)</b>	$1,427.531 + 1.998 \times A - 0.457 \times B$			

The R<sup>2</sup> value is 0.90 which exceeds the recommended value of 0.75.

The t-value and p-value are in ranges that suggest that the independent variables used in the model are appropriate for the prediction of electricity consumption.

## Reporting Period Energy Consumption

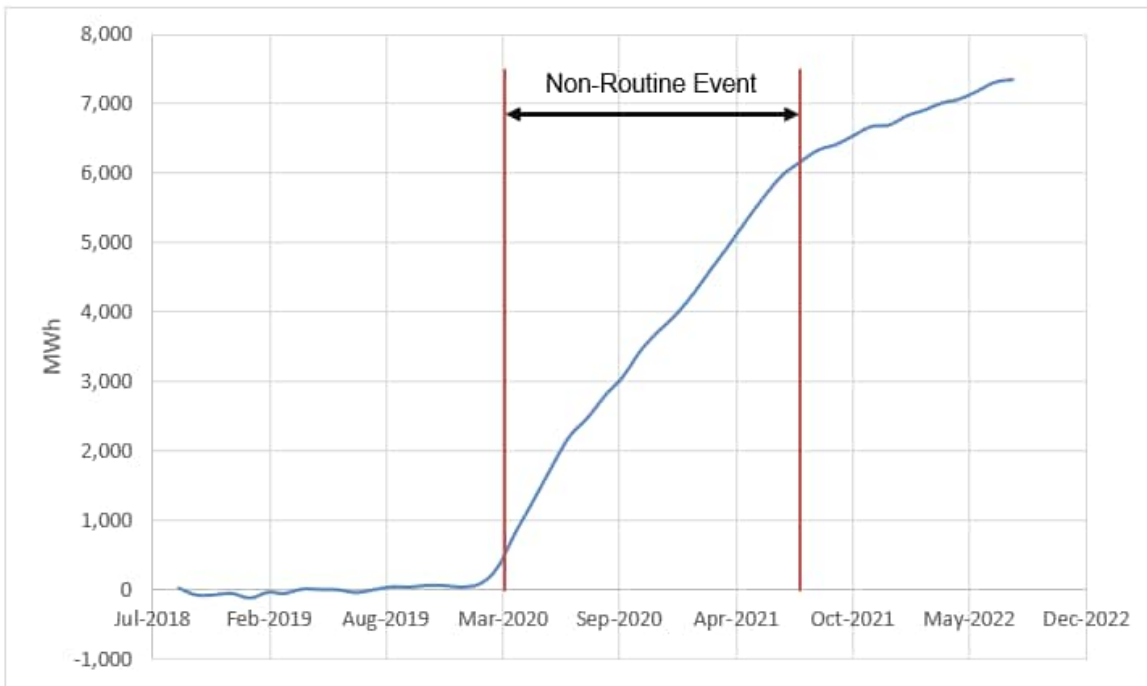
The M&T reporting period is from September 24, 2019, to September 23, 2021. In order to assess the achieved annual energy savings, monthly electricity consumption data from the last 12 months of the reporting period, September 24, 2020, to September 23, 2021 was used. The Facility's reporting period annual energy consumption is summarized in Table 4.

**Table 4. Summary of Reporting Period Annual Energy Consumption**

Description	Value	Unit
Start Date	24-Sept-20	
End Date	23-Sep-21	
Duration	365	Days
Reporting Period Annual Consumption	13,161	MWh
Reporting Period Average Demand	1,502	kW

## Non-Routine Adjustment

The Technical Reviewer assessed the impact of COVID-19 on the electricity consumption of [REDACTED] and found that the impact to be significant, as shown in Figure 1. The Electricity Savings must therefore be adjusted to exclude the impact of COVID-19 and include only the Electricity Savings from the implemented projects.



**Figure 1. CUSUM of [REDACTED]**

The Non-Routine Event (NRE) occurred from March 15, 2020 to August 31, 2021. The Technical Reviewer calculated the NRA using Method #5, as per the IPMVP guideline<sup>2</sup>, using data from September 1, 2021 to August 31, 2022. This period is after the end of the 24-month reporting period; however, [REDACTED] has confirmed that no additional energy savings measures were implemented during this time. There was one major equipment upgrade unrelated to energy savings measures. A 40 hp air handling unit was replaced in June 2022, which is not expected to have a significant effect on the Facility energy consumption. Therefore, the Technical Reviewer considers this period to be representative of the savings achieved prior to Sept 23, 2021.

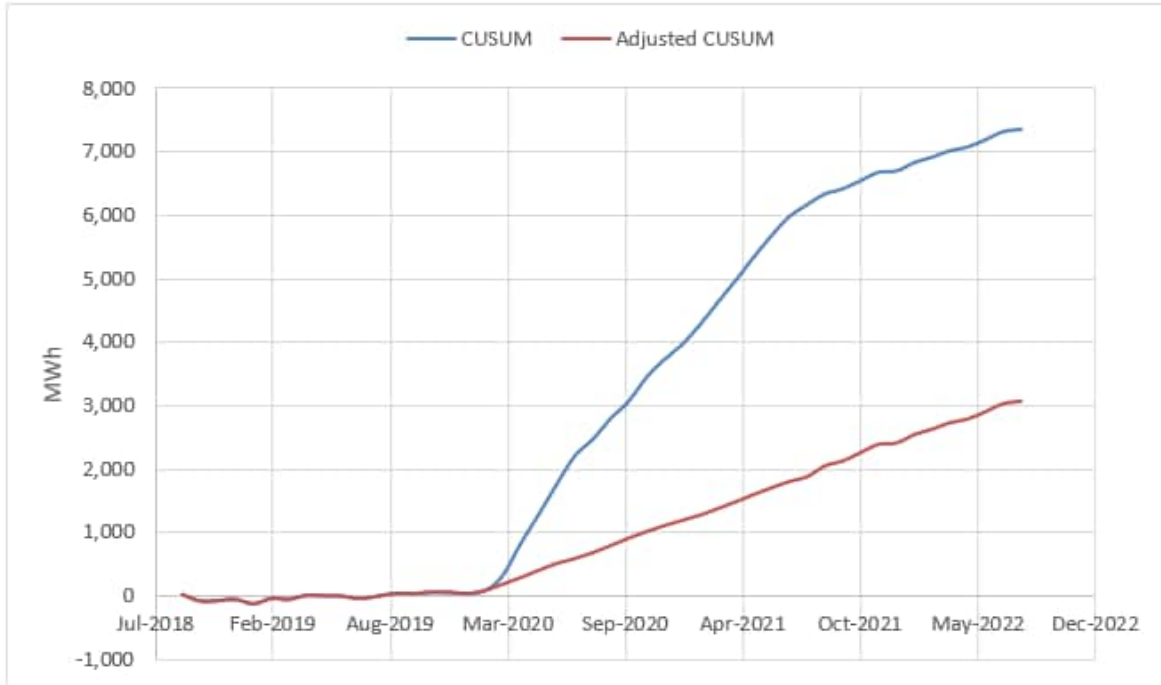
The NRE adjustment model characteristics are summarized in Table 5.

**Table 5: Characteristics of the Energy Model**

Variable	Model Independent Variables	Unit of Measure	t-value	p-value
A	Cooling Degree-Days (Balance Point of 18°C)	°C-day	6.26	<0.05
B	Heating Degree-Days (Balance Point of 15°C)	°C-day	-4.75	<0.05
<b>Baseline Time Resolution</b>	Monthly	<b>Model R<sup>2</sup> value</b>	0.94	
<b>Model Start Date</b>	1-Sep-21	<b>Model End Date</b>	31-Aug-22	
<b>Weather Data Source</b>	Environment Canada Outdoor average air temperature for Climate ID 6158359 (Toronto City Centre Station)			
<b>Model Equation (kWh)</b>	1,302.793 + 2,269 × A - 0.380 × B			

<sup>2</sup> IPMVP Application Guide on Non-Routine Events & Adjustments, October 2020 EVO 10400 – 1:2020.

In Figure 2, the effect of the NRE adjustment on the CUSUM can be seen. An NRA of -2,285 MWh was applied to the electricity savings.



**Figure 2. CUSUM With and Without NRA**

### Electricity Savings

The Electricity Savings are calculated according to the following formula and are summarized in Table 5. IPMVP Option C methodology was used to calculate the Electricity Savings.

$$\boxed{\text{Electricity Savings}} = \boxed{\text{Adjusted Baseline Energy}} - \boxed{\text{Reporting Period Energy}} \pm \boxed{\text{Non-Routine Adjustments}}$$

**Table 6. Summary of Electricity Savings**

Description	Value	Unit
Adjusted Baseline Annual Energy Consumption	16,700	MWh/yr
Reporting Period Annual Consumption	13,161	MWh/yr
Non-Routine Adjustment	-2,285	MWh/yr
Electricity Savings	1,253	MWh/yr
Uncertainty	52	%
Peak Demand Savings	129	kW

The uncertainty of the electricity savings is high because the savings are relatively small compared to the baseline energy. The savings represent 7.5% of the adjusted baseline energy.

## 5. Savings Summary

The total reviewed energy savings are summarized in Table 7 below.

**Table 7. Summary of Performance**

Description	kW	MWh
Total Savings	129	1,253
Savings Target	200	1,186
Percentage of Target Achieved	65%	106%

## 6. Future savings

██████████ intends to continue to achieve savings using the M&T system. However, ██████████ is planning to shift focus to greenhouse gas emissions reductions within the next year. The year-over-year performance of the M&T measures should be monitored to ensure persistence.

## 7. Third Annual Report

██████████ third annual report will be due on October 19, 2022.





**DELIVERY  
PARTNER™**

**CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM**

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period

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## Cogeneration System

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**Project ID:** Toronto-PI-600501

May 29, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Ltd.

**Prepared by:**  
CLEARresult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

### Revision History

Date	Description	Revision	Author
May 29 2022	M&V Report first issuance.	0	██████████

### Approvals

	Written by	Reviewed by
<b>Name</b>	██████████	██████████
<b>Date</b>	May 24, 2022	May 25, 2022
<b>Signature</b>	████████████████████	████████████████████

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of April 3, 2021 to April 2, 2022, are 49,467 MWh, which represent 85% of the Anticipated Electricity Savings.

The Project has achieved the minimum 80% Electricity Savings threshold. Thus, the Participant is eligible for the Final Incentive Payment equal to \$1,155,160, calculated in accordance with the terms of the Project Incentive Contract, for the Advanced Payment Option.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings
1 <sup>st</sup> Annual	Apr 3, 2021 to Apr 2, 2022	49,467	85%	\$6,530,000 <sup>2</sup>

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of this Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the Measure.
- The Incentive based on the performance of the Measure.

## In-Service Date Confirmation

The In-Service Date of April 3, 2021 was established on August 19, 2021.

## Metered Data Analysis

[REDACTED] the Participant representative, provided the raw data to the Technical Reviewer for analysis. The raw data includes the following data at hourly intervals:

- Gross electricity generation from the gas turbine generator (GTG)
- Electricity consumption of auxiliary loads, which include the GTG package loads and fuel gas booster compressor (FGBC)

<sup>1</sup> Percentage of the Anticipated Electricity Savings shown in the M&V Plan.

<sup>2</sup> Based on the Application Review Electricity Billing Rate of \$132/MWh from the Project Review.



- Natural gas consumption of each of the GTG and duct burner
- Steam produced in the heat recovery steam generators (HRSG)
- HRSG feedwater flowrate
- Combustion air cooling chilled water flowrate and supply/return temperature

The data provided is compliant with the M&V Plan.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Apr 3, 2021, 00:00		
Reporting Period End	Apr 2, 2022, 23:59		
Reporting Period Duration	8,760	hours	
Available Data	8,760	hours	
Missing Data	2	hours	See note below table.
Hours of Operation	7,463	hours	85% of the Reporting Period duration.

The Reporting Period dataset contained 2 hours of missing data on March 13, 2022, at 1 a.m. and 2 a.m., which coincides with the daylight savings time change. The Technical Reviewer assumed that the CHP system had operated during these two hours, as the data shows the CHP system operated during the adjacent hours. For each of the two hours the Technical Reviewer assumed that the gross generation was equal to the average of the gross during the adjacent hours.

## Performance of the Measure

The electrical performance of this generation project is based on the following equation:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

The Reporting Period Energy for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	51,295	MWh	
Auxiliary Loads Energy	1,828	MWh	1.5% of Gross Electrical Energy (see comment below table).
Reporting Period Energy	49,467	MWh	Gross Electrical Energy– Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%		The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	5,647	kW	Reporting Period Energy ÷ Reporting Period Duration

### Electricity Savings

The Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings. Since there has been no change in the Static Factors as defined in the M&V Plan Section B.5.1, Non-Routine Adjustments are not required for this Reporting Period.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Reporting Period Energy	49,467	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	49,467	MWh	
Uncertainty of the Electricity Savings	± 2.5%		The Uncertainty is mostly due to the accuracy of the meters.
Anticipated Electricity Savings	58,008	MWh	Per the M&V Plan.
Electricity Savings as Percentage of Anticipated Electricity Savings	87%		
Average Demand Savings	5,647	kW	Obtained from Table 3.
Summer Peak Demand Savings	5,424	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm - 7:00 pm, June 1 to August 31.

The Electricity Savings of the 1<sup>st</sup> Annual Reporting Period are 49,467 MWh, which represent 85% of the Anticipated Electricity Savings. The under-performance resulted from lower than anticipated operating hours and average net operating electrical output. The CHP system was anticipated to operate 8,600 hours whereas the Reporting Period uptime was 7,463 hours. The net average operating electrical output of 6,628 kW was lower than the anticipated output of 6,745 kW.

## Total System Efficiency

The CHP System's Total System Efficiency (TSE) is calculated according to the following equation.

$$TSE (\%) = [Gross\ Electrical\ Energy + Recovered\ Heat\ Utilized] / [Fuel\ Energy\ Input]$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
Gross Electrical Energy	51,295	MWh	Obtained from Table 3.
Recovered Heat Utilized	84,710	MWh	
Fuel Energy Input	176,148	MWh	Calculated from total volumetric natural gas consumption to the GTG and a natural gas higher heating value (HHV) of 1,052 BTU/scf provided by the Participant.
<b>Total System Efficiency</b>	77%		This value is higher than the 65% threshold required by the Program.

## Next Reporting Period

The M&V Plan shows additional annual reporting periods following completion of the 1<sup>st</sup> Annual Reporting Period. The Technical Reviewer will send reminders to obtain M&V data at the request of the IESO.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.



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## M&V Report

1<sup>st</sup> Annual Report

October 29, 2018 to October 28, 2019



Compressed Air System Upgrade

---

Project: Toronto-SCP-601267

August 20, 2021

Revision 0

**Prepared for:**

 (the Participant)

Toronto Hydro-Electric System Limited (the LDC)

**Prepared by:**

CLEARResult (the Technical Reviewer)

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Energy Conservation Measure (ECM), Independent Variable, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Regression Analysis, Reporting Period, Reporting Period Energy, Savings, Standard Error, Static Factors, Uncertainty.

## Approvals

	Written by Technical Reviewer	Reviewed by Engineering Manager
Name:	[REDACTED]	[REDACTED]
Date:	August 20, 2021	August 20, 2021
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
August 20, 2021	First M&V Report issuance.	0	[REDACTED]



## 1. Executive Summary

The Electricity Savings calculated for the 1<sup>st</sup> Annual Reporting Period of October 29, 2018, to October 28, 2019, are 364 MWh, which represent 191% of the Anticipated Electricity Savings.

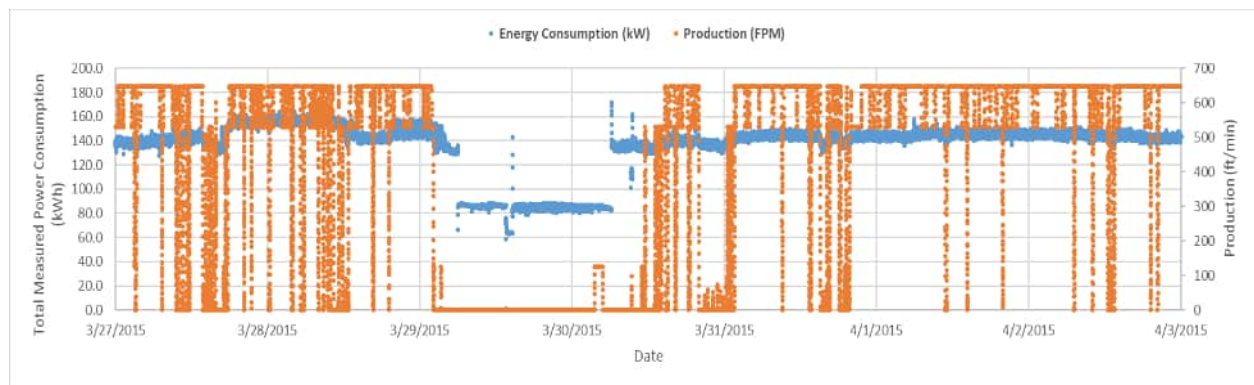
The Electricity Savings meet the 80% performance threshold required by the Program Rules.

## 2. Project Overview

### 2.1. Important Note

It has been noted that when the roofing and insulation manufacturing plant (the Facility) line speed is zero, still there are demands for the compressed air. The baseline model of the M&V Plan (Eq. 4) is capped for a minimum of 55,500 (feet per day) daily production. An average of 85.16 kWh has been identified to be a good representative of the compressors power consumption in the Baseline with no daily production.

**Figure 1 Baseline Compressors' Energy Consumption and the Facility Production Rate**



### 2.2. Baseline Energy & Anticipated Electricity Savings

The Baseline Energy and the Anticipated Electricity Savings are obtained from the M&V Plan Revision 1 dated May 31, 2017 and are presented in Table 1.

**Table 1. Baseline Energy and Anticipated Electricity Savings from the M&V Plan**

Description	Value	Unit
Baseline Energy	1,191	MWh/year
Anticipated Electricity Savings	191	MWh/year

This is an IPMVP Option B methodology of calculating the Electricity Savings.

This M&V Report calculates the actual Electricity Savings divided by the Anticipated Electricity Savings, to verify whether that the Project has achieved the required 80% of the Anticipated Electricity Savings.

### 2.3. In-Service Date and Previous Reporting Period

The In-Service Date of October 29, 2018, was established on December 13, 2018.

The 1<sup>st</sup> Quarterly Reporting Period was from October 29, 2018, to January 28, 2019.

### 2.4. Current Reporting Period

The 1<sup>st</sup> Annual Reporting Period is from October 29, 2018, to October 28, 2019. This Reporting Period represents 365 days (8,760 hours).

## 3. Reporting Period Energy

### 3.1. Raw Data

██████████ the Participant representative, provided the data of electrical consumption and the Facility production to the Technical Reviewer for analysis on June 25 and August 18, 2021.

Table 2 presents an overview of the data analysis related to the Reporting Period Energy, hours of operation and duration of the Reporting Period.

**Table 2. Reporting Period Hours, Durations, and Hours of Operations**

Parameter	Value	Unit	Comment
Start Date of Reporting Period	October 29, 2018, 00:00	-	
End Date of Reporting Period	October 28, 2019, 23:59	-	
Reporting Period Duration	8,760	Hours	
System Hours of Operation	8,760	Hours	100% uptime
Available Metered Data	8,744	Hours	99.8% of the Reporting Period Duration.
Missing Data	16	Hours	0.2% of the Reporting Period Duration.

Missing hours replaced with the average power consumption data as the missing hours are a small portion of the reporting period. Additionally, 72 days of the production data was not provided. The Technical Reviewer assumed that the Facility's production was zero as a conservative approach.

### 3.2. Reporting Period Energy

The Reporting Period Energy is shown is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Reporting Period Energy	967	MWh	From the sum of measured compressor and dryer power data.
Uncertainty	± 1%		Based on compressor electric meter specifications.

## 4. Electricity Savings

### 4.1. Results

The Electricity Savings are calculated according to the following formula:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

After the Baseline Period, the electric pump impellers were destroyed by the grit from the shingles. As a result, the Participant replaced four small electric pumps (less than an hours-power) with four new air operated diaphragm pumps. The air flow rate demand increases as the consequence of these new pumps and the two air compressors consume more electricity to supply the new demand.

The air flowrate of one of the diaphragm pumps has been measured as per email of January 7, 2018 from [REDACTED]<sup>1</sup> on behalf of the Participant. The measured flow rate data shows minimum of 25 cfm airflow demands at the normal operation of each pump. All pumps run continuously 24/7 throughout the year<sup>2</sup>.

An extra analysis has been done on the baseline data to define the compressors specific power. The Technical Reviewer has calculated the specific power of 20.78 kW/100 cfm when the baseline compressed air flow rates were near 100 cfm. The Technical Reviewer compared the calculated specific power with the compressor data sheet which shows 18 kW/100 cfm at rated capacity of 470 acfm and 22.2 kW at zero flow. Thus, the specific power of 20.78 kW/100 cfm is in acceptable range.

Therefore, a Non-Routine Adjustment was made to the baseline load by adding 20.78 kW for each operating hour of the Reporting Period.

The Reporting Period Energy and Electricity Savings are presented in Table 4.

---

<sup>1</sup> Email subject: "[REDACTED] - measured the air consumption of one of the diaphragm pumps", forwarded from "[REDACTED]", the LDC representative, dated January 7, 2019

<sup>2</sup> Email subject: "RE: Toronto-SCP-601267 - MVR-Q1 - [REDACTED] - measured the air consumption of one of the diaphragm pumps", from "[REDACTED]", dated April 1, 2019

**Table 4. Calculation of Electricity Savings**

Parameter	Value	Unit	Comment
Adjusted Baseline Energy	1,149	MWh	As Per M&V Baseline Energy: 1,191 MWh/year, with annual production of 4.8 million bundles of shingles.
Reporting Period Energy	967	MWh	From Table 3.
Non-Routine Adjustment	182	MWh	$20.78 \text{ kW} \times 8,760 \text{ h} / 1,000$
<b>Electricity Savings</b>	<b>364</b>	<b>MWh</b>	Equal to the Adjusted Baseline Energy - Reporting Period Energy + Non-Routine Adjustment
Uncertainty of the Electricity Savings	± 22%	-	The uncertainty is due to the accuracy of the electric meters (±1%) and the baseline uncertainty (±7%).
Anticipated Electricity Savings	191	MWh	From Table 1.
Electricity Savings as a Percentage of Anticipated Electricity Savings	191%	-	This value meets the 80% performance threshold required by the Program Rules.
Average Demand Savings	42	kW	Electricity Savings divided by Reporting Period duration: $364 \text{ MWh} / 8,760 \text{ h}$
Summer Peak Demand Savings	51	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm -7:00 pm.

## 4.2. Conclusion

The Electricity Savings are 364 MWh or 191% of the Anticipated Electricity Savings for the Reporting Period. The Electricity Savings meet the performance threshold of the Program.

The main reason of the overperformance is the non-routine adjustment that is required due the installation of four new diaphragm pumps. In the absence of the non-routine adjustment the Electricity Savings are expected to be within the range of 95% to 105% of the Anticipated Electricity Savings.

## 4.3. Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

#### 4.4. Electricity Savings to Date

The Electricity Savings to date are provided in Table 5.

**Table 5. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings		
		MWh	% of Contracted Electricity Saving	Cost Savings (\$)³
<b>1<sup>st</sup> Quarterly</b>	October 29, 2018 to January 28, 2019	58	120%	\$29,900
<b>1<sup>st</sup> Annual</b>	October 29, 2018 to October 28, 2019	364	191%	\$47,300

³ Based on Electricity Billing Rate of 130 \$/MWh, obtained from the Project Review (as per Application).



# Measurement & Verification Report

## 1<sup>st</sup> Annual

### September 1, 2018 to August 31, 2019



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Friday, February 21, 2020

**PROJECT ID:** Toronto-SCP-601461

**PREPARED FOR:**

Toronto Hydro-Electric System Limited  
14 Carlton Street, Toronto ON M5B 1K5

**PREPARED BY:**

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Prepared per Program Rules version “saveONenergy Process & Systems Upgrades Program, FINAL v1.1 June 8, 2016”

## Revision History

Date (MM/DD/YYYY)	Name/Description	Revision	Author
2/21/2020	First Issuance	0	[REDACTED]

**Reviewed by:**

Name: [REDACTED]

Signature: [REDACTED]

Date: 2/21/2020

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## 1. Executive Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of September 1, 2018 to August 31, 2019, are 2,217 MWh, which represents 104% of the Anticipated Electricity Savings.

The Electricity Savings meet the 80% performance threshold required by the Program Rules.

## 2. Project Overview

### 2.1. BASELINE ENERGY AND ANTICIPATED ELECTRICITY SAVINGS

The Baseline Energy and the Anticipated Electricity Savings are obtained from the M&V Plan, Rev. 2 dated May 12, 2017, and are presented in Table 1.

**Table 1. Baseline Energy and Anticipated Electricity Savings from the M&V Plan**

Description	Value	Unit
Baseline Energy	3,626	MWh/year
Anticipated Annual Electricity Savings	2,137	MWh/year

This M&V Report assesses the actual Electricity Savings based on raw data provided by the Participant and the methodology described in the M&V Plan. This is an IPMVP Option B methodology of calculating the Electricity Savings.

This M&V Report calculates the actual Electricity Savings divided by the Anticipated Electricity Savings, to verify whether the Project has achieved the required 80% of the Anticipated Electricity Savings.

### 2.2. IN-SERVICE DATE AND PREVIOUS REPORTING PERIOD

The In-Service Date is September 1, 2018, which was established on September 27, 2018.

The 1<sup>st</sup> Quarterly M&V Report covered the period of September 1 to November 30, 2018.

### 2.3. CURRENT REPORTING PERIOD

The 1<sup>st</sup> Annual Reporting Period is from September 1, 2018 to August 31, 2019, which represents 365 days (8,760 hours).

## 3. Reporting Period Energy

██, on behalf of the Participant, provided the raw data to the CMVP for analysis. The raw data includes ██████████ cooling and pump electrical consumption data. The hourly energy consumption of ██████████ electrical chillers was provided by ██████████

Table 2 presents an overview of the data analysis related to the Reporting Period Energy and hours of operation.

**Table 2. Reporting Period Hours, Duration, and Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	September 1, 2018, 00:00		Start date of the Reporting Period.
Reporting Period End	August 31, 2019, 23:59		This is the end date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date
Available Data of Enwave cooling and pump electrical consumption	8,760	hours	
Available Data of Bell electrical chillers	8,014	hours	All chillers have 746 hours of missing electricity data, except for Chiller 304A/B which has 6,576 hours of missing data. However, the hourly supplied cooling loads of all chillers are continuously available. Chiller 304A/B operates when there is an extra demand which is not the case for majority of Reporting Period. Therefore, the missing data of this chiller most likely is due chiller shutdown.
Missing Data	746	hours	The missing electricity data of the electrical chillers are replaced with the calculated electrical power obtained from supplied cooling loads. An average conversion factor of 0.589 kW/TR is used to convert the thermal energy to electrical energy. The conversion factor is calculated as per monthly average of electrical chiller consumption divided by the average monthly cooling tons that are provided in the Baseline Period.
Hours of Operation	8,760	hours	100% of the Reporting Period Duration

The Reporting Period Energy is shown is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Reporting Period Energy	1,224	MWh	Sum of energy of the chiller + chiller pump + chiller fan + EnWave pumps + EnWave chiller
Reporting Period Uncertainty	± 4.3	%	The Uncertainty is mostly due to the accuracy of the meters, along with the use of an average efficiency for the chillers.
Reporting Period Average Demand	139	kW	1,224 MWh / 8,760 hours × 1000
Reporting Period Summer Peak Demand	207	kW	Average hourly electricity demand (kW) during the summer peak period (weekdays, 1pm – 7pm, June 1 – August 31).

## 4. Electricity Savings

### 4.1. ADJUSTED BASELINE ENERGY CALCULATION

As defined in the M&V Plan, the Baseline Energy was adjusted to operating conditions of the Reporting Period using outdoor air temperature as the independent variable. The Adjusted Baseline Energy is shown in Table 4.

**Table 4. Adjusted Baseline Energy**

Description	Value	Unit	Comment
Reporting Period Hours of Operation	8,760	hours	
Adjusted Baseline Energy	3,441	MWh	Using the Baseline Adjustment equation as per the M&V Plan.
<b>Baseline Peak Demand</b>	592	kW	Obtained from the M&V Plan

### 4.2. RESULTS

The Electricity Savings are calculated according to the following formula:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustment}$$

Since there has been no change in the Static Factors as defined in the M&V Plan Section B.5.2, Non-Routine Adjustments are not required for this Reporting Period. The Reporting Period Energy, Adjusted Baseline Energy, and the Electricity Savings are presented in Table 5.

**Table 5. Calculation of Electricity Savings**

Description	Value	Unit	Comment
Adjusted Baseline Energy	3,441	MWh	From Table 6.
Reporting Period Energy	1,224	MWh	From Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	2,217	MWh	
Uncertainty of the Electricity Savings	± 15	%	The Uncertainty is a combination of the accuracy of the Baseline meters, the coefficient of variance for the Baseline data, the baseline adjustment equation and the Reporting Period power meters accuracy.
Anticipated Electricity Savings	2,137	MWh	From Table 1.
Electricity Savings as a Percentage of Anticipated Electricity Savings	104	%	
Summer Peak Demand Savings	384	kW	Baseline Peak Demand – Reporting Period Peak Demand

### 4.3. CONCLUSION

The 1<sup>st</sup> Annual Electricity Savings are 2,217 MWh and represent 104% of the Anticipated Electricity Savings.

The main reason for the slight overperformance is a minor change in the cooling demand from Bell compared to the Baseline Period.

### 4.4. NEXT REPORTING PERIOD AND NEXT STEPS

This is the final M&V Report, as the M&V Reporting Period is one year.

### 4.5. ELECTRICITY SAVINGS TO DATE

The Electricity Savings to date are presented in Table 6.

**Table 6. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings		
		MWh	% of Anticipated Savings Value <sup>1</sup>	Cost Savings (\$) <sup>2</sup>
1 <sup>st</sup> Quarterly	Sep. 1 to Nov. 30, 2018	507	136%	\$63,400
1 <sup>st</sup> Annual	Sep. 1, 2018 to Aug. 31, 2019	2,217	104%	\$277,000

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan

<sup>2</sup> Based on \$125/MWh obtained from the Project Review

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Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.



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## M&V Report

1<sup>st</sup> Annual Report

June 2, 2018 to June 1, 2019



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Project: Toronto-SCP-601491

July 08, 2019

Revision 0

**Prepared for:**



Toronto Hydro-Electric System Limited (the LDC)

**Prepared by:**

CLEARresult

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### Revision History

Date	Name/Description	Revision	Author
July 8, 2019	Y1 M&V Report issuance	0	[REDACTED]

### Approvals

Name	Title	Signature	Date
[REDACTED]	[REDACTED]	[REDACTED]	July 5, 2019

## 1. Executive Summary

The Electricity Savings calculated for the 1<sup>st</sup> Annual Reporting Period of June 2, 2018 to June 1, 2019 are 466 MWh, which represent 98% of the Anticipated Electricity Savings.

The Electricity Savings meet the 80% performance threshold required by the Program Rules.

## 2. Project Overview

### 2.1. Baseline Energy & Anticipated Electricity Savings

The Baseline Energy and the Anticipated Electricity Savings are obtained from the M&V Plan Revision 1 dated May 24, 2017, and are presented in Table 1.

**Table 1. Baseline Energy and Anticipated Electricity Savings from the M&V Plan**

Description	Value	Unit
Baseline Energy	0	MWh/year
Anticipated Electricity Savings	475	MWh/year

This M&V Report assesses the actual Electricity Savings based on raw data provided and the methodology described in the M&V Plan. This is an IPMVP Option B methodology of calculating the Electricity Savings.

This M&V Report calculates the actual Electricity Savings divided by the Anticipated Electricity Savings, to verify whether the Project has achieved the required 80% of the Anticipated Electricity Savings.

### 2.2. In-Service Date and Previous Reporting Period

The In-Service Date of June 2, 2018 was established on June 26, 2018.

### 2.3. Current Reporting Period

The 1<sup>st</sup> Annual Reporting Period is from June 2, 2018 to June 1, 2019. This Reporting Period represents 365 days (8,760 hours).

## 3. Reporting Period Energy

### 3.1. Raw Data

██████████ the Participant representative, provided the data of combined heat and power (CHP) system to the CMVP for analysis. The submitted metered data includes the hourly net CHP system electricity generation as well as the natural gas consumption.

Table 2 presents an overview of the data analysis related to the Reporting Period Energy, hours of operation and duration of the Reporting Period.

**Table 2. Reporting Period Hours, Durations, and Hours of Operations**

Parameter	Value	Unit	Comment
Start Date of Reporting Period	June 2, 2018, 00:00	-	
End Date of Reporting Period	June 1, 2019, 23:59	-	
Reporting Period Duration	8,760	Hours	
System Hours of Operation	8,758	Hours	99.98% uptime
Shutdown of CHP System	2	Hours	Two subsequent hours did not have electricity generation and the associated natural gas consumption readings were zero.
Missing Data	0	Hours	Data was provided for every hour of the Reporting Period.

The CHP system was operational for 8,758 hours of the 8,760 hours of the Reporting Period, equivalent to 99.98% uptime.

### 3.2. Reporting Period Energy

The energy generation of the CHP for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
CHP Gross Electricity	Not Available	MWh	Sum of the hourly interval gross energy generated by the CHP system.
Auxiliary Loads	Not Available	MWh	Sum of the hourly interval auxiliary energy consumption by the CHP system.
Reporting Period Energy	466	MWh	CHP Net Electricity Generation.
Uncertainty of the Reporting Period Energy	± 2.0%	-	The uncertainty is due to the accuracy of the electric meters.

## 4. Electricity Savings

### 4.1. Results

The Electricity Savings are calculated according to the following formula:

$$\text{Electricity Savings (MWh)} = \text{Reporting Period Energy (MWh)} \pm \text{Non-Routine Adjustments (MWh)}$$

Since there has been no change in the Static Factors as defined in the M&V Plan Section B.5.1, Non-Routine Adjustments are not required for this Reporting Period.

The Reporting Period Energy and Electricity Savings are presented in Table 4.

**Table 4. Calculation of Electricity Savings**

Parameter	Value	Unit	Comment
Baseline Energy	0	MWh	Baseline Energy is nil, due to no generation in the Baseline Period.
Reporting Period Energy	466	MWh	From Table 3.
Non-Routine Adjustment	0	MWh	None.
<b>Electricity Savings</b>	<b>466</b>	<b>MWh</b>	Equal to the Reporting Period Energy.
Uncertainty of the Electricity Savings	± 2.0%	-	The uncertainty is due to the accuracy of the electric meters.
Anticipated Electricity Savings	475	MWh	From Table 1.
Electricity Savings as a Percentage of Anticipated Electricity Savings	98%	-	This value meets the 80% performance threshold required by the Program Rules.
Average Demand Savings	53	kW	Electricity Savings divided by Reporting Period duration: $466 \text{ MWh} / 8,760 \text{ h}$
Summer Peak Demand Savings	47	kW	Summer peak demand savings, weekdays, 1pm – 7pm, June 1 – August 31.

## 4.2. Conclusion

The Electricity Savings are 466 MWh or 98% of the Anticipated Electricity Savings for the Reporting Period. The Electricity Savings meet the performance threshold of the Program.

## 4.3. Next Steps

This is the final M&V Report, as the M&V Reporting Period is one year in duration and this Project is a Small Capital Project. No additional M&V data will be required.

## 4.4. Electricity Savings to Date

The Electricity Savings to date are provided in Table 5.

**Table 5. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings		
		MWh	% of Contracted Electricity Saving	Cost Savings (\$)¹
<b>1<sup>st</sup> Quarterly</b>	June 2 to September 1, 2018	104	87%	\$17,100
<b>1<sup>st</sup> Annual</b>	June 2, 2018 to June 1, 2019	466	98%	\$76,900

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¹ Based on Electricity Billing Rate of \$165/MWh, obtained from the Project Application Review.



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## M&V Report

### 1<sup>st</sup> Annual M&V Report

February 7, 2019 to February 6, 2020

[REDACTED]  
[REDACTED] Cogeneration System

---

**Project ID:** Toronto-SCP-601583

March 26, 2020

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited (the LDC)

[REDACTED]

**Prepared by:**

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### Revision History

Date	Description	Revision	Author
March 26, 2020	Initial M&V Report issuance.	0	[REDACTED]

### Approvals

Name	Title	Signature	Date
[REDACTED]	Energy Engineer	[REDACTED]	March 26, 2020

# 1. Executive Summary

The Electricity Savings calculated for the 1<sup>st</sup> Annual Reporting Period of February 7, 2019, to February 6, 2020, are 1,958 MWh/year, which represents 96% of the Anticipated Electricity Savings.

The Electricity Savings meet the 80% performance threshold of the Program Rules.

The Total System Efficiency achieved for the 1<sup>st</sup> Annual Reporting Period is 70%, which meets the Program Rules requirement of 65%.

## 2. Project Overview

### 2.1. Baseline Energy and Anticipated Electricity Savings

The Baseline Energy and the Anticipated Electricity Savings are obtained from the M&V Plan Rev. 3, dated March 28, 2018, and are presented in Table 1.

This is an electricity generation Project, and therefore the Baseline Energy is 0 MWh/year.

**Table 1. Baseline Energy and Anticipated Electricity Savings**

Description	Value	Unit
Baseline Energy	0	MWh/year
Anticipated Electricity Savings	2,049	MWh/year

This M&V Report assesses the actual Electricity Savings based on raw data provided by the Participant and the methodology described in the M&V Plan. The M&V Report calculates the actual Electricity Savings divided by the Anticipated Electricity Savings, to verify whether the Project has achieved the required 80% of the Anticipated Electricity Savings.

### 2.2. In-Service Date and Previous Reporting Periods

The In-Service Date of February 7, 2019, was established on February 27, 2019.

The 1<sup>st</sup> Quarterly Reporting Period was from February 7, 2019, to May 6, 2019.

### 2.3. Current Reporting Period

The 1<sup>st</sup> Annual Reporting Period is from February 7, 2019, to February 6, 2020, which represents 365 days (8,760 hours).

## 3. Reporting Period Energy

### 3.1. Results

██████████ the LDC representative, provided the raw data to the CMVP for analysis. Data was provided on an hourly basis for the duration of the Reporting Period, for net electrical energy generation of each of four microturbines, total fuel consumption, and recovered thermal energy utilized by the Facility.

The IPMVP Option B methodology is used for calculating the Electricity Savings.

Table 2 presents an overview of the data analysis related to the duration of the Reporting Period, equipment hours of operation, and Reporting Period Energy.

**Table 2. Reporting Period Hours, Durations and Energy**

Description	Value	Unit	Comments
Reporting Period Start	Feb. 7, 2019 0:00		
Reporting Period End	Feb. 6, 2020 23:59		
Reporting Period Duration	8,760	hours	
Available Data	8,759	hours	100% of the Reporting Period Duration.
Missing Data	1	hours	0.01% of the Reporting Period Duration.
Hours of Operation	8,759	hours	100% of the Reporting Period Duration.
Reporting Period Energy	1,958	MWh	Net energy generated by the CHP System.

## 4. Total System Efficiency

### 4.1. Results

The Total System Efficiency (TSE) is calculated according to the following equation:

$$TSE (\%) = [CHP \text{ Gross Electrical Energy (MWh)} + CHP \text{ Usable Thermal Output (MWh)}] \div [Natural \text{ Gas Consumption (m}^3) \times Natural \text{ Gas HHV (MWh/m}^3)]$$

The CHP system achieved a Total System Efficiency of 70%, which meets the Program Rules minimum requirement of 65%. The TSE calculation is presented in Table 3.

**Table 3. Calculation of Total System Efficiency**

Description	Value	Unit	Comments
<b>Gross Electrical Energy</b>	2,186	MWh	Calculated using 6.6 kW of auxiliary loads for each hour of operation, per microturbine.
<b>Utilized Thermal Output</b>	3,273	MWh	
<b>Natural Gas Consumption</b>	7,818	MWh	
<b>Natural Gas HHV</b>	10.722	kWh/m <sup>3</sup>	Derived from 0.0386 GJ/m <sup>3</sup> value published by Enbridge.
<b>Total System Efficiency</b>	70%		Meets the 65% minimum threshold defined in the Program Rules.

## 5. Electricity Savings

### 5.1. Results

The Electricity Savings are calculated according to the following equation:

$$\text{Electricity Savings} = \text{Reporting Period Energy} - \text{Baseline Energy} \pm \text{Non-Routine Adjustments}$$

The Reporting Period Energy and the Electricity Savings are presented in Table 4.

**Table 4. Calculation of Electricity Savings**

Description	Value	Unit	Comments
Baseline Energy	0	MWh	Obtained from Table 1.
Reporting Period Energy	1,958	MWh	Obtained from Table 2.
Non-Routine Adjustment	0	MWh	None.
<b>Electricity Savings</b>	<b>1,958</b>	<b>MWh</b>	<i>Reporting Period Energy - Baseline Energy.</i>
Uncertainty of the Electricity Savings	± 2.5%		The Uncertainty is primarily due to the accuracy of the power meter readings.
Anticipated Electricity Savings	2,049	MWh	Obtained from Table 1.
<b>Electricity Savings as a Percentage of Anticipated Electricity Savings</b>	<b>96%</b>		Meets the 80% performance threshold.
Average Demand Savings	224	kW	Average net power output by the CHP system over the Reporting Period.
Peak Demand Savings	179	kW	Average net power output during the summer peak demand period, defined as Monday to Fridays, 1 pm to 7 pm, June 1 to August 31.

## 5.2. Conclusion

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period are 1,958 MWh which represent 96% of the Anticipated Electricity Savings, which meets the minimum threshold of 80% defined in the Program Rules. The Total System Efficiency is 70%, which meets the minimum threshold of 65% defined in the Program Rules.

The reason for the slight under-performance is the result of a lower average net power output of the CHP system (i.e., 224 kW) compared to what was anticipated as part of the M&V Plan (i.e., 235 kW). This is likely due to slight variations in the Facility electrical and thermal demand, particularly during the summer months.

## 5.3. Next Reporting Period and Next Steps

This is the final M&V Report, as the M&V Reporting Period is one year.

## 5.4. Electricity Savings to Date

The Electricity Savings to date are presented in Table 5.

**Table 5. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings		
		MWh	% of Contract Savings <sup>1</sup>	Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Feb 7, 2019 – May 6, 2019	532	107%	\$79,300
1 <sup>st</sup> Annual	Feb 7, 2019 – Feb 6, 2020	1,958	96%	\$291,700

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$149/MWh obtained from the Application Review.



Toronto Hydro-Electric System Limited  
14 Carlton Street  
Toronto, Ontario M5B 1K5



## **Third Party Evaluation Reports**

This document includes the following third party evaluation reports:

### **Process and Systems Upgrades Program:**

- #601586
- #601587
- #601600
- #601723
- #601770
- #601800
- #601818

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## M&V Report

### 1<sup>st</sup> Annual M&V Report

July 18, 2018 to July 17, 2019



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Project ID: Toronto-SCP-601586

August 8, 2019

**Prepared for:**

Toronto Hydro-Electric System Limited (the LDC)



**Prepared by:**

CLEARresult

393 University Ave, Suite 1622

Toronto, ON M5G 1E6

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.

### Revision History

Date	Name/Description	Revision	Author
August 8, 2019	Initial M&V Report issuance	0	[REDACTED]

### Approvals

Name	Title	Signature	Date
[REDACTED]	[REDACTED]	[REDACTED]	August 7, 2019

# 1. Executive Summary

The Electricity Savings calculated for the 1<sup>st</sup> Annual Reporting Period of July 18, 2018, to July 17, 2019, are 273 MWh which represent 94% of the Anticipated Electricity Savings.

The Electricity Savings meet the 80% performance threshold of the Program Rules.

## 2. Project Overview

### 2.1. Baseline Energy and Anticipated Electricity Savings

The Baseline Energy and the Anticipated Electricity Savings are obtained from the M&V Plan Rev. 0, dated May 11, 2017, and are presented in Table 1.

This is an electricity generation Project, and therefore the Baseline Energy is 0 MWh/year.

**Table 1. Baseline Energy and Anticipated Electricity Savings**

Description	Value	Unit
Baseline Energy	0	MWh/year
Anticipated Electricity Savings	292	MWh/year

This M&V Report assesses the actual Electricity Savings based on raw data provided by the Participant and the methodology described in the M&V Plan. The M&V Report calculates the actual Electricity Savings divided by the Anticipated Electricity Savings, to verify whether the Project has achieved the required 80% of the Anticipated Electricity Savings.

### 2.2. In-Service Date

The In-Service Date of July 18, 2018, was established on August 29, 2018. This date was conditional upon receipt of confirmation of the Environmental Activity and Sector Registration (EASR), which was issued on November 2, 2018.

### 2.3. Previous Reporting Periods

The 1<sup>st</sup> Quarterly Reporting Period was from July 18 to October 17, 2018, representing 92 days (2,208 hours).

### 2.4. Current Reporting Period

The 1<sup>st</sup> Annual Reporting Period is from July 18, 2018, to July 17, 2019, representing 365 days (8,760 hours).

## 3. Reporting Period Energy

### 3.1. Results

██████████ the participant representative, provided the raw data to the CMVP for analysis. Net electrical energy generation and natural gas consumption data was provided on an hourly basis for the duration of the M&V Period.

The IPMVP Option B methodology is used for calculating the Electricity Savings.

Table 2 presents an overview of the data analysis related to the duration of the Reporting Period, equipment hours of operation, and Reporting Period Energy.

**Table 2. Reporting Period Hours, Durations and Energy**

Description	Value	Unit	Comments
Reporting Period Start	July 18, 2018 0:00		Start date and time of the Reporting Period.
Reporting Period End	July 17, 2019 23:59		End date and time of the Reporting Period.
Reporting Period Duration	8,760	hours	Reporting Period End minus Reporting Period Start.
Available Data	8,760	hours	100% of the Reporting Period Duration.
Missing Data	0	hours	0% of the Reporting Period Duration.
Hours of Operation	8,696	hours	99.3% of the Reporting Period Duration.
Reporting Period Energy	273	MWh	Net energy generated by the CHP System.

## 4. Electricity Savings

### 4.1. Results

The Reporting Period Energy and the Electricity Savings are presented in Table 3. The Electricity Savings are calculated according to the following equation:

$$\text{Electricity Savings} = \text{Reporting Period Energy} - \text{Baseline Energy} \pm \text{Non-Routine Adjustments}$$

**Table 3. Calculation of Electricity Savings**

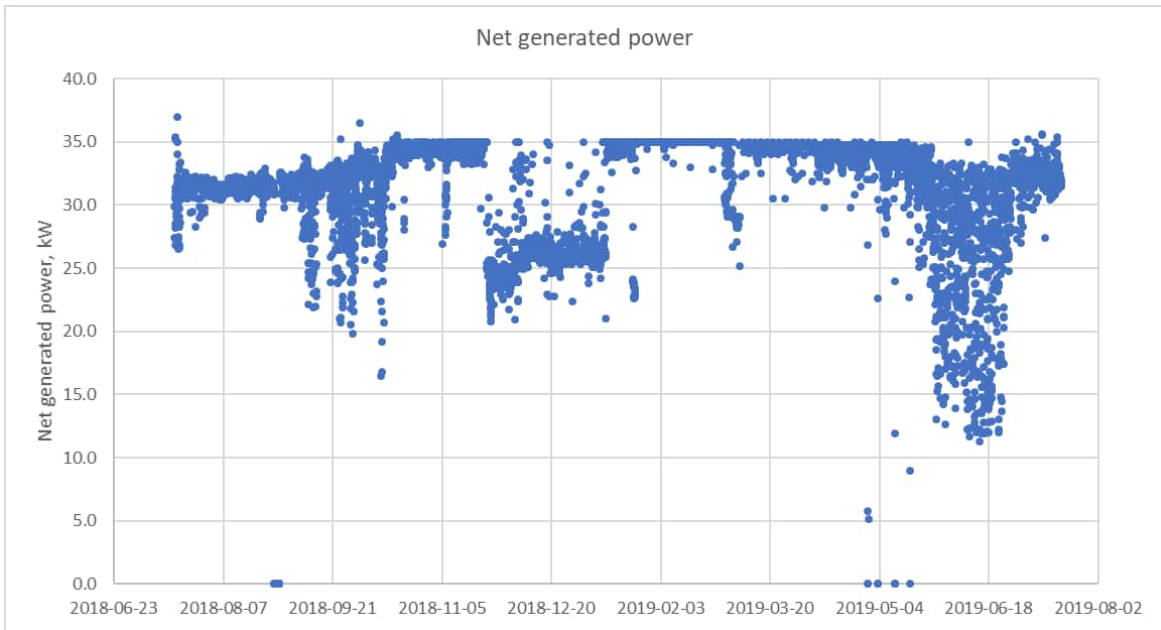
Description	Value	Unit	Comment
Baseline Energy	0	MWh	Obtained from Table 1.
Reporting Period Energy	273	MWh	Obtained from Table 2.
Non-Routine Adjustment	0	MWh	None.
<b>Electricity Savings</b>	<b>273</b>	<b>MWh</b>	Reporting Period Energy minus the Baseline Energy.
Uncertainty of the Electricity Savings	± 2.0%		The Uncertainty is primarily due to the accuracy of the power meter readings.
Anticipated Electricity Savings	292	MWh	From the M&V Plan.
<b>Electricity Savings as a Percentage of Anticipated Electricity Savings</b>	<b>94%</b>		Meets the 80% performance threshold.
Average Demand Savings	31.2	kW	Electricity Savings divided by duration of the Reporting Period.
Peak Demand Savings	29.5	kW	Peak demand period, June to August, weekdays from 1 pm – 7 pm.

## 4.2. Conclusion

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period are 273 MWh, which represent 94% of the Anticipated Electricity Savings for the Reporting Period. The Electricity Savings meet the 80% performance threshold of the Program Rules.

The reason for the slight under-performance is that net generated power was lower than anticipated. The System ran almost continuously, with a 99.3% uptime that approached the anticipated average 99.7% uptime. However, the Reporting Period average net output power of 31.2 kW was below the anticipated average net output power of 33.6 kW. Lower average output power occurred most consistently during December 2018, as well as during September 2018 and June 2019, as shown in Figure 1.

**Figure 1. Reporting Period net generation**



**4.3. Electricity Savings to Date**

The Electricity Savings to date are presented in Table 4.

**Table 4. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings		
		MWh	% of Contract Savings <sup>1</sup>	Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	July 18, 2018 – Oct. 17, 2018	67	94%	\$9,700
1 <sup>st</sup> Annual	July 18, 2018 – July 17, 2019	273	94%	\$39,300

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$144/MWh obtained from the Project Review.

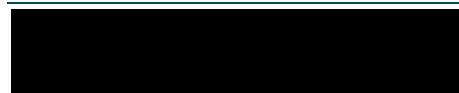




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CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period



## Cogeneration System

**Project ID:** Toronto-PI-601587

January 5, 2022  
Revision 0

**Prepared for:**

Toronto Hydro-Electric Systems Ltd.

**Prepared by:**

CLEARresult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
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*Prepared per Program Rules version "saveONenergy Process & Systems Upgrades Program, FINAL v2.0",  
April 6, 2018*



### Revision History

Date	Description	Revision	Author
January 10, 2022	M&V Report first issuance.	0	[REDACTED]

### Approvals

	Written by Technical Reviewer	Reviewed by Engineering Manager
<b>Name</b>	[REDACTED]	[REDACTED]
<b>Date</b>	January 10, 2022	January 10, 2022
<b>Signature</b>	[REDACTED]	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of November 2, 2020, to November 1, 2022, are 1,260 MWh, which represents 48% of the Anticipated Electricity Savings.

The significant underperformance is a result of much lower than anticipated electricity generation from the CHP System, caused by shutdown of the CHP System due to the COVID-19 pandemic and noise disturbance in the Facility. The Participant is aware of the underperformance but confirmed that they have no intention to delay the start of the Reporting Period from the In-Service Date.

The CHP System achieved a Total System Efficiency (TSE) of 58.5%, which is less than the minimum 65% Program requirement.

The Balance Incentive payable to the Participant is \$111,487, which is based on the performance ratio of 48% and an adjustment to account for the low TSE. Refer to the Appendix for details on the Incentive calculation.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings
1 <sup>st</sup> Quarterly	Nov 2, 2020 to Feb 1, 2021	258	39%	\$33,500 <sup>2</sup>
1 <sup>st</sup> Annual	Nov 2, 2020 to Nov 1, 2021	1,260	48%	\$163,800

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the Measure.
- The Incentive based on the performance of the Measure.

## In-Service Date Confirmation

The In-Service Date of November 2, 2020, was established on April 14, 2021.

<sup>1</sup> Percentage of the Anticipated Electricity Savings shown in the M&V Plan.

<sup>2</sup> Based on the contracted Electricity Billing Rate of \$130/MWh (see Approval Letter).

## Metered Data Analysis

[REDACTED] a representative of the Participant, provided the M&V data on November 15, 2021, to the Technical Reviewer for analysis. The data provide includes the following, at 15-minute intervals:

- CHP system gross electrical output
- Power draw of the CHP system auxiliary components
- CHP system volumetric fuel input rate
- CHP system heat utilization

The data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Nov 2, 2020, 00:00		
Reporting Period End	Nov 1, 2021, 23:59		
Reporting Period Duration	8,760	hours	
Available Data	8,757	hours	Almost 100% of the Reporting Period Duration
Missing Data	3	hours	
Hours of Operation	6,103	hours	70% of the Reporting Period duration.

## Performance of the Measure

The electrical performance of this generation project is based on the following equation:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

The Reporting Period Energy for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,296	MWh	
Auxiliary Loads Energy	36	MWh	
Reporting Period Energy	1,260	MWh	Gross Electrical Energy – Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%		The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	144	kW	Reporting Period Energy ÷ Reporting Period Duration
Summer Peak Demand Generation	256	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm - 7:00 pm, June 1 to August 31.

### Electricity Savings

The Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings. Since there has been no change in the Static Factors as defined in the M&V Plan Section B.5.1, Non-Routine Adjustments are not required for this Reporting Period.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Reporting Period Energy	1,260	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,260	MWh	
Uncertainty of the Electricity Savings	± 2.5%		The Uncertainty is mostly due to the accuracy of the meters.
Anticipated Electricity Savings	2,649	MWh	
Electricity Savings as Percentage of Anticipated Electricity Savings	48%		
Average Demand Savings	144	kW	Obtained from Table 3.
Summer Peak Demand Savings	256	kW	Obtained from Table 3.

The Electricity Savings of 1<sup>st</sup> Annual Reporting Period are 1,260 MWh, which represent 48% of the Anticipated Electricity Savings. The significant under-performance is due to the following:

- The CHP System uptime was 70%, which is lower than the anticipated uptime of 96%.
- The CHP System net operating electricity generation was 206 kW, which is significantly lower than the anticipated average generation of 315 kW.

The significantly reduced uptime was a result of the following:

- Prolonged shutdown of the CHP system during the first few months of operation, which was a result of unavailability of technical personnel (due to the COVID-19 pandemic) to troubleshoot operational issues.
- Shutdown of the CHP system at night due to noise disturbances in the penthouse level of the Facility.

The Participant is aware of the underperformance but had confirmed that they have no intention to delay the start of the Reporting Period from the In-Service Date. The Participant has indicated that the noise issue has been rectified by implementing sound attenuation measures and the CHP system is currently operating throughout the day.

## Total System Efficiency

The CHP System's Total System Efficiency (TSE) is calculated according to the following equation.

$$TSE (\%) = [Gross\ Electrical\ Energy + Recovered\ Heat\ Utilized] / [Fuel\ Energy\ Input]$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
Gross Electrical Energy	1,296	MWh	Obtained from Table 3.
Recovered Heat Utilized	1,226	MWh	
Fuel Energy Input	4,308	MWh	Calculated from total volumetric natural gas consumption and a natural gas higher heating value (HHV) of 1,020 BTU/ft <sup>3</sup> , specified in the M&V Plan.
<b>Total System Efficiency</b>	58.5%		This value is lower than the 65% threshold required by the Program.

Note that the TSE of 58.5% is less than the minimum 65% Program requirement but higher than the minimum 57.5% required to be eligible for an Incentive. See the Appendix for the Incentive calculation.

## Next Reporting Period

The 1<sup>st</sup> Annual Reporting Period is the final Reporting Period. Thus, there are no more reporting periods.

## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual M&V Reporting Period, Project Benefits, Eligible Costs and TSE, the Balance Incentive payable to the Participant is \$111,487. The Incentive calculation is shown in Table A1. Note that a 15% discount was applied to the Incentive, based on Program rules, as the TSE falls between 57.5% and 60.0%.

**Table A1. Incentive Calculation**

Electricity Savings (MWh)	1,260
Electricity Billing Rate (\$/MWh)	130 <sup>3</sup>
Electricity Billed Savings	\$163,800
Other Benefits and Costs	\$0
Project Benefits	\$163,800
Eligible Costs	\$870,146 <sup>4</sup>
Contracted Incentive Amount	\$529,800
Incentive 1 - \$200/MWh (capped at 120% of the contracted Incentive amount)	\$251,960
Incentive 2 - 40% of Eligible Costs	\$348,059
Incentive 3 - 1-year Payback	\$706,373
Project Incentive (Minimum of 3 limiters above)	\$251,960
Recommended Project Incentive (Discounted by 15% due to low TSE)	\$214,166
Recommended First Payment	\$102,679 <sup>5</sup>
Recommended Balance Payment	\$111,487

**Table A2. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Payment
<b>Payment 1</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

<sup>3</sup> Contracted Electricity Billing Rate (see Approval Letter)

<sup>4</sup> Reviewed Eligible Costs (see comment on Eligible Costs in the Payment Recommendation for the First Payment, issued on January 7, 2022).

<sup>5</sup> See Payment Recommendation for the First Payment.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.







CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES

# Measurement & Verification Report

## 1<sup>st</sup> Annual Reporting Period



### Cogeneration System

**Project ID:** Toronto-SCP-601600

March 13, 2023

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited (THES)



**Prepared by:**

Aladaco Consulting Inc.

Prepared per Program Rules version “saveONenergy Process & Systems Upgrades Program, FINAL v2.0  
April 6, 2018

## Approvals

	Written by	Reviewed by
Name:	██████████	██████████
Date:	March 13 <sup>th</sup> 2023	March 6 <sup>th</sup> , 2023
Signature:	██████████	██████████

## Revision History

Date	Description	Revision	Technical Reviewer
March 6, 2023	M&V Report first issuance.	0	██████████

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of September 28, 2021 to September 27, 2022, are 1,437 MWh, which represents 97% of the Anticipated Electricity Savings.

The Incentive payable to the Participant for this Reporting Period is \$147,900. Refer to the Appendix for details.

The Electricity Savings meet the 80% performance threshold required by the Program Rules.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings and Incentive payments to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Sept 28 to Dec 29, 2021 <sup>3</sup>	401	109	\$57,300
1 <sup>st</sup> Annual	Sept 28, 2021 to Sept 27, 2022	1,437	97	\$205,610

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Adjusted Baseline Energy and the Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## Important Considerations

Please note the following:

1. The In-Service Date was originally set to January 31, 2020. However, the Participant requested the Reporting Period begin September 28, 2021. The extension was requested due to necessary equipment repairs as well as a result of the COVID-19 pandemic. Please refer to “Toronto-SCP-

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$143/MWh obtained from the Project Application Review.

<sup>3</sup> There were 35 hours of missing data points in the Q1 raw data. Therefore, the 1<sup>st</sup> Quarterly Reporting Period was extended by 35 hours.

601600\_ [REDACTED] Cogeneration System\_Q1\_MVR” for more details.

2. The natural gas flow data provided is appears to be understated relative to the ICE specifications. The annual natural gas consumption is 9.7% lower than the calculated consumption based on the hourly electricity output and the ICE specification performance. However, the most conservative Total System Efficiency estimated is 70.6% which is higher than the 65% program requirement.

## In-Service Date Confirmation

The In-Service Date of January 31, 2020, was established on November 17, 2020.

1<sup>st</sup> Quarterly Report was issued on January 28, 2022 with an updated in-service date of September 28, 2021.

## Metered Data Analysis

[REDACTED] a representative of THES, provided the M&V data on January 25, 2023 to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	September 28, 2021 00:00		Start date of the Reporting Period.
Reporting Period End	September 27, 2022 23:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date
Available Data	8,701	hours	
Missing Data	59	hours	See comments below table
Hours of Operation	8,645	hours	99.4% of the Reporting Period Duration

The M&V data was missing (ie. the data set didn't include these hours or the cells were blank) for 59 hours:

- October 27, 2021, 16:00 to October 28, 2021, 17:00 (26 hours)
- December 12, 2021, 10:00 to December 12, 2021, 18:00 (9 hours)
- September 27, 2022, 1:00 to September 27, 2022 0:00 (24 hours)

The Technical Reviewer assumes that the CHP system did not operate during this period as the electrical output, thermal heat recovered, and natural gas consumption were missing or recorded as blank values. Therefore; the missing data was assumed to be zero gross electrical output.

Please note that these 59 hours represent 0.67% of the reporting period, which is well within the 10% missing data permissible per Section B.6.2 of the Measurement and Verification Plan. Additionally, the conservative assumption that the CHP system was not outputting any electricity during the period still meets the 80% performance threshold required by the Program Rules.

## Performance of the Measures

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the Baseline Energy is 0 MWh/year.

### Reporting Period Energy

The Reporting Period Energy is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,498	MWh	CHP System Gross Electrical Output (See comment below table)
Auxiliary Loads Energy	61	MWh	Equal to 4.1% of the Gross Electrical Energy (See comment below table).
Reporting Period Energy	1,437	MWh	Gross Electrical Energy – Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	165	kW	Reporting Period Energy divided by Reporting Period Duration.
Summer Peak Generation	127	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

The ICE supplier confirmed via email on January 18, 2022, that the metered power output from the ICE is gross power (i.e., does not exclude any internal or external auxiliary loads).

The Measurement and Verification Plan specifies that is the auxiliary loads are not metered, they should be determined using the equipment nameplate data; however, as a conservative approach, auxiliary loads were accounted for as 3% of the 125 kW ICE gross capacity. The auxiliary loads were applied for each unit individually (ie. if one unit was operating the loads were 3.75 kWh and 7.5 kWh if both units were operating

simultaneously). Because the System performed well above the 80% performance requirement, the Technical Reviewer deemed this approach sufficient.

### Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	1,437	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,437	MWh	
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	1,479	MWh	Obtained from the M&V Plan
Electricity Savings as a Percentage of Anticipated Electricity Savings	97%	-	
Average Demand Savings	165	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	127	kW	Equal to Summer Peak Generation from Table 3.

The 1<sup>st</sup> Annual Electricity Savings are 1,437 MWh and represent 97% of the Anticipated Electricity Savings.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$TSE (\%) = [Gross\ Electrical\ Energy + CHP\ Thermal\ Output\ Utilized] / CHP\ Energy\ Input$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,498	MWh	See the comment below.
CHP Thermal Output Utilized	2,212	MWh	
Metered CHP Energy Input	4,745	MWh	Calculated using the metered volumetric flowrate of natural gas and Natural Gas Higher Heating Value (HHV) of 38.4 MJ/m <sup>3</sup> (10.67 kWh/m <sup>3</sup> ), obtained from the M&V Plan.

Metered Total System Efficiency	78.2%	-	
---------------------------------	-------	---	--

The metered natural gas flow data flow data appears to be understated the energy input by 10% compared to the ICE specifications. However, when the ICE specifications are used to energy input, the TSE decreases to 70.6% which meets the 65% program requirement.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

The Incentive payable for the 1<sup>st</sup> Annual M&V Reporting Period is \$147,900. Table 6 outlines the payment schedule as defined in the contract and Program Rules, for reference.

**Table 6. Incentive Payment Schedule**

<b>Deferred Payment Schedule</b>	<b>Projected Date</b>	<b>Incentive Amount</b>
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.



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Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





DELIVERY  
PARTNER™

CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report

## 1<sup>st</sup> Annual Reporting Period



## 15.7 MW CHP System

**Project ID:** Toronto-PI-601723

March 09, 2022

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited



**Prepared by:**

CLEARresult (the Technical Reviewer)

393 University Avenue, Suite 1622, Toronto, ON M5G 1E6

(416) 504-3400

*Prepared per Program Rules version "saveONenergy Process & Systems Upgrades Program, FINAL v2.0 April 6, 2018"*

## Revision History

Date	Description	Revision	Author
March 9, 2022	M&V Report first issuance.	0	[REDACTED]

## Approvals

	Written by Technical Reviewer	Reviewed by Engineering Manager
<b>Name</b>	[REDACTED]	[REDACTED]
<b>Date</b>	March 9, 2022	March 9, 2022
<b>Signature</b>	[REDACTED]	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of February 12, 2021, to February 11, 2022, are 128,648 MWh, which represents 163% of the Anticipated Electricity Savings.

The Incentive payable to the Participant for this Reporting Period is \$1,575,093, which is equal to 10% of the Approved Incentive amount of \$15,750,930<sup>1</sup>.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>2</sup>	Electricity Cost Savings <sup>3</sup>
1 <sup>st</sup> Quarterly	Feb 12 to May 11, 2021	31,541	164%	\$1,675,000
1 <sup>st</sup> Annual	Feb 12, 2021 to Feb 11, 2022	128,648	163%	\$6,831,000

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the Measure.
- The Incentive based on the performance of the Measure.

## In-Service Date Confirmation

The In-Service Date of February 12, 2021, was established on July 30, 2021.

<sup>1</sup> This is the maximum Participant Incentive payable, according to Section 3.3a of the terms and conditions in the Project Application, dated September 14, 2018.

<sup>2</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan

<sup>3</sup> Based on \$53.1/MWh obtained from the Project Application Review

## Metered Data Analysis

\_\_\_\_\_ a representative of the Participant, provided the M&V data on March 3, 2022, to the Technical Reviewer for analysis. The data includes the following at 15-minute intervals:

- Gross electricity generation from the gas turbine generator (GTG)
- GTG auxiliary loads power consumption
- Fuel Gas Booster Compressor power consumption
- GTG and duct burner natural gas consumption
- Heat Recovery Steam Generator (HRSG) steam mass flowrate, temperature and pressure
- Economizer Feedwater temperature
- 6T Dryer exhaust gas input temperature

The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	February 12, 2021, 00:00		
Reporting Period End	February 11, 2022, 23:59		
Reporting Period Duration	8,760	hours	
Available Data	8,733	hours	
Missing Data	27	hours	The GTG was operating but data was frozen due to data communication problems. The Participant assumed missing gross generation values are 15,987 kW, which the Technical Reviewer considers to be reasonable.
Hours of Operation	8,544	hours	98% of the Reporting Period Duration

## Performance of the Measure

The Electricity Savings for generation projects are calculated according to the following equation:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustment}$$

Since there has been no change in the Static Factors as defined in the M&V Plan Section B.5.1, Non-Routine Adjustments are not required for this Reporting Period. The Reporting Period Energy and Electricity Savings are presented in Table 3 and Table 4, respectively.

### Reporting Period Energy

Table 3 presents a summary of the Reporting Period Energy analysis.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
CHP System Gross Energy	134,060	MWh	
CHP System Auxiliary Loads Energy	5,412	MWh	Represents 4% of the CHP System Gross Energy
<b>Reporting Period Energy</b>	128,648	MWh	Gross Energy – Auxiliary Loads Energy
Uncertainty of the Reporting Period Energy	± 2.5%	%	Primarily due to meter uncertainty.

### Electricity Savings

Table 4 presents a summary of the Electricity Savings analysis.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Reporting Period Energy	128,648	MWh	Obtained from Table 3 <b>Error! Reference source not found..</b>
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	128,648	MWh	
Uncertainty of the Electricity Savings	± 2.5%		Primarily due to meter uncertainty.
Anticipated Electricity Savings	79,005	MWh	Obtained from the M&V Plan
Electricity Savings as a Percentage of Anticipated Electricity Savings	163%		
Average Demand Savings	14,686	kW	Electricity Savings divided by Reporting Period duration.
Summer Peak Demand Savings	14,386	kW	Summer peak demand period is defined as June 1 to August 31, weekdays, 1:00 pm - 7:00 pm.

The 1<sup>st</sup> Annual Reporting Period Electricity Savings are 128,648 MWh and represent 163% of the Anticipated Electricity Savings.

The overperformance was due to the installation of a 15.7 MW (nameplate) CHP system whereas the Anticipated Electricity Savings are based on a 9.8 MW (nameplate) CHP system.

## Total System Efficiency

The CHP System's Total System Efficiency (TSE) is calculated according to the following equation.

$$TSE (\%) = [Gross\ Electrical\ Energy + Recovered\ Heat\ Utilized] / [Fuel\ Energy\ Input]$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	134,060	MWh	
Utilized Thermal Output	142,424	MWh	
Fuel Energy Input	394,571	MWh	Calculated from the volumetric fuel input, using a natural gas higher heating value of 10.67 kWh/m <sup>3</sup>
<b>Total System Efficiency</b>	70	%	Meets the minimum 62% requirement for this Project

## Next Reporting Period

The M&V Plan shows four additional annual reporting periods following completion of the 1<sup>st</sup> Annual Reporting Period. The Technical Reviewer will send reminders to the LDC to obtain M&V data.

## Appendix

The Incentive is calculated in accordance with the terms for Advanced Payment in the Section 4.1b of the Project Application Form.

**Table 6. Incentive Payment Schedule**

Advanced Payment Schedule	Projected Date	% of Approved Amount
<b>Payment 1</b>	The Participant and the LDC have agreed to the M&V Plan as provided by the Technical Reviewer and the LDC is in receipt of the Participant's Performance Security.	50% of the Approved Amount
<b>Payment 2</b>	The Technical Reviewer has confirmed the In-Service Date & the Eligible Costs, in receipt of Invoice Reconciliation Form and the Technical Reviewer has issued the initial M&V Report.	The amount that is 90% of the Participant Incentive less the First Payment noted above (Calculated based on the initial M&V Report less the First installment)



<b>Final Payment (Holdback)</b>	The Technical Reviewer has issued the final M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.
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Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.



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## Measurement & Verification Report

### 1<sup>st</sup> Annual Report

March 27, 2019 – March 26, 2020

[REDACTED]

[REDACTED] Electric Heating Controls and  
Windows Upgrade

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**Project:** Toronto-SCP-601770

August 7, 2020

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited (the LDC)

[REDACTED]

**Prepared by:**

CLEARResult

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## Revision History

Date	Description	Revision	Author
August 7, 2020	Annual M&V Report, first issuance.	0	[REDACTED]

## Approvals

Name	Title	Signature	Date
[REDACTED]	Energy Engineer	[REDACTED]	August 7, 2020

## 1. Executive Summary

The Electricity Savings calculated for the 1<sup>st</sup> Annual Reporting Period of March 27, 2019, to March 26, 2020, are 293 MWh which represent 115% of the Anticipated Electricity Savings.

The Electricity Savings meet the 80% performance threshold required by the Program Rules.

## 2. Project Overview

### 2.1. Baseline Energy and Anticipated Electricity Savings

The Baseline Energy and the Anticipated Electricity Savings are obtained from the M&V Plan, rev.1, dated May 8, 2018, and are presented in Table 1.

**Table 1. Baseline Energy and Anticipated Electricity Savings**

Description	Value	Unit
Baseline Energy	1,436	MWh/year
Anticipated Electricity Savings	254	MWh/year

This M&V Report assesses the actual Electricity Savings based on raw data provided by the Participant and the methodology described in the M&V Plan, rev.1. This is an IPMVP Option C methodology of calculating the Electricity Savings.

This M&V Report calculates the actual Electricity Savings divided by the Anticipated Electricity Savings, to verify whether the Project has achieved the required 80% of the Anticipated Electricity Savings.

### 2.2. In-Service Date and Previous Reporting Periods

The In-Service Date of March 27, 2019 was established on July 31, 2020.

Note that an M&V Report was not issued for the 1<sup>st</sup> Quarterly Reporting Period.

### 2.3. Current Reporting Period

The 1<sup>st</sup> Annual Reporting Period is from March 27, 2019, to March 26, 2020, representing 366 days (8,784 hours).

## 3. Reporting Period Energy

### 3.1. Raw Data

██████████ (the Participant's representative) provided the Facility's hourly utility power data to the CMVP for analysis.

Table 2 presents an overview of the data analysis related to the Reporting Period duration and hours of operation.

**Table 2. Reporting Period Duration and Hours of Operation**

Description	Value	Unit	Comments
Reporting Period start	March 27, 2019 0:00		
Reporting Period end	March 26, 2020 23:59		
Reporting Period duration	8,784	hours	
Available data	8,784	hours	100% of the Reporting Period Duration.
Missing data	0	Hours	0% of the Reporting Period Duration.
Hours of Operation	8,784	hours	100% of the Reporting Period Duration.

There were no missing power measurements. The M&V data is the utility power data provided by LDC.

### 3.2. Reporting Period Energy

The Reporting Period Energy is shown in Table 3 below.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comments
Reporting Period Energy	1,214	MWh	Total Facility electricity consumption.
Uncertainty of the Reporting Period Energy	± 0.0%		Utility meter is assumed to have zero uncertainty.

## 4. Electricity Savings

### 4.1. Adjusted Baseline Energy

The Adjusted Baseline Energy is calculated using the energy model defined in the M&V Plan rev.1, section B.5.1. The Baseline Energy is adjusted based on the monthly heating degree days (HDD) using the following equations:

$$\text{Adjusted Baseline Energy (MWh)} = \text{Sum of [Monthly Facility Adjusted Energy (kWh)] over the Reporting Period} / 1,000$$

$$\text{Monthly Facility Adjusted Energy (kWh)} = 256.82 \times \text{monthly sum of HDD (}^{\circ}\text{C.days, base } 16^{\circ}\text{C)} + 59,076$$

The monthly HDDs are calculated using the average daily outdoor air temperature (obtained from Environment Canada for Toronto Pearson, WMO 71624) during the Reporting Period, based on a heating balance point of 16°C.

The Adjusted Baseline Energy for this Reporting Period is 1,507 MWh.



## 4.2. Results

The Electricity Savings are calculated according to the following equation:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

Since there has been no change in the Static Factors as defined in the M&V Plan, rev.1 Section B.5.2, Non-Routine Adjustments are not required for this Reporting Period. The results are presented in Table 4.

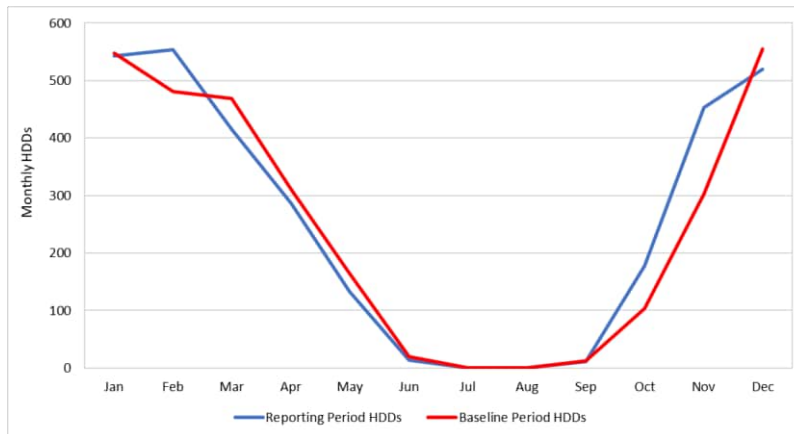
**Table 4. Calculation of Electricity Savings**

Description	Value	Unit	Comments
Adjusted Baseline Energy	1,507	MWh	From Section 4.1.
Reporting Period Energy	1,214	MWh	From Table 3.
Non-Routine Adjustments	0	MWh	None.
Electricity Savings	293	MWh	<i>Adjusted Baseline Energy - Reporting Period Energy</i>
Relative uncertainty of the Electricity Savings	± 46%		Based on Baseline Energy relative uncertainty of ± 9% and Reporting Period Energy relative uncertainty of ± 0%.
Anticipated Electricity Savings	254	MWh	From Table 1.
Electricity Savings as a Percentage of Anticipated Electricity Savings	115%		Meets the required 80% performance threshold as per the Program Requirements.
Average Demand Savings	33.4	kW	<i>Electricity Savings ÷ Reporting Period Duration</i>
Peak Demand Savings	5.7	kW	Summer peak demand period savings, defined as June 1 - August 31, weekdays, 1pm - 7pm.

## 4.3. Conclusion

The Electricity Savings are 293 MWh and represent 115% of the Anticipated Electricity Savings for this Reporting Period. One possible reason for the slightly higher than anticipated Electricity Savings is an overall colder heating season compared to the Baseline Period, as shown in Figure 1 below.

**Figure 1. Monthly HDDs in Baseline and Reporting Periods**



#### 4.4. Electricity Savings to Date

The Electricity Savings to date are presented in Table 5.

**Table 5. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings		
		MWh	% of Anticipated Savings Value <sup>1</sup>	Cost Savings <sup>2</sup> (\$)
1 <sup>st</sup> Quarterly	March 27, 2019 to June 27, 2019	N/A	N/A	N/A
1 <sup>st</sup> Annual	March 27, 2019 to March 26, 2020	293	115%	\$40,700

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$139/MWh obtained from the Project Review.





CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period

[Redacted]

[Redacted]

[Redacted]

## Cogeneration

## System

**Project ID:** Toronto-PROJECT-601800  
September 16, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited  
[Redacted]

**Prepared by:**  
CLEARResult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
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Prepared per Program Rules version "saveONenergy Process & Systems Upgrades Program, FINAL v2.0 April 6, 2018"

## Approvals

	Written by Technical Reviewer	Reviewed by Technical Reviewer
Name:	[REDACTED]	[REDACTED]
Date:	September 16, 2022	September 16, 2022
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
September 16, 2022	First M&V Report issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of June 30, 2021, to July 21, 2022, are 1,871 MWh, which represents 88% of the Anticipated Electricity Savings. The Total System Efficiency achieved for the 1<sup>st</sup> Annual Reporting Period is 68.3%, which meets the Program Rules minimum requirement of 65%.

Note that the original 1<sup>st</sup> Annual Reporting Period was scheduled to end on June 29, 2022. However, the Reporting Period had to be extended to July 21, 2022, as one of the engines in the combined heat and power (CHP) system was unexpectedly shutdown on May 26, 2022. The shutdown, which lasted 506 hours, was the result of a cylinder head failing, causing metal to enter a combustion chamber. The replacement was not successfully completed until June 16, 2022.

The Incentive payable to the Participant for this Reporting Period is \$186,842. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Jun 30 to Sep 29, 2021	472	133%	\$66,552
1 <sup>st</sup> Annual	Jun 30, 2021 to Jul 21, 2022	1,871	88%	\$269,464

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$144/MWh obtained from the Project Approval Letter.

## In-Service Date Confirmation

The In-Service Date was set to June 30, 2021, on August 4, 2021, by the Technical Reviewer.

## Metered Data Analysis

[REDACTED] the LDC representative, provided the M&V data on September 1, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Jun 30, 2021, 0:00		Start date of the Reporting Period.
Reporting Period End	Jul 21, 2022, 1:59		End date of the Reporting Period.
Reporting Period Duration	9,266	hours	End date minus start date.
Available Data	9,266	hours	
Missing Data	0	hours	0% of the Reporting Period Duration.
Unexpected Shutdown	506	hours	
Hours of Operation	8,431	hours	96% of the Reporting Period Duration excluding the 506 hours unexpected shutdown period.

## Performance of the Measure

The electrical performance of the project is based on the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The electrical generation of the CHP System for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,944	MWh	
CHP Auxiliary Loads Energy	73	MWh	3.8% of the CHP Gross Electrical Energy. See details below Table 3.
Reporting Period Energy	1,871	MWh	CHP Gross Electrical Energy – CHP Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter.
Average Generation	214	kW	Reporting Period Energy ÷ Reporting Period Duration
Summer Peak Demand Generation	209	kW	Summer peak demand period is defined as Monday to Friday, 1:00 pm - 7:00 pm, June 1 to August 31.

The auxiliary loads consist of internal and external auxiliary loads. The internal auxiliary loads, which consist of two onboard pumps and controls, are not metered. They are estimated by the supplier of the CHP system to be 1.5 kW for each engine. The Technical Reviewer accepted this value and applied either 1.5 kW or 3 kW per CHP system operating hour, depending on whether one or two engines were operating respectively, to calculate the internal auxiliary load energy. The external auxiliary loads consist of hot water circulation pumps and dump radiators. The external loads were part of the metered Reporting Period data. However, it appears that the hourly values provided for the external auxiliary loads were determined by the Participant's consultant, based on power ratings from equipment specifications and operating status. Both the internal and external auxiliary load values appear to be reasonable based on the CHP system installed.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.



**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	1,871	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,871	MWh	
Uncertainty of the Electricity Savings	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	2,125	MWh	As per the M&V Plan.
Electricity Savings as a Percentage of Anticipated Electricity Savings	88	%	
Average Demand Savings	214	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	209	kW	Summer peak demand period is defined as Monday to Friday, 1:00 pm -7:00 pm, June 1 to August 31.

The 1<sup>st</sup> Annual Reporting Period Electricity Savings are 1,871 MWh and represent 88% of the Anticipated Electricity Savings. The underperformance is the result of the Reporting Period average operating electrical output being 222 kW with 96% uptime, whereas the anticipated average operating electrical output was 243 kW with 100% uptime. Note that the original Project scope was based on the installation of four micro-turbine generators with a nominal capacity of 260 kW (i.e., 4 x 65 kW). In the completed Project, two 125 kW internal combustion reciprocating engines were installed.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{CHP Gross Energy (MWh)} + \text{CHP Utilized Thermal Output (MWh)}] / \text{CHP Fuel Energy Input (MWh)}$$

**Table 5. Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,944	MWh	Obtained from Table 3.
CHP Utilized Thermal Output	2,648	MWh	
Natural Gas Higher Heating Value (HHV)	10.75	kWh/m <sup>3</sup>	As per the M&V Plan.
CHP Fuel Energy Input (HHV)	6,724	MWh	
Total System Efficiency	68.3	%	

The CHP system achieved a TSE of 68.3%, which meets the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, and verified Eligible Costs, the Incentive payable to the Participant is \$186,842. The Master Payment Requisition will be issued once the Participant's invoice for the Incentive amount is provided.

Table 6 outlines the Incentive payment calculation using the latest available information.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	1,871	1 <sup>st</sup> Annual Reporting Period Electricity Savings.
Approved Amount	\$425,074	From the Project Approval Letter.
Limiter 1 - Electricity Savings	\$374,255	\$200 per MWh of Electricity Savings, capped at 120% of Approved Amount.
Estimated Eligible Project Costs	\$1,970,000	From the Project Approval Letter.
Actual Eligible Project Costs	\$1,283,465	Based on the review of invoices for the 1 <sup>st</sup> payment.
Limiter 2 - Project Costs	\$513,386	40% of minimum of Estimated and Actual Eligible Project Costs.
Net Benefits	\$113,291	Equal to the electricity savings, calculated using a billing rate of \$144/MWh, plus the Other Benefits less Other Costs from the Project Approval Letter.
Limiter 3 – 1-year Project Payback	\$1,170,174	Eligible Costs minus Net Benefits.
Gross Project Incentive	\$374,255	Minimum of the three limiters.
Project Incentives paid	\$187,413	Paid for 1 <sup>st</sup> Quarterly Reporting Period.
Study Incentive paid	N/A	Paid for Engineering Study. <sup>3</sup>
<b>Incentive payable</b>	<b>\$186,842</b>	Gross incentive minus incentives paid.

Table 7 provides the Incentive payment schedule.

<sup>3</sup> No deduction under "saveONenergy Process & Systems Upgrades Program, FINAL v2.0 April 6, 2018."

**Table 7. Incentive Payment Schedule**

<b>Deferred Payment Schedule</b>	<b>Projected Date</b>	<b>% of Approved Amount</b>
<b>Payment 1</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.



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## M&V Report

### 1<sup>st</sup> Annual M&V Report

June 1, 2019 to August 29, 2020



## Process Water System Improvements

---


**Project ID:** Toronto-SCP-601818

November 16, 2020

Rev. 1

**Prepared for:**

Toronto Hydro-Electric System Limited (the LDC)



**Prepared by:**

CLEARResult

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.



## Revision History

Date	Description	Revision	Author
Sept. 14, 2020	First M&V Report issuance.	0	[REDACTED]
Nov. 13, 2020	Revised analysis after consultant indicated that M&V Plan defines hourly average power to determine hours of operation. Initial analysis used the provided 15-minute interval data divided by four.	1	[REDACTED]

## Approvals

Name	Title	Signature	Date
[REDACTED]	Engineering Manager	[REDACTED]	November 13, 2020

# 1. Executive Summary

The Electricity Savings calculated for the 1<sup>st</sup> Annual Reporting Period of June 1, 2019, to August 29, 2020, are 652 MWh which represent 67% of the Anticipated Electricity Savings.

The Electricity Savings do not meet the 80% performance threshold of the Program Rules.

Note that due to COVID-19, the Facility was shut down from March 19 to June 18, 2020, and the Reporting Period was extended accordingly by 91 days. The pre- and post-COVID-19 electrical performances of the measure are nearly identical, indicating a back-to-normal operation of the measure from June 2020.

## 2. Project Overview

### 2.1. Baseline Energy and Anticipated Electricity Savings

The Baseline Energy and the Anticipated Electricity Savings are obtained from the M&V Plan, rev. 0, dated December 24, 2018, and are presented in Table 1.

**Table 1. Baseline Energy and Anticipated Electricity Savings**

Description	Value	Units
Baseline Energy	1,922	MWh/year
Anticipated Electricity Savings	976	MWh/year

This M&V Report assesses the actual Electricity Savings based on raw data provided by the Participant and the methodology described in the M&V Plan. The IPMVP Option B methodology is used for calculating the Electricity Savings.

The M&V Report calculates the actual Electricity Savings divided by the Anticipated Electricity Savings, to verify whether the Project has achieved the required 80% of the Anticipated Electricity Savings.

### 2.2. In-Service Date and Previous Reporting Periods

The In-Service Date of June 1, 2019, was established on May 26, 2020.

The 1<sup>st</sup> Quarterly Reporting Period was from June 1 to August 31, 2019, representing 92 days (2,208 hours).

### 2.3. Current Reporting Period

The 1<sup>st</sup> Annual Reporting Period is from June 1, 2019, to August 29, 2020, representing 365 days of operation (8,760 hours). Note that due to COVID-19, the Facility was shut down from March 19 to June 18, 2020, and the Reporting Period was extended accordingly by 91 days.

## 3. Reporting Period Energy

### 3.1. Results

██████████, the LDC representative, provided the raw data to the CMVP for analysis. The provided data included 15-minute interval amperage readings for 15 chiller plant pumps and 2 cooling tower fans, as well as amperage, voltage, and power factor for two chiller compressors. Additional spot-measured data from the variable frequency drives was already provided to correlate amperage readings to electrical power.

Table 2 presents an overview of the available data and the duration of the Reporting Period.

**Table 2. Reporting Period Duration and Available Data**

Description	Value	Units	Comments
Reporting Period Start	June 1, 2019 0:00		
Reporting Period End	August 29, 2020 23:59		Facility shutdown from March 19 to June 18 due to COVID-19 and Reporting Period extended by 91 days.
Reporting Period Duration	8,760	hours	Total measurement hours.
Available Data	8,278	hours	94.5% of the Reporting Period Duration (for the chiller)
Missing Data	482	hours	5.5% of the Reporting Period Duration.

From the 482 hours of missing data, 329 hours (equivalent 15-minute interval data) were due to stuck metering, resulting in constantly repeating values across all parameters. According to the consultant, this was caused by electrical system issues at the Facility that affected the building management system. It is assumed that the equipment was not operational during missing intervals, and since the Adjusted Baseline Energy is based on hours of operation, non-operational hours are equivalent to zero Electricity Savings, which is a conservative approach, as recommended by the IPMVP.

Note that there were an additional 638 hours (equivalent 15-minute interval data) when one or both compressors had missing data. As discussed with the consultant, and verified in subsequent analysis, the compressors and the evaporator pumps were highly correlated (0.82 correlation coefficient) in their operation. The missing combined compressor power was therefore estimated based on the operational status of the evaporator pumps, using either 0 kW when the pumps were off, or 37.4 kW (the measured compressor average power) when the pumps were on.

Table 3 presents the hours of operation for each group of equipment, which are used in the calculation of the Adjusted Baseline Energy. The hours of operation of a group are calculated as the total time during which the combined power of all equipment in the group (e.g., clean water pumps) was above a minimum threshold defined in the M&V Plan. Some pumps were out of operation for maintenance, but since equipment is grouped, this does not have any impact the calculations.

**Table 3. Reporting Period Hours of Operation**

Description	Value	Units	Comments
Chilled Water Pumps	6,291	hours	Consists of 3 pumps. Pump 3 is standby. Minimum threshold power is 5 kW.
Evaporator Pumps	6,330	hours	Consists of 2 pumps. Minimum threshold power is 1 kW.
Process Pumps	4,502	hours	Consists of 2 pumps. Minimum threshold power is 5 kW.
Condenser Pumps	4,670	hours	Consists of 2 pumps. Minimum threshold power is 5 kW. Note that Pump 4 was shut down on July 10, 2019.
Tower Fans	4,660	hours	Consists of 2 fans. Minimum threshold power is 2 kW.
Tower Pumps	5,813	hours	Consists of 3 pumps. Pump 3 is removed for maintenance. Minimum threshold power is 5 kW.
Clean Water Pumps	6,159	hours	Consists of 3 pumps. Pump 3 is not operational. Minimum threshold power is 5 kW.
Chiller (compressors)	6,255	hours	Consists of two compressors. Minimum threshold power is 5 kW.
System uptime (chiller compressors)	76%		System uptime, based on compressor hours of operation.

Table 4 presents the Reporting Period Energy for each group of equipment.

**Table 4. Reporting Period Energy**

Equipment	Energy, MWh	Comments
Chilled Water Pumps	72.0	
Evaporator Pumps	69.2	
Process Pumps	120.6	
Condenser Pumps	110.4	Pump 4 was shut down on July 10, 2019, and restarted Jan. 7, 2020.
Tower Fans	41.4	
Tower Pumps	129.2	Pump 3 is removed for maintenance.
Clean Water Pumps	97.4	Pump 3 is not operational.
Chiller (compressors)	220.1	
<b>Reporting Period Energy</b>	<b>860</b>	Total electricity consumption of the chilled water system.

## 4. Electricity Savings

### 4.1. Adjusted Baseline Energy

The Baseline Energy is adjusted to the conditions of the Reporting Period, as defined in the M&V Plan. The Adjusted Baseline Energy is calculated based on measured hours of operation during the Reporting Period and the average equipment group power measured during the Baseline Period, as shown in Table 5.

**Table 5. Adjusted Baseline Energy**

Equipment	Hours of Operation	Average Baseline Power, kW	Energy, MWh
Chilled Water Pumps	6,291	41.3	259.8
Evaporator Pumps	6,330	16.8	106.3
Process Pumps	4,502	55.0	247.6
Condenser Pumps	4,670	49.2	229.8
Tower Fans	4,660	4.9	22.8
Tower Pumps	5,813	25.1	145.9
Clean Water Pumps	6,159	42.3	260.5
Chiller (compressors)	6,255	38.2	238.9
<b>Adjusted Baseline Energy</b>			<b>1,512</b>

### 4.2. Results

The Electricity Savings analysis is presented in Table 6. Electricity Savings are calculated according to the following equation:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

Table 6. Calculation of Electricity Savings

Description	Value	Unit	Comments
Adjusted Baseline Energy	1,512	MWh	Obtained from Table 5.
Reporting Period Energy	860	MWh	Obtained from Table 4.
Non-Routine Adjustment	0	MWh	None.
<b>Electricity Savings</b>	<b>652</b>	<b>MWh</b>	
Uncertainty of the Electricity Savings	± 24%		From an estimated Baseline Energy uncertainty (±10%) and Reporting Period uncertainty (± 5%), based on underlying regression analyses and missing data estimates.
Anticipated Electricity Savings	976	MWh	Obtained from Table 1.
<b>Electricity Savings as a Percentage of Adjusted Anticipated Electricity Savings</b>	<b>67%</b>		Does not meet the 80% performance threshold.
Average Demand Savings	74	kW	<i>Electricity Savings (652 MWh) ÷ Reporting Period duration (8,760 h)</i>
Summer Peak Demand Savings	109	kW	Average demand savings during the Peak Demand Period, defined as June 1 – August 31, weekdays, 1pm – 7pm. <i>Baseline Peak Demand (273 kW, from M&amp;V Plan) - Reporting Period Peak Demand (164 kW)</i>

### 4.3. Conclusion

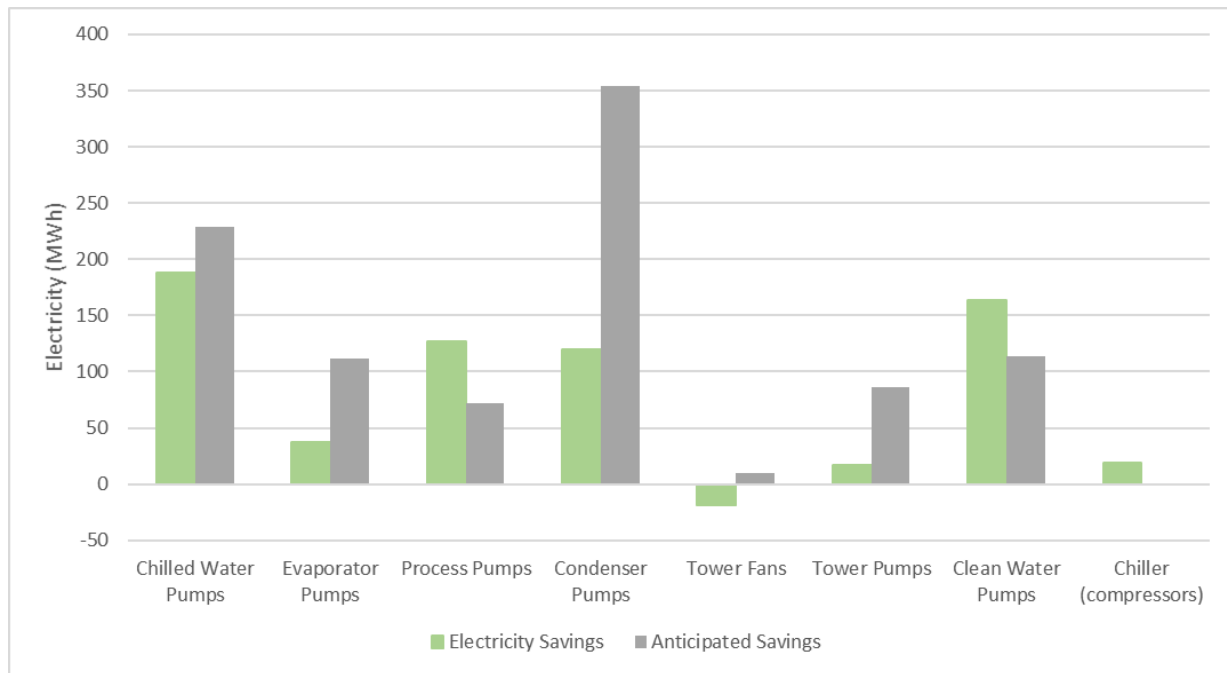
The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period are 652 MWh, which represent 67% of the Anticipated Electricity Savings. The Electricity Savings do not meet the 80% performance threshold of the Program Rules.

There are several possible reasons for the observed under-performance of the System:

- The Electricity Savings were not evenly divided among the different equipment, as shown in Figure 1. While most of the pumps showed some electricity savings, the tower fans showed losses. Some equipment, such as the process pumps and clean water pumps, showed higher electricity savings than anticipated. Other equipment, particularly the condenser pumps and evaporator pumps, generated significantly lower savings than anticipated.
- The measured uptime of the chiller compressors is 76%, compared to an anticipated 86%. The rest of the equipment also showed uptimes between 54% and 76%, compared to anticipated uptimes near 85%. Fewer hours of operation result in lower electricity savings.
- Missing hours account for 5.5% of the Reporting Period duration. It is conservatively assumed that the System is not operational during this time, and therefore Electricity Savings are nil.

In addition, the pre- and post-COVID-19 electrical performances of the measure are nearly identical, indicating a back-to-normal operation of the measure from the June 2020 re-opening of the Facility (i.e., the Electricity Savings of the 1<sup>st</sup> Quarterly Reporting Period are similar to the 1<sup>st</sup> Annual Reporting Period which excludes the shutdown of the Facility due to COVID-19).

**Figure 1. Actual and Anticipated Electricity Savings, by Equipment Type**



#### 4.4. Electricity Savings to Date

The Electricity Savings to date are presented in Table 7.

**Table 7. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings		
		MWh	% of Contract Savings <sup>1</sup>	Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	June 1, 2019 - August 31, 2019	156	64%	\$19,500
1 <sup>st</sup> Annual	June 1, 2019 - May 31, 2020	652	67%	\$81,400

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$125/MWh obtained from the Project Application Review.





Toronto Hydro-Electric System Limited

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## **Third Party Evaluation Reports**

This document includes the following third party evaluation reports:

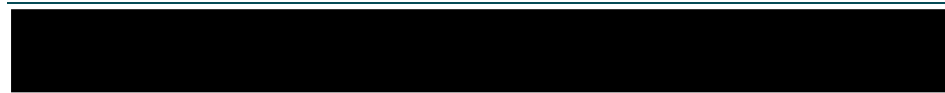
### **Process and Systems Upgrades Program:**

- #601886
- #601902
- #601906
- #601912
- #601913
- #601914
- #601915



CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period



## Cogeneration System

**Project ID:** Toronto-PROJECT-601886

July 21, 2022  
Revision 0

**Prepared for:**

Toronto Hydro-Electrical System Ltd. (the LDC)

**Prepared by:**

CLEAResult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

### Revision History

Date	Description	Revision	Author
July 21, 2022	M&V Report first issuance.	0	[REDACTED]

### Approvals

	Written by Technical Reviewer	Reviewed by Engineering Manager
<b>Name</b>	[REDACTED]	[REDACTED]
<b>Date</b>	July 12, 2022	July 21, 2022
<b>Signature</b>	[REDACTED]	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of May 7, 2021 to May 6, 2022, are 1,780 MWh, which represent 101% of the Anticipated Electricity Savings. The Total System Efficiency achieved for the 1<sup>st</sup> Annual Reporting Period is 63.7%, which does not meet the Program Rules requirement of 65%.

The Participant is eligible for an Incentive Payment of \$186,838 for this Reporting Period, calculated in accordance with the terms of the Project Agreement. See the Appendix for the Incentive calculation, which includes the penalty for not achieving the minimum 65% Total System Efficiency (TSE) requirement.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings
1 <sup>st</sup> Quarterly	May 7 to Aug 6, 2021	382	94	\$47,600 <sup>2</sup>
1 <sup>st</sup> Annual	May 7, 2021 to May 6, 2022	1,780	101	\$221,966 <sup>2</sup>

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data for the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the Measure.
- The Incentive based on the performance of the Measure.

## In-Service Date Confirmation

The In-Service Date of May 7, 2021 was established on November 2, 2021, conditional upon the submission of the Environmental Compliance Approval (ECA). The ECA was subsequently submitted by the Participant and an unconditional In-Service Date Confirmation was issued on January 6, 2022.

<sup>1</sup> Percentage of the Anticipated Electricity Savings shown in the M&V Plan.

<sup>2</sup> Based on the Electricity Billing Rate of \$124.7/MWh shown in the Approval Letter.

## Metered Data Analysis

the LDC representative, provided the raw data to the Technical Reviewer for analysis. The raw data includes the following hourly data for the CHP system:

- Net electricity generation
- Natural gas consumption
- Heat utilized

The data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	May 7, 2021, 00:00		
Reporting Period End	May 6, 2022, 23:59		
Reporting Period Duration	8,760	hours	
Available Data	8,760	hours	
Missing Data	0	hours	
Hours of Operation	8,624	hours	98.4% of the Reporting Period duration.

## Performance of the Measure

The electrical performance of this generation project is based on the following equation:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Reporting Period Energy

The Reporting Period Energy for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
CHP Net Electrical Energy	1,780	MWh	The electrical metering data provided represents the electricity generation, net of auxiliary loads
Auxiliary Loads Energy	168	MWh	Equal to 5.5 kW per micro-turbine per operating hour (see comment below table)
CHP Gross Electrical Energy	1,948	MWh	Net Electrical Energy + Auxiliary Loads Energy
Reporting Period Energy	1,780	MWh	Equal to the Net Electrical Energy
Uncertainty of the Reporting Period Energy	± 2.5%		The Uncertainty is mostly due to the accuracy of the meters.
<b>Average Generation</b>	203	kW	Reporting Period Energy ÷ Reporting Period Duration
<b>Summer Peak Demand Generation</b>	165	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm -7:00 pm.

The Participant provided an auxiliary load estimate of 5 to 6 kW and confirmed that the metered electrical output is net of the auxiliary loads, which is a typical arrangement for the Capstone C65 micro-turbine system. The Technical Reviewer applied an auxiliary load of 5.5 kW per micro-turbine per operating hour to calculate the Auxiliary Load Energy.

### Electricity Savings

The Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings. Since there has been no change in the Static Factors as defined in the M&V Plan Section B.5.1, Non-Routine Adjustments are not required for this Reporting Period.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Reporting Period Energy	1,780	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,780	MWh	
Uncertainty of the Electricity Savings	± 2.5%		The Uncertainty is mostly due to the accuracy of the meters.
Anticipated Electricity Savings	1,769	MWh	Per the M&V Plan.
Electricity Savings as Percentage of Anticipated Electricity Savings	101%		
Average Demand Savings	203	kW	Equal to Average Generation, obtained from Table 3.
Summer Peak Demand Savings	165	kW	Equal to Summer Peak Demand Generation, obtained from Table 3.

The Electricity Savings of the 1<sup>st</sup> Annual Reporting Period are 1,780 MWh, which represent 101% of the Anticipated Electricity Savings.

The slight overperformance resulted from higher than anticipated average operating net electrical output. The CHP system was anticipated to produce an average operating net electrical output of 202.1 kW whereas the Reporting Period average operating net electrical output was 206.4 kW. However, the higher operating electrical output was partly offset by lower than anticipated operating hours. The CHP system was anticipated to operate 8,753 hours but in the Reporting Period, the CHP system operated 8,624 hours.

## Total System Efficiency

The CHP System's Total System Efficiency (TSE) is calculated according to the following equation.

$$TSE (\%) = [Gross\ Electrical\ Energy + Recovered\ Heat\ Utilized] / [Fuel\ Energy\ Input]$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
Gross Electrical Energy	1,948	MWh	Obtained from Table 3.
Recovered Heat Utilized	3,787	MWh	
Fuel Energy Input	8,999	MWh	Calculated from total volumetric natural gas consumption and a natural gas higher heating value (HHV) of 10.75 kWh/m <sup>3</sup> specified in the M&V Plan.
<b>Total System Efficiency</b>	63.7%		This value is lower than the 65% threshold required by the Program.

The Technical Reviewer obtained a TSE of 63.7%, which is lower than the minimum 65% required by the Program. However, the Participant is eligible for an Incentive, subject to a 5%<sup>3</sup> penalty. See the Appendix for the Incentive calculation.

## Next Reporting Period

The 1<sup>st</sup> Annual Reporting Period is the final Reporting Period and there is no further M&V reporting, unless requested by the IESO.

<sup>3</sup> Based on Program Rules, a TSE that is greater than equal to 62.5% but less than 65%, results in a 5% penalty on the Incentive.

## Appendix - Incentive Payment

The Participant is eligible for an Incentive Payment of \$186,838 for this Reporting Period, calculated in accordance with the terms of the Project Agreement. The Incentive calculation is shown in Table 6.

**Table 6. Incentive Calculation**

Reporting Period Electricity Savings (MWh)	1,780
Electricity Billing Rate (\$/MWh)	124.7
Electricity Billed Savings	\$221,966
Net Other Benefits and Costs	-\$181,382 <sup>4</sup>
Project Benefits	\$40,584
Estimated Eligible Costs	\$1,500,000 <sup>4</sup>
Actual Eligible Costs	\$1,810,020
Approved Incentive Amount	\$353,800 <sup>4</sup>
Incentive 1 - \$200/MWh (Capped at 120% of the contracted Incentive amount)	\$355,999
Incentive 2 - 40% of Minimum of Actual and Estimated Eligible Costs	\$600,000
Incentive 3 - 1-year Payback	\$1,459,416
Project Incentive (Minimum of 3 limiters)	\$355,999
Incentive Penalty for TSE (5%)	\$17,800
Adjusted Project Incentive	\$338,199
First Payment (Recommended for First Quarterly Reporting Period)	\$151,361
Balance Payment	\$186,838

Table 7 provides the Incentive payment schedule

<sup>4</sup> From the Approval Letter



**Table 7. Incentive Payment Schedule**

<b>Deferred Payment Schedule</b>	<b>Projected Date</b>	<b>% of Approved Amount</b>
<b>Payment 1</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period

[Redacted]

[Redacted]

## [Redacted] Cogeneration System

**Project ID:** Toronto-PROJECT-601902  
September 28, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited

[Redacted]

**Prepared by:**  
CLEARResult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

Prepared per Program Rules version “saveONenergy Process & Systems Upgrades Program, FINAL v2.0  
April 6, 2018”

## Approvals

	Written by Technical Reviewer	Reviewed by Technical Reviewer
Name:	████████████████████	████████████████████
Date:	September 28, 2022	September 27, 2022
Signature:	████████████████████	████████████████████

## Revision History

Date	Description	Revision	Technical Reviewer
September 28, 2022	First M&V Report issuance.	0	████████████████████

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of June 18, 2021, to June 22, 2022, are 986 MWh, which represents 94% of the Anticipated Electricity Savings. The Total System Efficiency (TSE) achieved for the 1<sup>st</sup> Annual Reporting Period is 72.9%, which meets the Program Rules minimum requirement of 65%.

Note that the original 1<sup>st</sup> Annual Reporting Period was scheduled to end on June 17, 2022. However, the Reporting Period had to be extended to June 22, 2022, as the combined heat and power (CHP) system unexpectedly shut down from April 10 to 18, 2022. The shutdown, which lasted 99 hours, was the result of a failed valve spring, which damaged the piston.

The Incentive payable to the Participant for this Reporting Period is \$100,856. Refer to the Appendix for the Incentive calculation.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	June 18 to September 17, 2021	241	92%	\$31,600
1 <sup>st</sup> Annual	June 18, 2021 to June 22, 2022	986	94%	\$129,200

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$131/MWh obtained from the Project Approval Letter.

## In-Service Date Confirmation

The In-Service Date was set to June 18, 2021 on August 9, 2021, by the Technical Reviewer.

## Metered Data Analysis

[REDACTED] the LDC representative, provided the M&V data on September 1, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	June 18, 2021, 00:00	-	Start date of the Reporting Period.
Reporting Period End	June 22, 2022, 2:59	-	End date of the Reporting Period.
Reporting Period Duration	8,760	hours	End date minus start date, excluding the period of unexpected shutdown.
Available Data	8,760	hours	
Missing Data	0	hours	0% of the Reporting Period Duration.
Hours of Operation	8,321	hours	95% of the Reporting Period Duration.

## Performance of the Measure

The electrical performance of the project is based on the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

### Reporting Period Energy

The electrical generation of the CHP System for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,021	MWh	
CHP Auxiliary Loads Energy	34	MWh	3.4% of the CHP Gross Electrical Energy.
Reporting Period Energy	986	MWh	CHP Gross Electrical Energy – CHP Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Average Generation	113	kW	Reporting Period Energy ÷ Reporting Period Duration
Summer Peak Demand Generation	108	kW	Summer peak demand period is defined as Monday to Friday, 1:00 pm - 7:00 pm, June 1 to August 31.

The auxiliary loads consist of internal and external auxiliary loads. The internal auxiliary loads, which consist of two onboard pumps and controls, are not metered. They are estimated by [REDACTED] the supplier of the CHP system, to be 1.5 kW. The Technical Reviewer accepted this value and applied 1.5 kW per CHP operating hour to calculate the internal auxiliary load energy. The external auxiliary loads consist of hot water circulation pumps and dump radiators. The external loads were part of the metered Reporting Period data. However, it appears that the hourly values provided for the external auxiliary loads were determined by [REDACTED], the Participant's consultant, based on power ratings from equipment specifications and operating status. Both the internal and external auxiliary load values appear to be reasonable based on the CHP system installed.

### Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	986	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	986	MWh	
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	1,052	MWh	As per the M&V Plan.
Electricity Savings as a Percentage of Anticipated Electricity Savings	94%	-	
Average Demand Savings	113	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	108	kW	Equal to Summer Peak Demand Generation from Table 3.



The 1<sup>st</sup> Annual Reporting Period Electricity Savings are 986 MWh and represent 94% of the Anticipated Electricity Savings. The underperformance is due to a lower than anticipated average net operating electrical output, which is likely a result of a change in the Project scope. The original Project scope was based on installation of a CHP system with a total nominal capacity of 160 kW, consisting of two 125 kW internal combustion reciprocating engines, one of which would have been permanently derated to 35 kW. However, only one 125 kW internal combustion reciprocating engine was installed. The anticipated average net electrical output was 129 kW. However, in this 1<sup>st</sup> Annual Reporting Period, the average net electrical output was 119 kW.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [CHP \text{ Gross Electrical Energy (MWh)} + CHP \text{ Utilized Thermal Output (MWh)}] / CHP \text{ Fuel Energy Input (MWh)}$$

**Table 5. Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,021	MWh	Obtained from Table 3.
CHP Utilized Thermal Output	1,410	MWh	
Natural Gas Higher Heating Value (HHV)	10.79	kWh/m <sup>3</sup>	Obtained from the Enbridge Gas Composition and HHV Data in 2021.
CHP Fuel Energy Input (HHV)	3,335	MWh	Calculated using the Reporting Period total volumetric natural gas consumption and the natural gas HHV.
Total System Efficiency	72.9%	-	

The CHP system achieved a TSE of 72.9%, which meets the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, and verified Eligible Costs, the Incentive payable to the Participant is \$100,856. The Master Payment Requisition will be issued once the Participant's invoice for the Incentive amount is provided.

Table 6 outlines the Incentive payment calculation using the latest available information.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	986	1 <sup>st</sup> Annual Reporting Period Electricity Savings.
Approved Amount	\$210,400	From the Project Approval Letter.
Limiter 1 - Electricity Savings	\$197,230	\$200 per MWh of Electricity Savings, capped at 120% of Approved Amount.
Estimated Eligible Project Costs	\$1,948,299	From the Project Approval Letter.
Actual Eligible Project Costs	\$ 693,132	Based on the review of invoices.
Limiter 2 - Project Costs	\$277,253	40% of minimum of Estimated and Actual Eligible Project Costs.
Net Benefits	\$21,997	Equal to the electricity savings, calculated using a billing rate of \$131/MWh, plus the Other Benefits less Other Costs from the Project Approval Letter.
Limiter 3 – 1-year Project Payback	\$671,135	Eligible Costs minus Net Benefits.
Gross Project Incentive	\$197,230	Minimum of the three limiters.
Project Incentives paid	\$96,374	Paid for 1 <sup>st</sup> Quarterly Reporting Period.
<b>Incentive payable</b>	<b>\$100,856</b>	Gross incentive minus incentives paid.

Table 7 provides the Incentive payment schedule.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	% of Approved Amount
<b>Payment 1</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.



## M&V Report

1<sup>st</sup> Annual Report

November 20, 2018 – November 19, 2019

[REDACTED]

[REDACTED] System Upgrade

---

Project ID: Toronto-PROJECT-601906

December 24, 2019

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited (the LDC)

[REDACTED]

**Prepared by:**

CLEAResult Canada Inc.  
393 University Avenue, Suite 1622  
Toronto, ON, M5G 1E6  
416-504-3400

*Prepared per Program Rules in 'saveONenergy Process & Systems Upgrades Program, FINAL v2.0', April 6, 2018.*

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### Revision History

Date	Name/Description	Revision	Author
December 24, 2019	M&V Report first issuance.	0	[REDACTED]

### Approvals

Name	Title	Signature	Date
[REDACTED]	Engineering Manager	[REDACTED]	December 24, 2019

# 1. Executive Summary

The Electricity Savings for the M&V Reporting Period of November 20, 2018, to November 19, 2019, are 890 MWh, which represent 122% of the Anticipated Electricity Savings.

For the Incentive payment calculation, the Electricity Savings are capped at 120% of the Anticipated Electricity Savings. The Incentive payable to the Participant for the 1<sup>st</sup> Annual Reporting Period is \$90,978, pending the issuance of the Master Payment Requisition.

## 2. Project Overview

### 2.1. Baseline Energy and Anticipated Electricity Savings

The annual Baseline Energy and the Anticipated Electricity Savings are obtained from the M&V Plan, revision 1, dated December 4, 2018, and are presented in Table 1.

**Table 1. Annual Baseline Energy and Anticipated Electricity Savings**

Description	Value	Unit
Baseline Energy	1,807	MWh/year
Anticipated Electricity Savings	731	MWh/year

This M&V Report assesses the actual Electricity Savings based on raw data provided by the Participant and the methodology described in the M&V Plan.

The M&V Report calculates the actual Electricity Savings divided by the Anticipated Electricity Savings, to verify whether the Project has achieved the Anticipated Electricity Savings.

### 2.2. In-Service Date and Previous Reporting Periods

The In-Service Date is November 20, 2018, which was established on December 18, 2018.

The 1<sup>st</sup> Quarterly Reporting Period is from November 20, 2018, to February 19, 2019, representing 92 days (2,208 hours).

### 2.3. Current Reporting Period

The 1<sup>st</sup> Annual Reporting Period is from November 20, 2018, to November 19, 2019, representing 365 days (8,760 hours).



### 3. Reporting Period Energy

#### 3.1. Raw Data

██████████ (the LDC representative) provided the raw process data to the CMVP for analysis. The raw data includes hourly pump 473 power, operational status of the 4T vacuum system (on/off), and operational data for pump 474.

Table 2 presents an overview of the data related to the duration of the Reporting Period and equipment hours of operation.

**Table 2. Reporting Period Hours and missing data**

Description	Value	Unit	Comments
Reporting Period Start	November 20, 2018 0:00		
Reporting Period End	November 19, 2019 23:59		
Reporting Period Duration	8,760	hours	
Available Data	8,697	hours	Hours when pump 473 power is available. Corresponds to 99.3% of the Reporting Period Duration.
Hours of Operation	8,482	hours	Hours when pump 473 power is greater than 1 kW. Corresponds to 97.5% of the Available Data hours.

#### 3.2. Reporting Period Energy

This is an IPMVP Option B methodology of calculating the Electricity Savings.

The Reporting Period Energy is itemized in Table 3 below. Note that the 63 hours of missing pump 473 power are conservatively assumed as not operational, meaning no Electricity Savings during those hours.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comments
Pump 473 Average Power	115.3	kW	Average operational power (when power is greater than 1 kW).
Pump 474 Average Power	0	kW	Not operational during Reporting Period.
Reporting Period Energy	978	MWh	Total pump power (115.3 kW + 0 kW) × Reporting Period hours of operation (8,482 hours)

## 4. Electricity Savings

### 4.1. Adjusted Baseline Energy

The Adjusted Baseline Energy is calculated using pump 473 hours of operation. System (4T stock on/off) hours of operation, as defined in the M&V Plan, section B.5.2, underestimate the hours of operation because the pumps take time to shut down following a 'stock off' condition. The Adjusted Baseline Energy is 1,869 MWh, calculated as shown in Table 4.

**Table 4. Adjusted Baseline Energy Calculation**

Description	Value	Unit	Comments
Pump 473 Baseline Average Power	145.8	kW	From the M&V Plan.
Pump 474 Baseline Average Power	74.5	kW	From the M&V Plan.
Adjusted Baseline Energy	1,869	MWh	Total Baseline pump power (145.8 kW + 74.5 kW) × Reporting Period hours of operation (8,482 hours).

### 4.2. Results

The Electricity Savings are calculated according to the following equation:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

Since there has been no change in the Static Factors as defined in the M&V Plan Section B.5.3, Non-Routine Adjustments are not required for this Reporting Period. The Electricity Savings results are presented in Table 5.

**Table 5. Calculation of Electricity Savings**

Description	Value	Unit	Comment
Adjusted Baseline Energy	1,869	MWh	From Table 4.
Reporting Period Energy	978	MWh	From Table 3.
Non-Routine Adjustments	0	MWh	None.
Electricity Savings	890	MWh	<i>Adjusted Baseline Energy – Reporting Period Energy ± Non-Routine Adjustments.</i>
Electricity Savings Uncertainty	± 5.9%		Calculated using Adjusted Baseline Energy uncertainty (± 2.5%) and Reporting Period Energy uncertainty (± 2.5%), obtained from the M&V Plan.
Anticipated Electricity Savings	731	MWh	From Table 1.
Electricity Savings as a Percentage of Anticipated Electricity Savings	122%		This ratio is capped at 120% for the Incentive payment calculation.
Average Demand Savings	102	kW	<i>Electricity Savings ÷ Reporting Period duration.</i>
Reporting Period Peak Demand	95	kW	Average demand during the summer Peak Demand Period, defined as weekdays, 1pm – 7pm, June 1 – August 31.
Baseline Peak Demand	206	kW	From the M&V Plan.
Summer Peak Demand Savings	111	kW	<i>Reporting Period Peak Demand - Baseline Peak Demand.</i>

### 4.3. Incentive Payment

The 1<sup>st</sup> Annual Reporting Period Incentive is outlined in Table 6. CLEARresult has received the Invoice Reconciliation Form and the invoices.

**Table 6. Incentive Payments for Deferred Payment**

Deferred Payment Schedule	Description	Amount
<b>Payment 1</b>	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the first quarterly M&V Report.	\$84,462.00 (Paid)
<b>Final Payment (Holdback)</b>	The balance payment is the difference between the actual Participant Incentive, calculated on the basis of the first annual M&V Report, and the total payments made to date.	\$90,978.00

#### 4.4. Conclusion

The Electricity Savings are 890 MWh and represent 122% of the Anticipated Electricity Savings for the Reporting Period.

One reason for the overperformance is that the pumps take time to shut off even after the 4T equipment has cycled off. This resulted in increased hours of operation, and correspondingly increased Electricity Savings. More significantly, however, pump 473 operated at a lower than anticipated average power, particularly in the second half of the Reporting Period.

#### 4.5. Electricity Savings to Date

The Electricity Savings to date are presented in Table 7.

**Table 7. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings			
		MWh	% of Contract Savings Value <sup>1</sup>	Cost Savings (\$) <sup>2</sup>	Incentive Payment (\$)
1 <sup>st</sup> Quarterly	Nov. 20, 2018 to Feb. 19, 2019	213	116%	\$11,300	\$84,462
1 <sup>st</sup> Annual	Nov. 20, 2018 to Nov. 19, 2019	890	122%	\$47,300	\$90,978

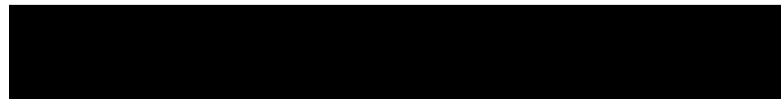
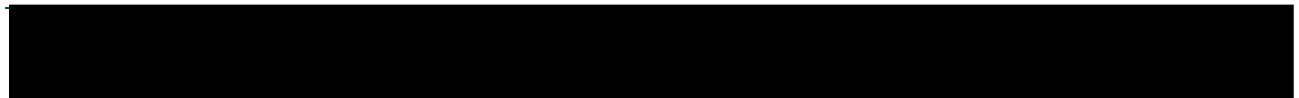
<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on the Electricity Billing Rate of \$53.14/MWh obtained from the Project Review.



# Measurement & Verification Report

## 1<sup>st</sup> Annual Reporting Period



## Cogeneration

## System

---

**Project ID:** Toronto-PROJECT-601912  
September 21, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited

**Prepared by:**  
CLEARResult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

Prepared per Program Rules version "saveONenergy Process & Systems Upgrades Program, FINAL v2.0  
April 6, 2018"

## Approvals

	Written by Technical Reviewer	Reviewed by Senior Engineer
Name:	[REDACTED]	[REDACTED]
Date:	September 16, 2022	September 21, 2022
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
September 21, 2022	First M&V Report issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of May 28, 2021, to July 14, 2022, are 996 MWh, which represents 99.6% of the Anticipated Electricity Savings.

Note that the original 1<sup>st</sup> Annual Reporting Period was scheduled to end on May 17, 2022. However, the Reporting Period had to be extended to July 14, 2022, as the combined heat and power (CHP) system was unexpectedly shutdown on January 14, 2022, due to a low oil pressure alarm resulting from a failure of the engine valve train and a damaged piston. The repairs could not be performed until March 2, 2022, due to COVID-19 supply constraints of the equipment. Thus, the Reporting Period was extended by 1134 hours and excludes this shutdown period.

The Incentive payable to the Participant for this Reporting Period is \$96,050. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	May 28 to Aug 27, 2021	258	103%	\$34,000
1 <sup>st</sup> Annual	May 27, 2021, to July 14, 2022	996	99.6%	\$131,443

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$132/MWh obtained from the Letter of Approval.



## In-Service Date Confirmation

The In-Service Date was set to May 28, 2021, on July 27, 2021, by the Technical Reviewer.

## Metered Data Analysis

from Toronto Hydro provided the M&V data on September 1, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	May 28, 2021, 00:00		Start date of the Reporting Period
Reporting Period End	July 14, 2022, 05:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date, less the 1,134 hours of unexpected shutdown period.
Available Data	8,752	hours	
Missing Data	8	hours	0.1% of the Reporting Period Duration
Hours of Operation	8,517	hours	97% of the Reporting Period Duration

The M&V data was missing the CHP system gross electrical output values for the period August 11, 2021, from 6:00 to 13:00, for a total eight hours. The Technical Reviewer assumes that the CHP system did not operate during this period as there was no natural gas consumption and replaced the missing data with zero values.

The CHP system did not operate from January 14, 2022, 09:00 to March 2, 2022, 14:00 (1,134 hours) due to an unexpected failure in the control board. The problem was investigated and subsequently fixed by the manufacturer. Therefore, the Reporting Period was extended by 1,134 hours.

## Performance of the Measure

The Electricity Savings of the project is calculated using the following equation:

$$\boxed{\text{Electricity Savings}} = \boxed{\text{Reporting Period Energy}} \pm \boxed{\text{Non-Routine Adjustments}}$$

## Baseline Energy

This is an electricity generation project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The Reporting Period Energy of the CHP System for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,027	MWh	
Auxiliary Loads Energy	31	MWh	1.8% of the CHP Gross Electrical Output. See comments below table.
Reporting Period Energy	996	MWh	Gross Electrical Energy – Reporting Period Energy
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Average Demand Generation	114	kW	Reporting Period Energy ÷ Reporting Period Duration
Summer Peak Demand Generation	112	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

The auxiliary loads consist of internal and external auxiliary loads. The internal auxiliary loads, which consist of two onboard pumps and controls, are not metered. They are estimated by ██████████, the supplier of the CHP system, to be 1.5 kW. The Technical Reviewer accepted this value and applied 1.5 kW per CHP operating hour to calculate the internal auxiliary load energy. The external auxiliary loads consist of hot water circulation pumps and dump radiators. The external loads were part of the metered Reporting Period data. However, it appears that the hourly values provided for the external auxiliary loads were determined by ██████████, the Participant's consultant, based on power ratings from equipment specifications and operating status. Both the internal and external auxiliary load values appear to be reasonable based on the CHP system installed.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	996	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	996	MWh	

Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Annual Electricity Savings	1,000	MWh/year	Obtained from the M&V Plan, Rev 0, dated Mar 19, 2019.
Electricity Savings as a Percentage of Anticipated Electricity Savings	99.6%	-	
Average Demand Savings	114	kW	Obtained from Table 3.
Summer Peak Demand Savings	112	kW	Obtained from Table 3.

The 1<sup>st</sup> Annual Electricity Savings are 996 MWh and represent 99.6% of the Anticipated Electricity Savings. The CHP system was operated as anticipated during the 1<sup>st</sup> Annual Reporting Period.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{Gross Electrical Energy (MWh)} + \text{Utilized Thermal Output (MWh)}] / \text{CHP Fuel Energy Input (MWh)}$$

**Table 5. Total System Efficiency**

Description	Value	Unit	Comment
Gross Electrical Energy	1,027	MWh	Obtained from Table 3
Utilized Thermal Output	1,287	MWh	
CHP Fuel Energy Input	3,441	MWh	Calculated using the metered volumetric flowrate of natural gas and natural gas Higher Heating Value (HHV) of 10.75 kWh/m <sup>3</sup> , obtained from the M&V Plan
Total System Efficiency	67.2%	-	

The CHP system achieved a Total System Efficiency of 67.2%, which meets the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual M&V Report, the Incentive payable to the Participant is \$96,050.

The Incentive is based on the \$200/MWh of Electricity Savings limiter. Table 6 outlines the Incentive payment calculation.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	996	Annual Electricity Savings, defined in this Report.
Estimated Eligible Project costs	\$969,296	From the Project Approval Letter.
<b>Actual Eligible Project Cost</b>	<b>\$897,305</b>	Based on Review of Eligible Costs as part of the Q1 Payment Recommendation.
Other Benefits	\$49,326	From the Project Approval Letter.
Other Costs	\$141,918	From the Project Approval Letter.
Net Project benefits	\$38,851	Electricity Bill Savings + Other Benefits – Other Costs.
<b>Approved Incentive Amount</b>	<b>\$200,000</b>	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$199,156	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Project Costs	\$358,922	40% of minimum if Actual and Estimated Eligible costs.
Limiter 3 - Project Payback	\$858,454	Eligible costs minus net benefits.
Project Incentive	\$199,156	Minimum of the three limiters.
Project Incentive paid to Date	\$103,106	Paid for 1 <sup>st</sup> Quarterly Reporting Period.
<b>Incentive payable</b>	<b>\$96,050</b>	Gross incentive minus incentive paid.

Table 7 provides the Incentive payment schedule.

**Table 7. Incentive Payment Schedule**

<b>Deferred Payment Schedule</b>	<b>Projected Date</b>	<b>% of Approved Amount</b>
<b>Payment 1</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

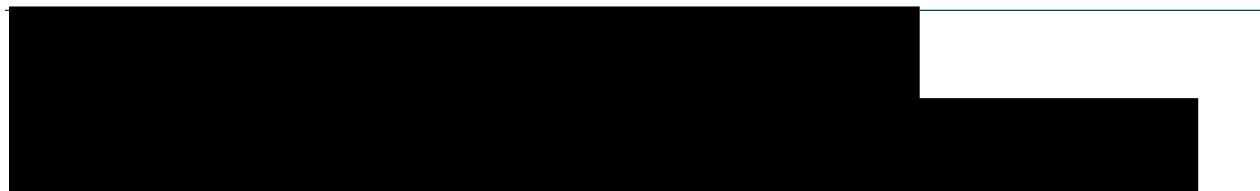
Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual



## Cogeneration System

**Project ID:** Toronto-Project-601913

June 28, 2022

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited  


**Prepared by:**

CLEAResult

393 University Avenue, Suite 1622, Toronto, ON M5G 1E6

(416) 504-3400

Prepared per Program Rules version "saveONenergy Process & Systems Upgrades Program, FINAL v2.0  
April 6, 2018



## Approvals

	Written by Technical Reviewer	Reviewed by Senior Engineer
Name:	[REDACTED]	[REDACTED]
Date:	June 28, 2022	June 28, 2022
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
June 28, 2022	M&V Report first issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of May 27, 2021 to May 26, 2022, are 1,020 MWh, which represents 105% of the Anticipated Electricity Savings. The Total System Efficiency achieved for the 1<sup>st</sup> Annual Reporting Period is 71%, which meets the Program Rules requirement of 65%.

The Incentive payable to the Participant for this Reporting Period is \$101,261. Refer Appendix for the Incentive calculation.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	May 27 to Aug 26, 2021	264	105%	\$32,000
1 <sup>st</sup> Annual	May 27, 2021 to May 26, 2022	1,020	105%	\$123,400

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of May 27, 2021 was established on July 29, 2021.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan

<sup>2</sup> Based on \$121/MWh obtained from the Project Approval Letter

## Metered Data Analysis

from Toronto Hydro provided the M&V data on October 1, 2021, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	May 27, 2021, 00:00		Start date of the Reporting Period.
Reporting Period End	May 26, 2022, 23:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date
Available Data	8,760	hours	
Missing Data	0	hours	0% of the Reporting Period Duration
Hours of Operation	8,703	hours	99.3% of the Reporting Period Duration

## Performance of the Measure(s)

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\boxed{\text{Electricity Savings}} = \boxed{\text{Adjusted Baseline Energy}} - \boxed{\text{Reporting Period Energy}} \pm \boxed{\text{Non-Routine Adjustments}}$$

### Baseline Energy

This is an electricity generation Project with no prior generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The Reporting Period Energy and the average and peak generation values are presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
CHP Gross Electrical Output	1,038	MWh	
Auxiliary Loads	18	MWh	1.8% of the CHP Gross Electrical Output.
<b>Reporting Period Energy</b>	1,020	MWh	CHP Net Electrical Output.
<b>Uncertainty of the Reporting Period Energy</b>	± 2.5%	%	The Uncertainty is mostly due to the accuracy of the meters.
<b>Average Generation</b>	116	kW	Reporting Period Energy divided by Reporting Period Duration
<b>Summer Peak Generation</b>	121	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

## Electricity Savings

The Baseline Energy, Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	Obtained from Table 3.
Reporting Period Energy	1,020	MWh	Obtained from Table 3..
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,020	MWh	
Uncertainty of the Electricity Savings	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter
Anticipated Electricity Savings	974	MWh	Obtained from the Table 4 of the M&V Plan, Rev 0, dated Feb 4, 2019.
Electricity Savings as a Percentage of Anticipated Electricity Savings	105	%	
Average Demand Savings	116	kW	Obtain from Table 3
Summer Peak Demand Savings	121	kW	Obtain from Table 3

The 1<sup>st</sup> Annual Electricity Savings are 1,020 MWh, which represent 105% of the Anticipated Electricity Savings. The overperformance is due to higher than anticipated hours of operation and average operating electrical load of the cogeneration system. The cogeneration system was anticipated to operate 8,568

hours with an average operating output of 113.7 kW but the actual operating hours and average output were 8,703 hours and 117.2 kW.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{CHP Gross Electrical Energy (MWh)} + \text{Utilized Thermal Output (MWh)}] / \text{CHP Natural Gas Consumption (MWh)}$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,038	MWh	
Utilized Thermal Output	1,446	MWh	
CHP Natural Gas Consumption	3,485	MWh	Calculated using the metered volumetric flowrate of natural gas and Natural Gas Higher Heating Value (HHV) of 10.84 kWh/m <sup>3</sup> , obtained from the Enbridge Gas website.
<b>Total System Efficiency</b>	71.3	%	

The CHP system achieved a Total System Efficiency of 71.3%, which meets the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, the Incentive payable to the Participant is \$101,260.59.

Table 6 outlines the Incentive payment calculation using the latest available information.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	1,020	1 <sup>st</sup> Annual Reporting Period Electricity Savings.
<b>Estimated Eligible Costs</b>	969,296	As per the Project Approval Letter
Actual Eligible Costs	\$884,190	Based on Review of Eligible Costs as part of the Q1 Payment Recommendation
Electricity Billed Savings	\$123,425	Based on the Project Approval Letter Electricity Billing Rate of \$121/MWh
Other Benefits	\$52,168	From the Project Approval Letter
Other Costs	\$138,633	From the Project Approval Letter
Net Project Benefits	\$40,174	Electricity Billed Savings +Other Benefits – Other Costs
<b>Approved Incentive Amount</b>	<b>\$194,800</b>	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$204,008	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Eligible Costs	\$353,676	40% of the minimum of Actual and Estimated Eligible costs.
Limited 3 – Project Payback	\$844,015	Eligible costs minus Net Project Benefits
Gross Project Incentive	\$204,008	Minimum of the three limiters.
Project Incentives paid to Date	\$102,747	Paid for 1 <sup>st</sup> Quarterly Reporting Period.
<b>Incentive payable</b>	<b>\$101,261</b>	Gross incentive minus incentives paid.

Table 7 provides the Incentive payment schedule

**Table 7. Incentive Calculation**

<b>Deferred Payment Schedule</b>	<b>Projected Date</b>	<b>% of Approved Amount</b>
<b>Payment 1</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





# Measurement & Verification Report

## 1<sup>st</sup> Annual Reporting Period

# Cogeneration System

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**Project ID:** Toronto-PROJECT-601914  
August 04, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited

**Prepared by:**  
CLEARresult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

Prepared per Program Rules version "saveONenergy Process & Systems Upgrades Program, FINAL v2.0  
April 6, 2018"

## Approvals

	Written by Technical Reviewer	Reviewed by Senior Engineer
Name:	[REDACTED]	[REDACTED]
Date:	July 29, 2022	August 3, 2022
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
August 4, 2022	First M&V Report issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of May 29, 2021, to June 5, 2022, are 990 MWh, which represents 98% of the Anticipated Electricity Savings. The combined heat and power (CHP) system achieved a Total System Efficiency of 69.4%, which meets the Program's minimum requirement of 65%.

Note that the original 1<sup>st</sup> Annual Reporting Period was scheduled to end on May 28, 2022. However, the Reporting Period had to be extended to June 5, 2022, as the CHP system was unexpectedly shutdown on January 17, 2022. The shutdown, which lasted 171 hours, was a result of a control board failure, which resulted in no power supply to the control system. The repairs could not be performed until January 24, 2022, due to COVID-19 constraints that affected the delivery of the replacement parts. Thus, the Reporting Period was extended by 171 hours and excludes this shutdown period.

The Incentive payable to the Participant for this Reporting Period is \$94,229. Refer to the Appendix for the Incentive calculation.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	May 29 to Aug 28, 2021	264	102%	\$32,400
1 <sup>st</sup> Annual	May 29, 2021, to June 5, 2022	990	98%	\$121,811

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$123.02/MWh obtained from the Approval Letter.

## In-Service Date Confirmation

The In-Service Date was set to May 29, 2021, on July 30, 2021, by the Technical Reviewer.

## Metered Data Analysis

from Toronto Hydro provided the M&V data on July 20, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	May 29, 2021, 00:00		Start date of the Reporting Period
Reporting Period End	June 5, 2022, 02:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus Start date, less the 171 hour unexpected shutdown period.
Available Data	8,760	hours	
Missing Data	0	hours	
Hours of Operation	8,424	hours	96.2% of the Reporting Period Duration

The CHP system did not operate from January 17, 2022, 14:00 to January 24, 2022, 15:00 (171 hours) due to an unexpected failure in the control board. The problem was investigated and fixed by the manufacturer. Therefore, the Reporting Period was extended by 171 hours.

## Performance of the Measure

The Electricity Savings is calculated as follows:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The electricity generation of the CHP system for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,021	MWh	
Auxiliary Loads Energy	31	MWh	3.1% of the Gross Electrical Energy. See comment below Table 3
Reporting Period Energy	990	MWh	Gross Electrical Energy – Auxiliary Loads Energy
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Average Generation	113	kW	Reporting Period Energy divided by Reporting Period Duration
Summer Peak Demand Generation	115	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

Based on discussions with [REDACTED], the Participant's consultant, the auxiliary loads consist of internal and external auxiliary loads. The internal auxiliary loads, which consist of two onboard pumps and controls are not metered. They were calculated by [REDACTED], the supplier of the CHP system, to be 1.5 kW. The Technical Reviewer accepted this value and applied 1.5 kWh per CHP operating hour to calculate the internal auxiliary load energy. The external auxiliary loads consist of hot water circulation pumps and dump radiators. The external loads were part of the metered Reporting Period data. However, it appears that the hourly values provided for the external auxiliary loads were determined by [REDACTED] based on power ratings from equipment specifications and operating status. Both the internal and external auxiliary load values appear to be reasonable based on the type of system installed.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	990	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	990	MWh	
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Annual Electricity Savings	1,013	MWh/Year	Obtained from the M&V Plan, Rev 0, dated Feb 12, 2019.

Electricity Savings as a Percentage of Anticipated Electricity Savings	98%	-	
Average Demand Savings	113	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	115	kW	Equal to Peak Demand Generation from Table 3.

The 1<sup>st</sup> Quarterly Electricity Savings are 990 MWh which represent 98% of the Anticipated Electricity Savings. The underperformance is due to the less than anticipated operating hours of the CHP system. The CHP system was anticipated to operate 8,590 hours annually, but the hours of operation for the Reporting Period was 8,424 hours.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{Gross Electrical Energy (MWh)} + \text{Utilized Thermal Output (MWh)}] / \text{Fuel Energy Input (MWh)}$$

**Table 5. Total System Efficiency**

Description	Value	Unit	Comment
Gross Electrical Energy	1,021	MWh	Obtained from Table 3.
Utilized Thermal Output	1,323	MWh	
Fuel Energy Input (HHV)	3,376	MWh	Calculated using the metered volumetric flowrate of natural gas and natural gas Higher Heating Value (HHV) of 10.75 kWh/m <sup>3</sup> , obtained from the M&V Plan.
Total System Efficiency	69.4%	-	

The CHP system achieved a Total System Efficiency of 69.4%, which meet the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No Additional M&V data will be required, unless requested by the IESO.

## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, the Incentive payable to the Participant is \$94,229. The Payment Recommendation will be issued upon receipt of the Participant's invoice to Toronto Hydro for the payment amount.

Table 6 outlines the Incentive payment calculation using the latest available information.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	990	1 <sup>st</sup> Annual Reporting Period Electricity Savings.
<b>Estimated Eligible Costs</b>	\$964,884	As per the Project Approval Letter
Actual Eligible Costs	\$1,044,361	Based on Review of Eligible Costs as part of the Q1 Payment Recommendation
Electricity Billed Savings	\$121,811	Based on the Project Approval Letter Electricity Billing Rate of \$123.02/MWh
Other Benefits	\$37,938	From the Project Approval Letter
Other Costs	\$126,924	From the Project Approval Letter
Net Project Benefits	\$32,825	Electricity Billed Savings +Other Benefits – Other Costs
<b>Approved Incentive Amount</b>	<b>\$202,600</b>	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$198,035	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Eligible Costs	\$385,954	40% of the minimum of Actual and Estimated Eligible costs.
Limited 3 – 1-year Project Payback	\$932,059	Eligible costs minus Net Project Benefits
Recommended Project Incentive	\$198,035	Minimum of the three limiters.
Project Incentive paid to Date	\$103,806	Paid for 1 <sup>st</sup> Quarterly Reporting Period.
<b>Incentive payable</b>	<b>\$94,229</b>	Recommended Project – Project Incentive Paid to Date.

Table 7 provides the Incentive payment schedule.



**Table 7. Incentive Payment Schedule**

<b>Deferred Payment Schedule</b>	<b>Projected Date</b>	<b>% of Approved Amount</b>
<b>Payment 1</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period

[Redacted]

[Redacted]

## Cogeneration System

**Project ID:** Toronto-PROJECT-601915  
July 07, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited

[Redacted]

**Prepared by:**  
CLEARresult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

Prepared per Program Rules version “saveONenergy Process & Systems Upgrades Program, FINAL v2.0 April 6, 2018”

## Approvals

	Written by Technical Reviewer	Reviewed by Technical Reviewer
Name:	[REDACTED]	[REDACTED]
Date:	July 6, 2022	July 6, 2022
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
July 7, 2022	First M&V Report issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of May 26, 2021, to May 25, 2022, are 912 MWh, which represents 100% of the Anticipated Electricity Savings. The Total System Efficiency achieved for the 1<sup>st</sup> Annual Reporting Period is 72.7%, which meets the Program Rules requirement of 65%.

The Incentive payable to the Participant for this Reporting Period is \$91,290. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	May 26 to Aug 25, 2021	237	104%	\$33,500
1 <sup>st</sup> Annual	May 26, 2021 to May 25, 2022	912	100%	\$113,082

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date was set to May 26, 2021, on July 29, 2021, by the Technical Reviewer.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$124/MWh obtained from the Project Approval Letter.

## Metered Data Analysis

[REDACTED] the LDC representative, provided the M&V data on June 7, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	May 26, 2021, 00:00		Start date of the Reporting Period.
Reporting Period End	May 25, 2022, 23:59		End date of the Reporting Period.
Reporting Period Duration	8,760	hours	End date minus start date.
Available Data	8,760	hours	
Missing Data	0	hours	0% of the Reporting Period Duration.
Hours of Operation	8,560	hours	98% of the Reporting Period Duration.

## Performance of the Measure

The electrical performance of the project is based on the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The electrical generation of the combined heat and power (CHP) System for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
CHP Gross Electrical Output	941	MWh	
Auxiliary Loads	29	MWh	3.1% of the CHP Gross Electrical Output.
Reporting Period Energy	912	MWh	CHP Net Electrical Output.
Uncertainty of the Reporting Period Energy	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter.
Average Generation	104	kW	
Summer Peak Demand Generation	111	kW	Summer peak demand period is defined as Monday to Friday, 1:00 pm -7:00 pm, June 1 to August 31.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	912	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	912	MWh	
Uncertainty of the Electricity Savings	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	911	MWh	As per the M&V Plan.
Electricity Savings as a Percentage of Anticipated Electricity Savings	100	%	
Average Demand Savings	104	kW	
Summer Peak Demand Savings	111	kW	Summer peak demand period is defined as Monday to Friday, 1:00 pm -7:00 pm, June 1 to August 31.

The 1<sup>st</sup> Annual Reporting Period Electricity Savings are 912 MWh and represent 100% of the Anticipated Electricity Savings.



## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{CHP Gross Energy (MWh)} + \text{CHP Utilized Thermal Output (MWh)}] / \text{CHP Fuel Energy Input (MWh)}$$

**Table 5. Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	941	MWh	
CHP Utilized Thermal Output	1,299	MWh	
Natural Gas Higher Heating Value (HHV)	10.75	kWh/m <sup>3</sup>	As per the M&V Plan.
CHP Fuel Energy Input (HHV)	3,083	MWh	Calculated using the metered volumetric natural gas consumption and natural gas HHV value.
Total System Efficiency	72.7	%	

The CHP system achieved a TSE of 72.7%, which meets the Program Rules requirement of 65%. The Technical Reviewer also determined that when the CHP Fuel Energy Input (HHV) is quantified based on the specifications, the TSE is 67.4%. However, the Technical Reviewer has accepted the TSE based on metered CHP Fuel Energy Input (HHV) as a result of both values being above the 65% Program Rules requirement.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, and verified Eligible Costs, the Incentive payable to the Participant is \$91,290. The Master Payment Requisition will be issued once the Participant's invoice for the Incentive amount is provided.

Table 6 outlines the Incentive payment calculation using the latest available information.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	912	1 <sup>st</sup> Annual Reporting Period Electricity Savings.
Approved Amount	\$182,200	From the Project Approval Letter.
Limiter 1 - Electricity Savings	\$182,390	\$200 per MWh of Electricity Savings, capped at 120% of Approved Amount.
Estimated Eligible Project Costs	\$1,024,177	From the Project Approval Letter.
Actual Eligible Project Costs	\$979,095	Verified, based on invoices provided by the Participant.
Limiter 2 - Project Costs	\$391,638	40% of minimum of Estimated and Actual Eligible Project Costs.
Net Benefits	\$31,383	Equal to the electricity savings, calculated using a billing rate of \$124/MWh, plus the Other Benefits less Other Costs from the Project Approval Letter.
Limiter 3 – 1-year Project Payback	\$947,712	Eligible Costs minus Net Benefits.
Gross Project Incentive	\$182,390	Minimum of the three limiters.
Project Incentives paid	\$91,100	Paid for 1 <sup>st</sup> Quarterly Reporting Period.
Study Incentive paid	N/A	Paid for Engineering Study. <sup>3</sup>
<b>Incentive payable</b>	<b>\$91,290</b>	Gross incentive minus incentives paid.

Table 7 provides the Incentive payment schedule.

<sup>3</sup> Not applicable under the CFF2 framework.

**Table 7. Incentive Payment Schedule**

<b>Deferred Payment Schedule</b>	<b>Projected Date</b>	<b>% of Approved Amount</b>
<b>Payment 1</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.



Toronto Hydro-Electric System Limited  
14 Carlton Street  
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## **Third Party Evaluation Reports**

This document includes the following third party evaluation reports:

### **Process and Systems Upgrades Program:**

- #601920
- #601929
- #601934
- #601935
- #601937
- #601938
- #601939



CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period

## Cogeneration System

**Project ID:** Toronto-PROJECT-601920  
July 28, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited

**Prepared by:**  
CLEARresult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

Prepared per Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018

## Approvals

	Written by Technical Reviewer	Reviewed by Senior Engineer
Name:	[REDACTED]	[REDACTED]
Date:	July 26, 2022	July 27, 2022
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
July 28, 2022	First M&V Report issuance.	0	[REDACTED]



## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of June 11, 2021, to June 10, 2022, are 1,047 MWh, which represents 86% of the Anticipated Electricity Savings.

The Incentive payable to the Participant for this Reporting Period is \$106,739. Refer to the Appendix for the Incentive calculation.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	June 11 to September 10, 2021	259	89%	\$32,116
1 <sup>st</sup> Annual	June 11, 2021, to June 10, 2022	1,047	86%	\$124,850

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan Rev.0 dated January 31, 2019, which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of June 11, 2021 was established on August 3, 2021.

## Metered Data Analysis

[REDACTED] from Toronto Hydro provided the M&V data on July 20, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$124/MWh obtained from the Approval Letter.

## Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	June 11, 2021, 0:00		Start date of the Reporting Period
Reporting Period End	June 10, 2022, 23:59		End Date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date.
Available Data	8,760	hours	
Missing Data	0	hours	
Hours of Operation	8,601	hours	98.2% of the Reporting Period Duration.

## Performance of the Measure

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\boxed{\text{Electricity Savings}} = \boxed{\text{Adjusted Baseline Energy}} - \boxed{\text{Reporting Period Energy}} \pm \boxed{\text{Non-Routine Adjustments}}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The electricity generation of the combined heat and power (CHP) System for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,064	MWh	
Auxiliary Loads Energy	16	MWh	1.5% of the CHP Gross Electrical Energy.
Reporting Period Energy	1,047	MWh	Gross Electrical Energy – Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%		The Uncertainty is the accuracy of the electrical meter.
Average Generation	120	kW	Reporting Period Energy divided by Reporting Period Duration.
Summer Peak Demand Generation	119	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm - 7:00 pm.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	1,047	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,047	MWh	
Uncertainty of the Electricity Savings	± 2.5%		The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	1,216	MWh	Obtained from Table 5 of the M&V Plan, Rev.0, dated January 31, 2019.
Electricity Savings as a Percentage of Anticipated Electricity Savings	86%		
Average Demand Savings	120	kW	Electricity Savings divided by Reporting Period Duration.
Summer Peak Demand Savings	119	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm - 7:00 pm.

The 1<sup>st</sup> Annual Electricity Savings are 1,047 MWh, which represent 86% of the Anticipated Electricity Savings.

The original Project scope was based on the installation of a CHP system consisting of two 75 kW internal combustion engines (ICEs), with a total nameplate capacity of 150 kW. However, the actual CHP system installed consists of a single 125 kW ICE.

The underperformance is due to the lower capacity CHP system. The CHP system was anticipated to operate with an average net operating electrical output of 142 kW but the average net operating electrical output during the Reporting Period was 122 kW. Note that the reduced electrical output was partly offset by higher operating hours in the Reporting Period 8,601 hours compared to the anticipated operating hours of 8,592.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{Gross Electrical Energy (MWh)} + \text{Utilized Thermal Output (MWh)}] / \text{Fuel Energy Input (MWh)}$$

**Table 5. Total System Efficiency**

Description	Value	Unit	Comment
Gross Electrical Energy	1,064	MWh	Obtained from Table 3.
Utilized Thermal Output	1,452	MWh	
Fuel Energy Input	3,512	MWh	Calculated using the metered volumetric flowrate of natural gas and Natural Gas Higher Heating Value (HHV) of 10.75 kWh/m <sup>3</sup> , obtained from the M&V Plan.
Total System Efficiency	71.6	%	

The CHP System achieved a Total System Efficiency of 71.6%, which meets the Program's minimum requirement of 65%

## Next Reporting Period and Next Steps

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, the Incentive payable to the Participant is \$106,739. The Payment Recommendation will be issued upon receipt of the Participant's invoice to Toronto Hydro for the payment amount.

Table 6 outlines the Incentive payment calculation using the latest available information.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	1,047	1 <sup>st</sup> Annual Reporting Period Electricity Savings.
<b>Estimated Eligible Costs</b>	\$794,965	As per the Project Approval Letter
Actual Eligible Costs	\$1,044,859	Based on Review of Eligible Costs as part of the Q1 Payment Recommendation
Electricity Billed Savings	\$129,850	Based on the Project Approval Letter Electricity Billing Rate of \$121/MWh
Other Benefits <sup>3</sup>	\$61,696	From the Project Approval Letter
Other Costs <sup>3</sup>	\$188,332	From the Project Approval Letter
Net Project Benefits	\$3,214	Electricity Billed Savings +Other Benefits – Other Costs
<b>Approved Incentive Amount</b>	<b>\$243,200</b>	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$209,436	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Eligible Costs	\$317,986	40% of the minimum of Actual and Estimated Eligible costs.
Limited 3 – 1-year Project Payback	\$791,751	Eligible costs minus Net Project Benefits
Recommended Project Incentive	\$209,346	Minimum of the three limiters.
Project Incentive paid to Date	\$102,697	Paid for 1 <sup>st</sup> Quarterly Reporting Period.
<b>Incentive payable</b>	<b>\$106,739</b>	Recommended Project – Project Incentive Paid to Date.

Table 7 provides the Incentive payment schedule

<sup>3</sup> The Other Benefits and Other Costs are from the Project Approval Letter and based on the original Project Scope. Due to change in CHP system capacity and lower than anticipated Electricity Savings, the actual Other Benefits and Other Costs are expected to be different from the contracted value. However, the change should not impact the Project Incentive, given the very large margin between the \$200/MWh Incentive limiter and the 1-Year Payback limiter.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.







# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period

[Redacted]

[Redacted]

## Cogeneration System

**Project ID:** Toronto-PROJECT-601929  
August 04, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited

[Redacted]

**Prepared by:**  
CLEARresult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

Prepared per Program Rules version "saveONenergy Process & Systems Upgrades Program, FINAL v2.0 April 6, 2018"

## Approvals

	Written by Technical Reviewer	Reviewed by Technical Reviewer
Name:	[REDACTED]	[REDACTED]
Date:	August 4, 2022	August 2, 2022
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
August 4, 2022	First M&V Report issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of June 8, 2021, to June 18, 2022, are 1,001 MWh, which represents 104% of the Anticipated Electricity Savings. The Total System Efficiency achieved for the 1<sup>st</sup> Annual Reporting Period is 67.2%, which meets the Program Rules requirement of 65%.

Note that the original 1<sup>st</sup> Annual Reporting Period was scheduled to end on June 7, 2022. However, the Reporting Period had to be extended to June 18, 2022, as the combined heat and power (CHP) system was unexpectedly shutdown on May 30, 2022. The shutdown, which lasted 258 hours, was the result of a phase B short, which damaged the generator. The repairs could not be performed until June 10, 2022, due to COVID-19 constraints that affected the delivery of the replacement parts.

The Incentive payable to the Participant for this Reporting Period is \$98,125. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Jun 8 to Sep 7, 2021	257	106%	\$34,900
1 <sup>st</sup> Annual	Jun 8, 2021 to Jun 18, 2022	1,001	104%	\$110,343

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$110.27/MWh obtained from the Project Approval Letter.

## In-Service Date Confirmation

The In-Service Date was set to June 8, 2021, on July 29, 2021, by the Technical Reviewer.

## Metered Data Analysis

[REDACTED] the LDC representative, provided the M&V data on July 20, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Jun 8, 2021, 00:00		Start date of the Reporting Period.
Reporting Period End	Jun 18, 2022, 17:59		End date of the Reporting Period.
Reporting Period Duration	9,018	hours	End date minus start date.
Available Data	9,018	hours	
Missing Data	0	hours	0% of the Reporting Period Duration.
Unexpected Shutdown	258	hours	
Hours of Operation	8,332	hours	95% of the Reporting Period Duration excluding the 258 hours unexpected shutdown period.

## Performance of the Measure

The electrical performance of the project is based on the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The electrical generation of the CHP System for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,033	MWh	
CHP Auxiliary Loads Energy	32	MWh	3.1% of the CHP Gross Electrical Energy. See details below Table 3.
Reporting Period Energy	1,001	MWh	CHP Gross Electrical Energy – CHP Auxiliary Loads Energy
Uncertainty of the Reporting Period Energy	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter.
Average Generation	114	kW	
Summer Peak Demand Generation	115	kW	Summer peak demand period is defined as Monday to Friday, 1:00 pm -7:00 pm, June 1 to August 31.

The auxiliary loads consist of internal and external auxiliary loads. The internal auxiliary loads, which consist of two onboard pumps and controls, are not metered. They are estimated by [REDACTED], the supplier of the CHP system, to be 1.5 kW. The Technical Reviewer accepted this value and applied 1.5 kW per CHP operating hour to calculate the internal auxiliary load energy. The external auxiliary loads consist of hot water circulation pumps and dump radiators. The external loads were part of the metered Reporting Period data. However, it appears that the hourly values provided for the external auxiliary loads were determined by [REDACTED], the Participant's consultant, based on power ratings from equipment specifications and operating status. Both the internal and external auxiliary load values appear to be reasonable based on the CHP system installed.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	1,001	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,001	MWh	
Uncertainty of the Electricity Savings	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	966	MWh	As per the M&V Plan.
Electricity Savings as a Percentage of Anticipated Electricity Savings	104	%	
Average Demand Savings	114	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	115	kW	Summer peak demand period is defined as Monday to Friday, 1:00 pm -7:00 pm, June 1 to August 31.

The 1<sup>st</sup> Annual Reporting Period Electricity Savings are 1,001 MWh and represent 104% of the Anticipated Electricity Savings. The overperformance is the result of the Reporting Period average operating electrical output being 120 kW, which is slightly higher than the anticipated average operating electrical output of 119 kW.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{CHP Gross Energy (MWh)} + \text{CHP Utilized Thermal Output (MWh)}] / \text{CHP Fuel Energy Input (MWh)}$$

**Table 5. Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,033	MWh	Obtained from Table 3.
CHP Utilized Thermal Output	1,371	MWh	
Natural Gas Higher Heating Value (HHV)	10.75	kWh/m <sup>3</sup>	As per the M&V Plan.
CHP Fuel Energy Input (HHV)	3,579	MWh	Calculated using the metered volumetric natural gas consumption and natural gas HHV value.
Total System Efficiency	67.2	%	

The CHP system achieved a TSE of 67.2%, which meets the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, and verified Eligible Costs, the Incentive payable to the Participant is \$98,125. The Master Payment Requisition will be issued once the Participant's invoice for the Incentive amount is provided.

Table 6 outlines the Incentive payment calculation using the latest available information.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	1,001	1 <sup>st</sup> Annual Reporting Period Electricity Savings.
Approved Amount	\$193,200	From the Project Approval Letter.
Limiter 1 - Electricity Savings	\$200,132	\$200 per MWh of Electricity Savings, capped at 120% of Approved Amount.
Estimated Eligible Project Costs	\$1,350,299	From the Project Approval Letter.
Actual Eligible Project Costs	\$655,480	Based on the review of invoices for the 1 <sup>st</sup> payment.
Limiter 2 - Project Costs	\$262,192	40% of minimum of Estimated and Actual Eligible Project Costs.
Net Benefits	\$34,621	Equal to the electricity savings, calculated using a billing rate of \$110.27/MWh, plus the Other Benefits less Other Costs from the Project Approval Letter.
Limiter 3 – 1-year Project Payback	\$620,859	Eligible Costs minus Net Benefits.
Gross Project Incentive	\$200,132	Minimum of the three limiters.
Project Incentives paid	\$102,007	Paid for 1 <sup>st</sup> Quarterly Reporting Period.
Study Incentive paid	N/A	Paid for Engineering Study. <sup>3</sup>
<b>Incentive payable</b>	<b>\$98,125</b>	Gross incentive minus incentives paid.

Table 7 provides the Incentive payment schedule.

<sup>3</sup> No deduction under "saveONenergy Process & Systems Upgrades Program, FINAL v2.0 April 6, 2018."



**Table 7. Incentive Payment Schedule**

<b>Deferred Payment Schedule</b>	<b>Projected Date</b>	<b>% of Approved Amount</b>
<b>Payment 1</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period



## Cogeneration

## System

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**Project ID:** Toronto-PROJECT-601934  
December 08, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited



**Prepared by:**  
CLEAResult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

**Prepared in accordance with:**  
Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018

## Approvals

	Written by Technical Reviewer	Reviewed by Senior Engineer
Name:	[REDACTED]	[REDACTED]
Date:	December 8, 2022	December 8, 2022
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
December 8, 2022	First M&V Report issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of August 17, 2021, to September 19, 2022, are 976 MWh, which represents 83% of the Anticipated Electricity Savings.

Note that the original 1<sup>st</sup> Annual Reporting Period was scheduled to end on August 16, 2022. However, the Reporting Period had to be extended to September 19, 2022, as the combined heat and power (CHP) system was unexpectedly shut down on July 28, 2022 for 798 hours, due to an issue with the Domestic Hot Water (DHW) pump which was damaged by sudden water shutdown. The repairs could not be performed until August 30, 2022, due to COVID-19 supply constraints of the equipment. Thus, the Reporting Period was extended by 798 hours and excluded this shutdown period.

The Incentive payable to the Participant for this Reporting Period is \$92,252. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	August 17 to November 16, 2021	260	88%	\$31,200
1 <sup>st</sup> Annual	August 17, 2021, to September 19, 2022	976	83%	\$117,150

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan Rev.0 dated January 30, 2019, which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan. Please note that the M&V Plan shows Anticipated Electricity Savings of 1,240 MWh which is an error. The Anticipated Electricity Savings should be 1,175 MWh, based on the Project Application Review and the Approval Letter.

<sup>2</sup> Based on \$120/MWh obtained from the Approval Letter.

## In-Service Date Confirmation

The In-Service Date of August 17, 2021 was established on September 3, 2021.

## Metered Data Analysis

██████████ from Toronto Hydro provided the M&V data on November 30, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Aug. 17, 2021, 0:00		
Reporting Period End	Sep 19, 2022, 5:59		
Reporting Period Duration	8,760	hours	End date minus start date, less the 798 hours of shutdown. See comment below table.
Available Data	8,738	hours	
Missing Data	22	hours	See comment below table.
Hours of Operation	8,345	hours	95% of the Reporting Period Duration.

The CHP system did not operate from July 28, 2022, 12:00 pm to August 30, 2022, 6:00 pm (798 hours) due to an unexpected failure in the DHW pump. The problem was investigated and subsequently fixed by the manufacturer. Therefore, the Reporting Period was extended by 798 hours and excludes the 798 hours of shutdown.

The M&V data was missing the CHP system gross electrical output values for the period of May 27, 2022, 6:00 pm to May 28, 2022, 5:00 pm, for a total of 22 hours. The Technical Reviewer assumes that the CHP system did not operate during this period as there was no natural gas consumption and filled the missing data with zero gross electrical output values.

## Performance of the Measure

The electrical performance of the Project is based on the Adjusted Baseline Energy and the Reporting Period Energy, as follows:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

## Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The electrical generation of the CHP System for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,011	MWh	
Auxiliary Loads Energy	35	MWh	3.4% of the CHP Gross Electrical Output. See comment below the table
Reporting Period Energy	976	MWh	Gross Electrical Energy – Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%		The Uncertainty is the accuracy of the electrical meter.
Average Generation	111	kW	Reporting Period Energy divided by Reporting Period Duration.
Summer Peak Demand Generation	111	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm - 7:00 pm.

The auxiliary loads consist of internal and external auxiliary loads. The internal loads consist of two onboard pumps and controls, are not metered. They are estimated by ██████████, the supplier of the CHP system, to be 1.5 kW. The Technical Reviewer accepted this value and applied 1.5 kW per CHP operating hour to calculate the internal auxiliary load energy. The external loads consist of hot water circulation pumps and dump radiators which are the part of the metered Reporting Period data. However, it appears that the hourly values provided for the external auxiliary loads were determined by ██████████ the Participant's consultant, based on power ratings from equipment specifications and operating status. Both the internal and external auxiliary load values appear to be reasonable based on the CHP system installed.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	976	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	976	MWh	



Uncertainty of the Electricity Savings	± 2.5%		The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	1,175	MWh	Obtained from the Approval Letter.
Electricity Savings as a Percentage of Anticipated Electricity Savings	83%		
Average Demand Savings	111	kW	Equal to Average Generation from Table 3. .
Summer Peak Demand Savings	111	kW	Equal to Summer Peak Demand Generation from Table 3.

The Electricity Savings of the 1<sup>st</sup> Annual Period are 976 MWh and represent 83% of the Anticipated Electricity Savings.

The original Project scope was based on a 150 kW CHP System, consisting of two 75 kW internal combustion engines (ICEs). However, in the completed Project, one 125 kW ICE was installed. The underperformance is due to the lower capacity and lower operating hours of the CHP system. The CHP system was anticipated to operate 8,592 hours with an average net operating output of 137 kW, but during the Reporting Period the CHP operated 8,345 hours with an average net operating output of 117 kW.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{Gross Electrical Energy (MWh)} + \text{Utilized Thermal Output (MWh)}] / \text{Fuel Energy Input (MWh)}$$

**Table 5. Total System Efficiency**

Description	Value	Unit	Comment
Gross Electrical Energy	1,011	MWh	From Table 3.
Utilized Thermal Output	1,382	MWh	
Fuel Energy Input	3,264	MWh	Calculated using the metered volumetric flowrate of natural gas and natural gas Higher Heating Value (HHV) of 10.75 kWh/m <sup>3</sup> , obtained from the M&V Plan
Total System Efficiency	73.3%		

The CHP system achieved a Total System Efficiency of 73.3%, which meets the Program Rules minimum requirement of 65%.

## Next Reporting Period and Next Steps

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, the Incentive payable to the Participant is \$92,252.

The Incentive is based on the \$200/MWh of Electricity Savings limiter. Table 6 outlines the Incentive payment calculation.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	976	Annual Electricity Savings, defined in this Report.
Estimated Eligible Project costs	\$794,964	As per the Letter of Approval.
<b>Actual Eligible Project Cost</b>	\$778,354	As per vendor Invoices.
Other Benefits	\$60,859	As Per the Letter of Approval.
Other Cost	\$187,348	As per the Letter of Approval.
Net Project benefits	-\$9,337 <sup>3</sup>	Electricity Bill Savings + Other Benefits – Other Costs
<b>Approved Incentive Amount</b>	\$235,000	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$195,254	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Project Costs	\$311,342	40% of minimum if Actual and Estimated Eligible costs.
Limiter 3 - Project Payback	\$787,691	Eligible costs minus net benefits.
Project Incentive	\$195,254	Minimum of the three limiters.
Project Incentive paid to Date	\$103,002	Paid for 1 <sup>st</sup> Quarterly Reporting Period.
<b>Incentive payable</b>	<b>\$92,252</b>	Project Incentive minus Incentive paid to date.

Table 7 provided the Incentive Payment Schedule

<sup>3</sup> This Net Project Benefits value is based on the Approval Letter Other Benefits and Costs value, which were based on higher electricity generation, and does not reflect the actual electricity generation. The Technical Reviewer did not revise the Other Benefits and Costs value as it should not have impact on the Project Incentive.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

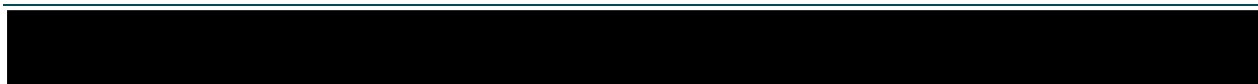
Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period



## Cogeneration System

**Project ID:** Toronto-PROJECT-601935  
October 20, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited



**Prepared by:**  
CLEARresult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

**Prepared in accordance with:**  
Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018

## Approvals

	Written by Technical Reviewer	Reviewed by:
Name:	[REDACTED]	[REDACTED]
Date:	October 20, 2022	October 20, 2022
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
October 20, 2022	First M&V Report issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of June 9, 2021 to June 16, 2022, are 792 MWh, which represents 82% of the Anticipated Electricity Savings.

The original Reporting Period has been extended by 170 hours (approximately seven days). The combined heat and power (CHP) System was not operational for 170 hours from August 10 to August 17, 2021, due to an unexpected defect in the expansion tank bladder.

The Incentive payable (balance payment) to the Participant for this Reporting Period is \$70,427. Refer to the Appendix for Incentive calculation details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	June 9 to Sep. 16, 2021 <sup>3</sup>	222	97%	\$26,900
1 <sup>st</sup> Annual	June 9, 2021, to June 16, 2022	792	82%	\$95,900

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan Rev.0, dated February 5, 2019, which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of the Project is June 9, 2021, which was established on July 30, 2021.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$121/MWh obtained from the Project Letter of Approval.

<sup>3</sup> The Reporting Period has been extended by 170 hours (approximately 7 days). Refer to Table 2 for details.



## Metered Data Analysis

██████████, from Toronto Hydro, provided the M&V data on July 20, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements. The data includes the following:

- Hourly gross electrical output of the CHP System (kW)
- Hourly recovered heat from the CHP System (kWh)
- Hourly natural gas consumption (m<sup>3</sup>)
- Hourly external auxiliary loads (kW)

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	June 9, 2021, 0:00		
Reporting Period End	June 16, 2022, 1:59		Extended by 170 hours. See note below.
Reporting Period Duration	8,760	hours	End date minus start date, excluding the shutdown period from August 10, 17:00 to August 17, 18:00.
Available Data	8,760	hours	
Missing Data	0	hours	
Hours of Operation	8,368	hours	96% of the Reporting Period Duration.

The CHP System was shut down from August 10, 17:00 to August 17, 18:00, 2021, to replace the expansion tank. The expansion tank failed unexpectedly, due to a defect in the tank bladder.

The shut down period of 170 hours represents 1.9% of the original Reporting Period. However, the Technical Reviewer excluded the 170-hour shutdown period and extended the Reporting Period by the same amount, i.e., 170 hours from June 9, 0:00 to June 16, 1:59, 2022.

## Performance of the Measures

The Electricity Savings of the Project is calculated based on the Reporting Period Energy, as follows:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The electrical generation of the CHP System for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comments
Gross Electrical energy	821	MWh	
Auxiliary Loads Energy	29	MWh	3.5% of the Gross Electrical Energy.
Reporting Period Energy	792	MWh	<i>Gross Electrical Energy - Auxiliary Loads Energy</i>
Uncertainty of the Reporting Period Energy	± 2.5%		The Uncertainty is the accuracy of the electrical meter.
Average Generation	90	kW	<i>Reporting Period Energy ÷ Reporting Period Duration</i>
Summer Peak Demand Generation	101	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm - 7:00 pm.

The auxiliary loads consist of internal and external auxiliary loads. The internal auxiliary loads, which consist of two onboard pumps and controls, are not metered. They are estimated by [REDACTED], the supplier of the CHP system, to be 1.5 kW. The Technical Reviewer accepted this value and applied 1.5 kW per CHP operating hour to calculate the internal auxiliary load energy.

The external auxiliary loads consist of hot water circulation pumps and dump radiators. The external loads were part of the metered Reporting Period data. However, it appears that the hourly values provided for the external auxiliary loads were determined by [REDACTED], the Participant's consultant, based on power ratings from equipment specifications and operating status. Both the internal and external auxiliary load values appear to be reasonable based on the CHP system installed.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comments
Baseline Energy	0	MWh	
Reporting Period Energy	792	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	792	MWh	
Uncertainty of the Electricity Savings	± 2.5%		The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	971	MWh	Obtained from the M&V Plan, Rev.0, dated February 5, 2019.
Electricity Savings as a Percentage of Anticipated Electricity Savings	82%		
Average Demand Savings	90	kW	Electricity Savings ÷ Reporting Period Duration
Summer Peak Demand Savings	101	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm - 7:00 pm

The Electricity Savings of the 1<sup>st</sup> Annual Reporting Period are 792 MWh and represent 82% of the Anticipated Electricity Savings.

The under-performance resulted from lower than anticipated annual operating hours and average net electrical output of the CHP System. The CHP System was anticipated to operate with an average operating net electrical output of 113 kW whereas the Reporting Period average operating electrical output was 95 kW (i.e., 16% less). Additionally, the operating hours of the CHP System during the Reporting Period (8,368 hours) were 3% lower than anticipated (8,592 hours). It should be noted that the Project was originally planned for a total nominal capacity of 250 kW CHP System, consisting of two 125 kW internal combustion engines (ICEs), one of which was planned to serve as standby unit. In the completed Project, only one 125 kW ICE unit was installed.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{CHP System Gross Electrical Energy} + \text{CHP System Thermal Output Used}] / \text{CHP System Energy Input (HHV)}$$

Table 5 outlines the TSE calculation of the CHP System.

**Table 5. Total System Efficiency**

Description	Value	Unit	Comments
CHP System Gross Electrical Energy	821	MWh	From Table 3.
CHP System Thermal Output Used	1,094	MWh	
CHP System Natural Gas Consumption	245,432	m <sup>3</sup>	
Natural Gas HHV	10.75	kWh/m <sup>3</sup>	From the M&V Plan.
CHP System Energy Input (HHV)	2,638	MWh	
Total System Efficiency	73%		

The CHP system achieved a Total System Efficiency of 73%, which meets the Program Rules minimum requirement of 65%.

## Next Reporting Period and Next Steps

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, and review of the Actual Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is \$70,427. The Master Payment Requisition will be issued upon receipt of the Participant's invoice to the LDC for this balance payment amount.

The Project Incentive Amount of \$158,499 was calculated in accordance with the Program Rules and is limited by the “\$200/MWh of Electricity Savings”, up to a maximum of 120% of Approved Incentive Amount.

Table 6 outlines the Incentive payment calculation using the latest available information.

**Table 6. Incentive Calculation**

Description	Value	Comments
Electricity Savings (MWh)	792	Annual Electricity Savings, from Table 4.
Approved Incentive Amount (\$)	194,200	From the Project Letter of Approval.
Limiter 1 - Electricity Savings (\$)	158,499	\$200 per MWh of Electricity Savings, limited to 120% of the Approved Incentive Amount.
Actual Eligible Costs (\$)	669,988	Reviewed invoices provided by the Participant.
Estimated Eligible Costs (\$)	971,398	From the Project Letter of Approval.
Limiter 2 - Eligible Costs (\$)	267,995	40% of minimum Actual and Estimated Eligible Costs.
Project Net Benefits (\$)	9,954	<i>Electricity Billed Savings + Other Benefits (from Letter of Approval) – Other Costs (from Letter of Approval)</i>
Limiter 3 – 1-year Payback (\$)	660,035	<i>Actual Eligible Costs - Project Net Benefits</i>
<b>Project Incentive (\$)</b>	158,499	Minimum of the three limiters.
<b>Incentives paid to date (\$)</b>	88,072	Paid for the 1 <sup>st</sup> Quarterly Reporting Period.
<b>Incentive payable (Balance Payment) (\$)</b>	70,427	<i>Project Incentive – Incentives paid to date</i>

Table 7 shows the payment schedule as defined in the Project Letter of Approval and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment</b>	After issuance of the final (Y1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period

[Redacted]

[Redacted]

## Cogeneration System

**Project ID:** Toronto-PROJECT-601937  
August 10, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited

[Redacted]

**Prepared by:**  
CLEARresult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

Prepared per Program Rules version "saveONenergy Process & Systems Upgrades Program, FINAL v2.0 April 6, 2018"



## Approvals

	Written by Technical Reviewer	Reviewed by Technical Reviewer
Name:	[REDACTED]	[REDACTED]
Date:	August 10, 2022	August 10, 2022
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
August 10, 2022	First M&V Report issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of June 3, 2021, to June 7, 2022, are 997 MWh, which represents 102% of the Anticipated Electricity Savings. The Total System Efficiency achieved for the 1<sup>st</sup> Annual Reporting Period is 69.1%, which meets the Program Rules minimum requirement of 65%.

Note that the original 1<sup>st</sup> Annual Reporting Period was scheduled to end on June 2, 2022. However, the Reporting Period had to be extended to June 7, 2022, as the combined heat and power (CHP) system was unexpectedly shutdown on September 3, 2021. The shutdown, which lasted 101 hours, was the result of a glycol pump failure, resulting in a glycol leak within the unit. The replacement was not successfully completed until September 7, 2021.

The Incentive payable to the Participant for this Reporting Period is \$100,713. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Jun 3 to Sep 2, 2021	249	101%	\$30,100
1 <sup>st</sup> Annual	Jun 3, 2021 to Jun 7, 2022	997	102%	\$120,627

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$121/MWh obtained from the Project Approval Letter.

## In-Service Date Confirmation

The In-Service Date was set to June 3, 2021, on August 16, 2021, by the Technical Reviewer.

## Metered Data Analysis

[REDACTED], the LDC representative, provided the M&V data on July 20, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Jun 3, 2021, 00:00		Start date of the Reporting Period.
Reporting Period End	Jun 7, 2022, 4:59		End date of the Reporting Period.
Reporting Period Duration	8,861	hours	End date minus start date.
Available Data	8,861	hours	
Missing Data	0	hours	0% of the Reporting Period Duration.
Unexpected Shutdown	101	hours	
Hours of Operation	8,361	hours	95% of the Reporting Period Duration excluding the 101 hours unexpected shutdown period.

## Performance of the Measure

The electrical performance of the project is based on the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The electrical generation of the CHP System for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,027	MWh	
CHP Auxiliary Loads Energy	30	MWh	2.9% of the CHP Gross Electrical Energy. See details below Table 3.
Reporting Period Energy	997	MWh	CHP Gross Electrical Energy – CHP Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter.
Average Generation	114	kW	
Summer Peak Demand Generation	107	kW	Summer peak demand period is defined as Monday to Friday, 1:00 pm -7:00 pm, June 1 to August 31.

The auxiliary loads consist of internal and external auxiliary loads. The internal auxiliary loads, which consist of two onboard pumps and controls, are not metered. They are estimated by the supplier of the CHP system to be 1.5 kW. The Technical Reviewer accepted this value and applied 1.5 kW per CHP operating hour to calculate the internal auxiliary load energy. The external auxiliary loads consist of hot water circulation pumps and dump radiators. The external loads were part of the metered Reporting Period data. However, it appears that the hourly values provided for the external auxiliary loads were determined by [REDACTED], the Participant's consultant, based on power ratings from equipment specifications and operating status. Both the internal and external auxiliary load values appear to be reasonable based on the CHP system installed.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	997	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	997	MWh	
Uncertainty of the Electricity Savings	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	980	MWh	As per the M&V Plan.
Electricity Savings as a Percentage of Anticipated Electricity Savings	102	%	
Average Demand Savings	114	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	107	kW	Summer peak demand period is defined as Monday to Friday, 1:00 pm -7:00 pm, June 1 to August 31.

The 1<sup>st</sup> Annual Reporting Period Electricity Savings are 997 MWh and represent 102% of the Anticipated Electricity Savings. The overperformance is the result of the Reporting Period average operating electrical output being 119 kW, which is higher than the anticipated average operating electrical output of 112 kW.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{CHP Gross Energy (MWh)} + \text{CHP Utilized Thermal Output (MWh)}] / \text{CHP Fuel Energy Input (MWh)}$$

**Table 5. Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,027	MWh	Obtained from Table 3.
CHP Utilized Thermal Output	1,481	MWh	
Natural Gas Higher Heating Value (HHV)	10.75	kWh/m <sup>3</sup>	As per the M&V Plan.
CHP Fuel Energy Input (HHV)	3,629	MWh	Calculated using the volumetric natural gas consumption from the specifications and natural gas HHV value.
Total System Efficiency	69.1	%	

The CHP system achieved a TSE of 69.1%, which meets the Program Rules minimum requirement of 65%. The Technical Reviewer noted that the natural gas readings were relatively low compared to the specs and that the CHP utilized thermal output had readings greater than the available heat, as per the specs.

Therefore, the CHP utilized thermal output was limited to the specifications and the natural gas consumption was determined based on the specifications in order to quantify TSE.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, and verified Eligible Costs, the Incentive payable to the Participant is \$100,713. The Master Payment Requisition will be issued once the Participant's invoice for the Incentive amount is provided.

Table 6 outlines the Incentive payment calculation using the latest available information.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	997	1 <sup>st</sup> Annual Reporting Period Electricity Savings.
Approved Amount	\$196,000	From the Project Approval Letter.
Limiter 1 - Electricity Savings	\$199,383	\$200 per MWh of Electricity Savings, capped at 120% of Approved Amount.
Estimated Eligible Project Costs	\$824,463	From the Project Approval Letter.
Actual Eligible Project Costs	\$720,639	Based on the review of invoices for the 1 <sup>st</sup> payment.
Limiter 2 - Project Costs	\$288,256	40% of minimum of Estimated and Actual Eligible Project Costs.
Net Benefits	\$36,937	Equal to the electricity savings, calculated using a billing rate of \$121/MWh, plus the Other Benefits less Other Costs from the Project Approval Letter.
Limiter 3 – 1-year Project Payback	\$683,703	Eligible Costs minus Net Benefits.
Gross Project Incentive	\$199,383	Minimum of the three limiters.
Project Incentives paid	\$98,670	Paid for 1 <sup>st</sup> Quarterly Reporting Period.
Study Incentive paid	N/A	Paid for Engineering Study. <sup>3</sup>
<b>Incentive payable</b>	<b>\$100,713</b>	Gross incentive minus incentives paid.

Table 7 provides the Incentive payment schedule.

<sup>3</sup> No deduction under "saveONenergy Process & Systems Upgrades Program, FINAL v2.0 April 6, 2018."

**Table 7. Incentive Payment Schedule**

<b>Deferred Payment Schedule</b>	<b>Projected Date</b>	<b>% of Approved Amount</b>
<b>Payment 1</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.



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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period

[Redacted]

[Redacted]

[Redacted]

## Cogeneration

## System

**Project ID:** Toronto-PROJECT-601938  
September 16, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited

[Redacted]

**Prepared by:**  
CLEARResult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

Prepared per Program Rules version "saveONenergy Process & Systems Upgrades Program, FINAL v2.0 April 6, 2018"

## Approvals

	Written by Technical Reviewer	Reviewed by Technical Reviewer
Name:	████████████████████	████████████████████
Date:	September 16, 2022	September 16, 2022
Signature:	████████████████████	████████████████████

## Revision History

Date	Description	Revision	Technical Reviewer
September 16, 2022	First M&V Report issuance.	0	████████████████████

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of May 26, 2021, to May 25, 2022, are 921 MWh, which represents 124% of the Anticipated Electricity Savings. The Total System Efficiency (TSE) achieved for the 1<sup>st</sup> Annual Reporting Period is 73.3%, which meets the Program Rules minimum requirement of 65%.

The Incentive payable to the Participant for this Reporting Period is \$104,440. Refer to the Appendix for the Incentive calculation.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	May 26 to August 25, 2021	241	342%	\$29,200
1 <sup>st</sup> Annual	May 26, 2021 to May 25, 2022	921	124%	\$111,500

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date was set to May 26, 2021 on August 4, 2021, by the Technical Reviewer.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$121/MWh obtained from the Project Approval Letter.

# Metered Data Analysis

[REDACTED] the LDC representative, provided the M&V data on September 1, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

## Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	May 26, 2021, 00:00	-	Start date of the Reporting Period.
Reporting Period End	May 25, 2022, 23:59	-	End date of the Reporting Period.
Reporting Period Duration	8,760	hours	End date minus start date.
Available Data	8,760	hours	
Missing Data	0	hours	0% of the Reporting Period Duration.
Hours of Operation	8,188	hours	93.5% of the Reporting Period Duration.

## Performance of the Measure

The electrical performance of the project is based on the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The electrical generation of the CHP System for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	951	MWh	
CHP Auxiliary Loads Energy	30	MWh	3.2% of the CHP Gross Electrical Energy.
Reporting Period Energy	921	MWh	CHP Gross Electrical Energy – CHP Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Average Generation	105	kW	Reporting Period Energy ÷ Reporting Period Duration
Summer Peak Demand Generation	106	kW	Summer peak demand period is defined as Monday to Friday, 1:00 pm - 7:00 pm, June 1 to August 31.

The auxiliary loads consist of internal and external auxiliary loads. The internal auxiliary loads, which consist of two onboard pumps and controls, are not metered. They are estimated by [REDACTED], the supplier of the CHP system, to be 1.5 kW. The Technical Reviewer accepted this value and applied 1.5 kW per CHP operating hour to calculate the internal auxiliary load energy. The external auxiliary loads consist of hot water circulation pumps and dump radiators. The external loads were part of the metered Reporting Period data. However, it appears that the hourly values provided for the external auxiliary loads were determined by [REDACTED], the Participant's consultant, based on power ratings from equipment specifications and operating status. Both the internal and external auxiliary load values appear to be reasonable based on the CHP system installed.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	921	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	921	MWh	
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	746	MWh	As per the M&V Plan.
Electricity Savings as a Percentage of Anticipated Electricity Savings	124%	-	
Average Demand Savings	105	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	106	kW	Equal to Summer Peak Demand Generation from Table 3.

The 1<sup>st</sup> Annual Reporting Period Electricity Savings are 921 MWh and represent 124% of the Anticipated Electricity Savings. The overperformance is due to higher average electrical output from June to September 2022 compared to the Project Review anticipated average electrical output. Based on the original operating criteria, a significant turn-down of the engines was expected in the summer months in order to minimize the amount of CHP heat wasted due to lower heating loads. However, there doesn't appear to any thermal load following during the Reporting Period. Additionally, per the M&V Plan, the original Project scope included installation of three 65 kW microturbine cogeneration units (one backup). In the completed Project, one 125 kW reciprocating engine cogeneration unit was installed. Microturbine systems typically have higher auxiliary load electricity consumption than reciprocating engines due to the presence of a gas compressor. This resulted in a higher net electricity generation.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{CHP Gross Energy (MWh)} + \text{CHP Utilized Thermal Output (MWh)}] / \text{CHP Fuel Energy Input (MWh)}$$

**Table 5. Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	951	MWh	Obtained from Table 3.
CHP Utilized Thermal Output	1,291	MWh	
Natural Gas Higher Heating Value (HHV)	10.79	kWh/m <sup>3</sup>	Obtained from the Enbridge Gas Composition and HHV Data in 2021.
CHP Fuel Energy Input (HHV)	3,059	MWh	
Total System Efficiency	73.3%	-	

The CHP system achieved a TSE of 73.3%, which meets the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.



## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, and verified Eligible Costs, the Incentive payable to the Participant is \$104,440. The Master Payment Requisition will be issued once the Participant's invoice for the Incentive amount is provided.

Table 6 outlines the Incentive payment calculation using the latest available information.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	921	1 <sup>st</sup> Annual Reporting Period Electricity Savings.
Approved Amount	\$149,200	From the Project Approval Letter.
Limiter 1 - Electricity Savings	\$179,040	\$200 per MWh of Electricity Savings, capped at 120% of Approved Amount.
Estimated Eligible Project Costs	\$883,463	From the Project Approval Letter.
Actual Eligible Project Costs	\$770,082	Based on the review of invoices.
Limiter 2 - Project Costs	\$308,033	40% of minimum of Estimated and Actual Eligible Project Costs.
Net Benefits	\$31,280	Equal to the electricity savings, calculated using a billing rate of \$121/MWh, plus the Other Benefits less Other Costs from the Project Approval Letter.
Limiter 3 – 1-year Project Payback	\$738,802	Eligible Costs minus Net Benefits.
Gross Project Incentive	\$179,040	Minimum of the three limiters.
Project Incentives paid	\$74,600	Paid for 1 <sup>st</sup> Quarterly Reporting Period.
<b>Incentive payable</b>	<b>\$104,440</b>	Gross incentive minus incentives paid.

Table 7 provides the Incentive payment schedule.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	% of Approved Amount
<b>Payment 1</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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Capitalized terms used in this document have the meaning given to them either in the Save on Energy Process and Systems Upgrade Program Rules, or the IPMVP Core Concepts dated October 2016 and Uncertainty Assessment for IPMVP, dated April 2018, as applicable.

***IPMVP defined terms:***

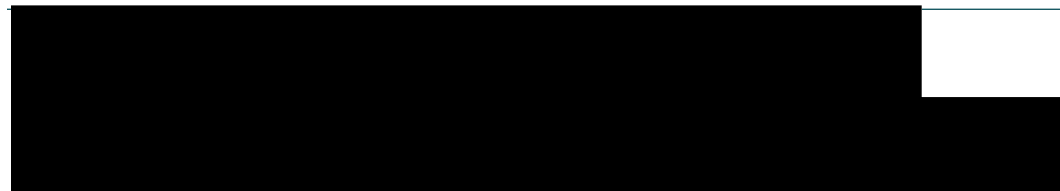
Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period



## Cogeneration System

**Project ID:** Toronto-PROJECT-601939

July 11, 2022

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited  


**Prepared by:**

CLEAResult

393 University Avenue, Suite 1622, Toronto, ON M5G 1E6

(416) 504-3400

Prepared in accordance with Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018

### Approvals

	Written by Technical Reviewer	Reviewed by Senior Engineer
Name:	[REDACTED]	[REDACTED]
Date:	July 6, 2022	July 8, 2022
Signature:	[REDACTED]	[REDACTED]

### Revision History

Date	Description	Revision	Technical Reviewer
July 11, 2022	M&V Report first issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of May 27, 2021, to May 26, 2022, are 1,031 MWh, which represents 106% of the Anticipated Electricity Savings. The Total System Efficiency achieved for the 1<sup>st</sup> Annual Reporting Period is 77%, which meets the Program Rules requirement of 65%.

The Incentive payable to the Participant for this Reporting Period is \$103,330. Refer Appendix for the Incentive calculation.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	May 27 to Aug 26, 2021	259	106%	\$33,929
1 <sup>st</sup> Annual	May 27, 2021, to May 26, 2022	1,031	106%	\$135,022

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of May 27, 2021 was established on August 11, 2021.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan

<sup>2</sup> Based on \$131/MWh obtained from the Project Approval Letter

## Metered Data Analysis

[REDACTED] from Toronto Hydro provided the M&V data on June 7, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	May 27, 2021, 00:00		Start date of the Reporting Period.
Reporting Period End	May 26, 2022, 23:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date
Available Data	8,760	hours	
Missing Data	0	hours	0% of the Reporting Period Duration
Hours of Operation	8,442	hours	96.4% of the Reporting Period Duration

## Performance of the Measure(s)

The electrical performance of the project is based on the reporting period energy, as follows:

$$\boxed{\text{Electricity Savings}} = \boxed{\text{Reporting Period Energy}} \pm \boxed{\text{Non-Routine Adjustments}}$$

### Baseline Energy

This is an electricity generation Project with no prior generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The Reporting Period Energy and the average and peak generation values are presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,047	MWh	Metered total gross electricity generation.
Auxiliary Loads Energy	17	MWh	Metered to auxiliary load. Equal to 1.6% of the Gross Electrical Energy.
<b>Reporting Period Energy</b>	1,031	MWh	Gross Electrical Energy-Auxiliary Loads Energy.
<b>Uncertainty of the Reporting Period Energy</b>	± 2.5%	%	The Uncertainty is mostly due to the accuracy of the meters.
<b>Average Generation</b>	118	kW	Reporting Period Energy divided by Reporting Period Duration
<b>Summer Peak Generation</b>	113	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

## Electricity Savings

The Baseline Energy, Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	Obtained from Table 3.
Reporting Period Energy	1,031	MWh	Obtained from Table 3..
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,031	MWh	
Uncertainty of the Electricity Savings	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter
Anticipated Electricity Savings	968	MWh	Obtained from the Table 4 of the M&V Plan, Rev 0, dated Feb 4, 2019.
Electricity Savings as a Percentage of Anticipated Electricity Savings	106	%	
Average Demand Savings	118	kW	Obtain from Table 3
Summer Peak Demand Savings	113	kW	Obtain from Table 3

The 1<sup>st</sup> Annual Electricity Savings are 1,031 MWh, which represent 106% of the Anticipated Electricity Savings. The overperformance is due to higher than anticipated hours of operation and average operating



electrical output of the cogeneration system. The cogeneration system was anticipated to operate 8,148 hours with an average operating output of 119 kW, but the actual operating hours and average output were 8,442 hours and 122 kW, respectively.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{CHP Gross Electrical Energy (MWh)} + \text{Utilized Thermal Output (MWh)}] / \text{CHP Fuel Energy Input (MWh)}$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,047	MWh	Obtained from Table 3
CHP Utilized Thermal Output	1,601	MWh	
CHP Fuel Energy Input	3,464	MWh	Calculated using the metered volumetric flowrate of natural gas and Natural Gas Higher Heating Value (HHV) of 10.75 kWh/m <sup>3</sup> , obtained from the M&V Plan
<b>Total System Efficiency</b>	76.5	%	

The CHP system achieved a Total System Efficiency of 76.5%, which meets the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, the Incentive payable to the Participant is \$103,330.

Table 6 outlines the Incentive payment calculation using the latest available information.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	1,031	1 <sup>st</sup> Annual Reporting Period Electricity Savings.
<b>Estimated Eligible Costs</b>	\$1,299,299	As per the Project Approval Letter
Actual Eligible Costs	\$1,053,409	Based on Review of Eligible Costs as part of the Q1 Payment Recommendation
Electricity Billed Savings	\$135,022	Based on the Project Approval Letter Electricity Billing Rate of \$131/MWh
Other Benefits	\$50,893	From the Project Approval Letter
Other Costs	\$134,316	From the Project Approval Letter
Net Project Benefits	\$51,599	Electricity Billed Savings +Other Benefits – Other Costs
<b>Approved Incentive Amount</b>	<b>\$193,600</b>	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$206,141	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Eligible Costs	\$421,364	40% of the minimum of Actual and Estimated Eligible costs.
Limited 3 – Project Payback	\$1,001,800	Eligible costs minus Net Project Benefits
Gross Project Incentive	\$206,141	Minimum of the three limiters.
Project Incentives paid to Date	\$102,811	Paid for 1 <sup>st</sup> Quarterly Reporting Period.
<b>Incentive payable</b>	<b>\$103,330</b>	Gross incentive minus incentives paid.

Table 7 provides the Incentive payment schedule

**Table 7. Incentive Calculation**

<b>Deferred Payment Schedule</b>	<b>Projected Date</b>	<b>% of Approved Amount</b>
<b>Payment 1</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.



Toronto Hydro-Electric System Limited  
14 Carlton Street  
Toronto, Ontario M5B 1K5



## **Third Party Evaluation Reports**

This document includes the following third party evaluation reports:

### **Process and Systems Upgrades Program:**

- #601940
- #601941
- #601947
- #601948
- #601953
- #601955
- #601962



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CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period



## Cogeneration System

**Project ID:** Toronto-PROJECT-601940  
October 25, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited



**Prepared by:**  
CLEAResult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

**Prepared in accordance with:**  
Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018

## Approvals

	Written by Technical Reviewer	Reviewed by:
Name:	████████████████████	████████████████████
Date:	October 25, 2022	October 25, 2022
Signature:	████████████████████	████████████████████

## Revision History

Date	Description	Revision	Technical Reviewer
October 25, 2022	First M&V Report issuance.	0	████████████████████ ██████████



## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of June 22, 2021 to June 21, 2022, are 915 MWh, which represents 111% of the Anticipated Electricity Savings.

The Incentive payable (balance payment) to the Participant for this Reporting Period is \$85,594. Refer to the Appendix for Incentive calculation details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	June 22 to September 21, 2021	246	190%	\$33,000
1 <sup>st</sup> Annual	June 22, 2021 to June 21, 2022	915	111%	\$122,700

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan Rev.0 dated March 27, 2019, which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of the Project is June 22, 2021, which was established on August 11, 2021.

## Metered Data Analysis

[REDACTED], from Toronto Hydro, provided the M&V data on July 20, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements and includes the following:

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$134/MWh obtained from the Project Letter of Approval.

- Hourly gross electrical output of the CHP System (kW)
- Hourly recovered heat from the CHP System (kWh)
- Hourly natural gas consumption by the CHP System (m<sup>3</sup>)
- Hourly external auxiliary loads (kW)

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	June 22, 2021, 0:00		
Reporting Period End	June 21, 2022 23:59		
Reporting Period Duration	8,760	hours	
Available Data	8,760	hours	
Missing Data	0	hours	
Hours of Operation	8,470	hours	97% of the Reporting Period Duration.

## Performance of the Measure

The Electricity Savings of the Project is calculated based on the Reporting Period Energy, as follows:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The electrical generation of the CHP System for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comments
Gross Electrical energy	943	MWh	
Auxiliary Loads Energy	27	MWh	2.9% of the Gross Electrical Energy.
Reporting Period Energy	915	MWh	<i>Gross Electrical Energy - Auxiliary Loads Energy</i>
Uncertainty of the Reporting Period Energy	± 2.5%		The Uncertainty is the accuracy of the electrical meter.
Average Generation	105	kW	<i>Reporting Period Energy ÷ Reporting Period Duration</i>
Summer Peak Demand Generation	109	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm - 7:00 pm.

The auxiliary loads consist of internal and external auxiliary loads. The internal auxiliary loads, which consist of two onboard pumps and controls, are not metered. They are estimated by ██████████, the supplier of the CHP system, to be 1.5 kW. The Technical Reviewer accepted this value and applied 1.5 kW per CHP operating hour to calculate the internal auxiliary load energy.

The external auxiliary loads consist of hot water circulation pumps and dump radiators. The external loads were part of the metered Reporting Period data. However, it appears that the hourly values provided for the external auxiliary loads were determined by ██████████, the Participant's consultant, based on power ratings from equipment specifications and operating status. Both the internal and external auxiliary load values appear to be reasonable based on the CHP system installed.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comments
Baseline Energy	0	MWh	
Reporting Period Energy	915	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	915	MWh	
Uncertainty of the Electricity Savings	± 2.5%		The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	823	MWh	Obtained from the M&V Plan, Rev.0, dated March 27, 2019.
Electricity Savings as a Percentage of Anticipated Electricity Savings	111%		
Average Demand Savings	105	kW	<i>Electricity Savings ÷ Reporting Period Duration</i>
Summer Peak Demand Savings	109	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm - 7:00 pm.

The Electricity Savings of the 1<sup>st</sup> Annual Reporting Period are 915 MWh and represent 111% of the Anticipated Electricity Savings.

The over-performance resulted from higher than anticipated average net electrical output of the CHP System. The CHP System was anticipated to operate with an average operating net electrical output of 94 kW whereas the Reporting Period average operating electrical output was 108 kW (i.e., 15% more). The operating hours of the CHP System during the Reporting Period (8,470 hours) were 3% lower than anticipated (8,760 hours). It should be noted that the Project was originally planned for a total nominal capacity of 195 kW CHP system, consisting of three 65 kW micro-turbines, with one unit as an emergency backup. In the completed Project, one 125 kW internal combustion engine (ICE) was installed.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{CHP System Gross Electrical Energy} + \text{CHP System Thermal Output Used}] / \text{CHP System Energy Input (HHV)}$$

Table 5 outlines the TSE calculation of the CHP System.

**Table 5. Total System Efficiency**

Description	Value	Unit	Comments
CHP System Gross Electrical Energy	943	MWh	From Table 3.
CHP System Thermal Output Used	1,248	MWh	
CHP System Natural Gas Consumption	287,190	m <sup>3</sup>	
Natural Gas HHV	10.75	kWh/m <sup>3</sup>	From the M&V Plan.
CHP System Energy Input (HHV)	3,087	MWh	
Total System Efficiency	71%		

The CHP system achieved a Total System Efficiency of 71%, which meets the Program Rules minimum requirement of 65%.

## Next Reporting Period and Next Steps

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, and review of the Actual Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is \$85,594. The Master Payment Requisition will be issued upon receipt of the Participant's invoice to the LDC for this balance payment amount.

The Project Incentive Amount of \$183,091 was calculated in accordance with the Program Rules and is limited by the "\$200/MWh of Electricity Savings", up to a maximum of 120% of Approved Incentive Amount.

Table 6 outlines the Incentive payment calculation using the latest available information.

**Table 6. Incentive Calculation**

Description	Value	Comments
Electricity Savings (MWh)	915	Annual Electricity Savings, from Table 4.
Approved Incentive Amount (\$)	164,600	From the Project Letter of Approval.
Limiter 1 - Electricity Savings (\$)	183,091	\$200 per MWh of Electricity Savings, limited to 120% of the Approved Incentive Amount.
Actual Eligible Costs (\$)	643,354	Reviewed invoices provided by the Participant.
Estimated Eligible Costs (\$)	861,931	From the Project Letter of Approval.
Limiter 2 - Eligible Costs (\$)	257,342	40% of minimum Actual and Estimated Eligible Costs.
Project Net Benefits (\$)	41,166	<i>Electricity Billed Savings + Other Benefits (from Letter of Approval) – Other Costs (from Letter of Approval)</i>
Limiter 3 – 1-year Payback (\$)	602,188	<i>Actual Eligible Costs - Project Net Benefits</i>
<b>Project Incentive (\$)</b>	183,091	Minimum of the three limiters.
<b>Incentives paid to date (\$)</b>	97,497	Paid for the 1 <sup>st</sup> Quarterly Reporting Period.
<b>Incentive payable (Balance Payment) (\$)</b>	85,594	<i>Project Incentive – Incentives paid to date</i>

Table 7 shows the payment schedule as defined in the Project Letter of Approval and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment</b>	After issuance of the final (Y1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.

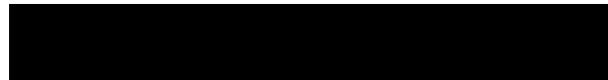
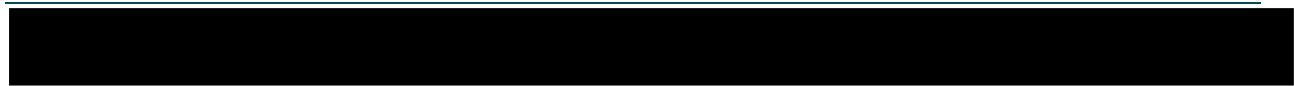






CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period



## Cogeneration

## System

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**Project ID:** Toronto-PROJECT-601941  
August 17, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited



**Prepared by:**  
CLEARresult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

Prepared per Program Rules version "saveONenergy Process & Systems Upgrades Program, FINAL v2.0 April 6, 2018"

## Approvals

	Written by:	Reviewed by:
Name:	██████████	██████████
Date:	August 17, 2022	August 16, 2022
Signature:	██████████	██████████

## Revision History

Date	Description	Revision	Technical Reviewer
August 17, 2022	First M&V Report issuance.	0	██████████

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of June 25, 2021, to June 24, 2022, are 1,884 MWh, which represents 94% of the Anticipated Electricity Savings.

The Incentive payable to the Participant for this Reporting Period is \$174,084. Refer to the Appendix for the Incentive calculation.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Jun 25 to Sep 24, 2021	511	101%	\$61,800
1 <sup>st</sup> Annual	Jun 25, 2021, to June 24, 2022	1,884	94%	\$228,009

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date was set to June 25, 2021, on August 16, 2021, by the Technical Reviewer.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$121/MWh obtained from the Project Approval Letter.

## Metered Data Analysis

[REDACTED] from Toronto Hydro-Electric System Limited, provided the M&V data on July 20, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	June 25, 2021, 00:00		Start date of the Reporting Period
Reporting Period End	June 24, 2022, 23:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date
Available Data	8,760	hours	
Missing Data	0	hours	0% of the Reporting Period Duration
Hours of Operation	8,542	hours	97.5% of the Reporting Period Duration

## Performance of the Measure

The electrical performance of the project is based on the reporting period energy, as follows:

$$\boxed{\text{Electricity Savings}} = \boxed{\text{Reporting Period Energy}} \pm \boxed{\text{Non-Routine Adjustments}}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The electrical generation of the cogeneration system for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,942	MWh	
Auxiliary Loads Energy	58	MWh	3% of the CHP Gross Electrical Output. See comment below table.
Reporting Period Energy	1,884	MWh	Gross Electrical Energy – Reporting Period Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Average Generation	215	kW	Reporting Period Energy ÷ Reporting Period Duration
Summer Peak Demand Generation	228	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

The auxiliary loads consist of internal and external auxiliary loads. The internal auxiliary loads, which consist of two onboard pumps and controls, are not metered. They are estimated by [REDACTED], the supplier of the CHP system, to be 1.5 kW. The Technical Reviewer accepted this value and applied 1.5 kW per CHP operating hour to calculate the internal auxiliary load energy. The external auxiliary loads consist of hot water circulation pumps and dump radiators. The external loads were part of the metered Reporting Period data. However, it appears that the hourly values provided for the external auxiliary loads were determined by [REDACTED], the Participant's consultant, based on power ratings from equipment specifications and operating status. Both the internal and external auxiliary load values appear to be reasonable based on the CHP system installed.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	1,884	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,884	MWh	
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Annual Electricity Savings	2,002	MWh/Year	Obtained from the M&V Plan, Rev 0, dated February 11, 2019.
Electricity Savings as a Percentage of Anticipated Electricity Savings	94%	-	
Average Demand Savings	215	kW	Obtained from Table 3.
Summer Peak Demand Savings	228	kW	Obtained from Table 3.

The 1<sup>st</sup> Annual Electricity Savings are 1,884 MWh and represent 94% of the Anticipated Electricity Savings. The underperformance is due to less than anticipated operating hours of the cogeneration system and the average hourly generated electricity. The cogeneration system was anticipated to operate with an uptime of 98%, whereas the uptime in the Reporting Period was only 97.5%. The cogeneration system was anticipated to have an average net operating electrical output of 234 kW in comparison to the average net operating electrical output of 221 kW in the 1<sup>st</sup> Annual Reporting Period.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{CHP Gross Electrical Energy (MWh)} + \text{Utilized Thermal Output (MWh)}] / \text{CHP Fuel Energy Input (MWh)}$$

**Table 5. Total System Efficiency**

Description	Value	Unit	Comment
Gross Electrical Energy	1,942	MWh	
Utilized Thermal Output	2,593	MWh	
Natural Gas Higher Heating Value (HHV)	10.84	kWh/m <sup>3</sup>	From the latest published HHV data for natural gas by Enbridge.
Fuel Energy Input (HHV)	6,479	MWh	Calculate using the metered volumetric natural gas consumption and the natural gas HHV.
Total System Efficiency	70.0%	-	

The CHP system achieved a Total System Efficiency of 70.0%, which meets the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required.

## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual M&V Report, the Incentive payable to the Participant is \$174,084. The Master Payment Requisition will be issued once the Participant's invoice for the Incentive amount is provided.

The Incentive is based on the \$200/MWh of the Electricity Savings limiter. Table 6 outlines the Incentive payment calculation.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	1,884	1 <sup>st</sup> Annual Reporting Period Electricity Savings.
<b>Approved Amount</b>	\$400,400	From the Project Approval Letter
Estimated Eligible Project Costs	\$1,380,344	From the Project Approval Letter.
Actual Eligible Project Costs	\$1,550,032.67	Based on review of invoices for the 1 <sup>st</sup> Payment Recommendation
Electricity Billed Savings	\$228,009	Based on electricity billing rate of \$121/MWh from the Project Approval Letter
Other Benefits	\$106,292	From the Project Approval Letter
Other Costs	\$246,299	From the Project Approval Letter
Net Benefits	\$88,002	Electricity Billed Savings + Other Benefits – Other Costs
Limiter 1 - Electricity Savings	\$376,875	\$200 per MWh of Electricity Savings, capped at 120% of the Approved Amount.
Limiter 2 - Project Costs	\$552,138	40% of minimum of Estimated Eligible Project Costs and Actual Eligible Project Costs.
Limiter 3 - Project Payback	\$1,292,342	Eligible Project Costs minus Net Benefits.
Project Incentive	\$376,875	Minimum of the three limiters.
Incentive Paid for the 1 <sup>st</sup> Quarterly Reporting Period	<b>\$202,791</b>	
<b>Balance Incentive payable</b>	<b>\$174,084</b>	As per Table 7.

Table 7 provides the Incentive payment schedule.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	% of Approved Amount
<b>Payment 1</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.



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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period

[Redacted]

[Redacted]

## Cogeneration System

**Project ID:** Toronto-PROJECT-601947  
November 16, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited  
[Redacted]

**Prepared by:**  
CLEARresult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

**Prepared in accordance with:**  
Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018

## Approvals

	Written by Technical Reviewer	Reviewed by:
Name:	[REDACTED]	[REDACTED]
Date:	November 16, 2022	November 16, 2022
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
November 16, 2022	First M&V Report issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of June 19, 2021 to June 18, 2022, are 965 MWh, which represents 99.7% of the Anticipated Electricity Savings.

The Incentive payable (balance payment) to the Participant for this Reporting Period is \$96,337. Refer to the Appendix for Incentive calculation details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	June 19 to September 18, 2021	244	100.1%	\$32,000
1 <sup>st</sup> Annual	June 19, 2021, to June 18, 2022	965	99.7%	\$126,500

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan Rev.0 dated February 19, 2019, which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of the Project is June 19, 2021, which was established on August 16, 2021.

## Metered Data Analysis

[REDACTED], from Toronto Hydro, provided the M&V data on July 20, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements and includes the following:

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$131/MWh obtained from the Project Letter of Approval.

- Hourly gross electrical output of the CHP System (kW)
- Hourly recovered heat from the CHP System (kWh)
- Hourly natural gas consumption of the CHP System (m<sup>3</sup>)
- Hourly external auxiliary loads (kW).

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	June 19, 2021, 0:00		
Reporting Period End	June 18, 2022, 23:59		
Reporting Period Duration	8,760	hours	
Available Data	8,760	hours	
Missing Data	0	hours	
Hours of Operation	8,397	hours	96% of the Reporting Period Duration.

## Performance of the Measure

The Electricity Savings of the Project is calculated based on the Reporting Period Energy, as follows:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The electrical generation of the CHP System for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comments
Gross Electrical Energy	1,005	MWh	
Auxiliary Loads Energy	39	MWh	3.9% of the Gross Electrical Energy.
Reporting Period Energy	965	MWh	<i>Gross Electrical Energy - Auxiliary Loads Energy</i>
Uncertainty of the Reporting Period Energy	± 2.5%		The Uncertainty is the accuracy of the electrical meter.
Average Generation	110	kW	<i>Reporting Period Energy ÷ Reporting Period Duration</i>
Summer Peak Demand Generation	111	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm - 7:00 pm.

The auxiliary loads consist of internal and external auxiliary loads. The internal auxiliary loads, which consist of two onboard pumps and controls, are not metered. They are estimated by [REDACTED], the supplier of the CHP system, to be 1.5 kW. The Technical Reviewer accepted this value and applied 1.5 kW per CHP operating hour to calculate the internal auxiliary load energy.

The external auxiliary loads consist of hot water circulation pumps and dump radiators. The external loads were part of the metered Reporting Period data. However, it appears that the hourly values provided for the external auxiliary loads were determined by [REDACTED], the Participant's consultant, based on power ratings from equipment specifications and operating status. Both the internal and external auxiliary load values appear to be reasonable based on the CHP system installed.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comments
Baseline Energy	0	MWh	
Reporting Period Energy	965	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	965	MWh	
Uncertainty of the Electricity Savings	± 2.5%		The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	968	MWh	Obtained from the M&V Plan, Rev.0, dated February 19, 2019.
Electricity Savings as a Percentage of Anticipated Electricity Savings	99.7%		
Average Demand Savings	110	kW	<i>Electricity Savings ÷ Reporting Period Duration</i>
Summer Peak Demand Savings	111	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm - 7:00 pm.

The Electricity Savings of the 1<sup>st</sup> Annual Reporting Period are 965 MWh and represent 99.7% of the Anticipated Electricity Savings. The CHP system performed as anticipated.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{CHP System Gross Electrical Energy} + \text{CHP System Thermal Output Used}] / \text{CHP System Energy Input (HHV)}$$

Table 5 outlines the TSE calculation of the CHP System.

**Table 5. Total System Efficiency**

Description	Value	Unit	Comments
CHP System Gross Electrical Energy	1,005	MWh	From Table 3.
CHP System Thermal Output Used	1,354	MWh	
CHP System Natural Gas Consumption	313,727	m <sup>3</sup>	
Natural Gas HHV	10.75	kWh/m <sup>3</sup>	From the M&V Plan.
CHP System Energy Input (HHV)	3,373	MWh	
Total System Efficiency	70%		

The CHP system achieved a Total System Efficiency of 70%, which meets the Program Rules minimum requirement of 65%.



## Next Reporting Period and Next Steps

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, and review of the Actual Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is \$96,337. The Master Payment Requisition will be issued upon receipt of the Participant's invoice to the LDC for this balance payment amount.

The Project Incentive Amount of \$193,086 was calculated in accordance with the Program Rules and is limited by the "\$200/MWh of Electricity Savings", up to a maximum of 120% of Approved Incentive Amount.

Table 6 outlines the Incentive payment calculation using the latest available information.

**Table 6. Incentive Calculation**

Description	Value	Comments
Electricity Savings (MWh)	965	Annual Electricity Savings, from Table 4.
Approved Incentive Amount (\$)	193,600	From the Project Letter of Approval.
Limiter 1 - Electricity Savings (\$)	193,086	\$200 per MWh of Electricity Savings, limited to 120% of the Approved Incentive Amount.
Actual Eligible Costs (\$)	873,395	Reviewed invoices provided by the Participant.
Estimated Eligible Costs (\$)	1,401,299	From the Project Letter of Approval.
Limiter 2 - Eligible Costs (\$)	349,358	40% of minimum Actual and Estimated Eligible Costs.
Project Net Benefits (\$)	47,412	<i>Electricity Billed Savings + Other Benefits (from Letter of Approval) – Other Costs (from Letter of Approval)</i>
Limiter 3 – 1-year Payback (\$)	825,983	<i>Actual Eligible Costs - Project Net Benefits</i>
<b>Project Incentive (\$)</b>	193,086	Minimum of the three limiters.
<b>Incentives paid to date (\$)</b>	96,749	Paid for the 1 <sup>st</sup> Quarterly Reporting Period.
<b>Incentive payable (Balance Payment) (\$)</b>	96,337	<i>Project Incentive – Incentives paid to date</i>

Table 7 shows the payment schedule as defined in the Project Letter of Approval and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment</b>	After issuance of the final (Y1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period

[Redacted]

[Redacted]

[Redacted]

## Cogeneration

## System

**Project ID:** Toronto-PROJECT-601948  
September 13, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited  
[Redacted]

**Prepared by:**  
CLEARResult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

Prepared per Program Rules version "saveONenergy Process & Systems Upgrades Program, FINAL v2.0 April 6, 2018"



## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of July 7, 2021, to July 16, 2022, are 924 MWh, which represents 97% of the Anticipated Electricity Savings. The Total System Efficiency achieved for the 1<sup>st</sup> Annual Reporting Period is 65.1%, which meets the Program Rules minimum requirement of 65%.

Note that the original 1<sup>st</sup> Annual Reporting Period was scheduled to end on July 6, 2022. However, the Reporting Period had to be extended to July 16, 2022, as the combined heat and power (CHP) system was unexpectedly shutdown on November 29, 2021. The shutdown, which lasted 220 hours, was the result of a glycol leak in the exhaust heat exchanger. The replacement was not successfully completed until December 8, 2021.

The Incentive payable to the Participant for this Reporting Period is \$80,736. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Jul 7 to Oct 6, 2021	262	109%	\$34,900
1 <sup>st</sup> Annual	Jul 7, 2021 to Jul 6, 2022	924	97%	\$122,900

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$133/MWh obtained from the Project Approval Letter.

## In-Service Date Confirmation

The In-Service Date was set to July 7, 2021, on August 17, 2021, by the Technical Reviewer.

## Metered Data Analysis

[REDACTED], the LDC representative, provided the M&V data on September 1, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Jul 7, 2021, 00:00		Start date of the Reporting Period.
Reporting Period End	Jul 16, 2022, 3:59		End date of the Reporting Period.
Reporting Period Duration	8,980	hours	End date minus start date.
Available Data	8,980	hours	
Missing Data	0	hours	0% of the Reporting Period Duration.
Unexpected Shutdown	220	hours	
Hours of Operation	8,317	hours	95% of the Reporting Period Duration excluding the 220 hours unexpected shutdown period.

## Performance of the Measure

The electrical performance of the project is based on the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.



## Reporting Period Energy

The electrical generation of the CHP System for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	963	MWh	
CHP Auxiliary Loads Energy	39	MWh	4.0% of the CHP Gross Electrical Energy. See details below Table 3.
Reporting Period Energy	924	MWh	CHP Gross Electrical Energy – CHP Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter.
Average Generation	105	kW	Reporting Period Energy ÷ Reporting Period Duration
Summer Peak Demand Generation	114	kW	Summer peak demand period is defined as Monday to Friday, 1:00 pm - 7:00 pm, June 1 to August 31.

The auxiliary loads consist of internal and external auxiliary loads. The internal auxiliary loads, which consist of two onboard pumps and controls, are not metered. They are estimated by the supplier of the CHP system to be 1.5 kW. The Technical Reviewer accepted this value and applied 1.5 kW per CHP operating hour to calculate the internal auxiliary load energy. The external auxiliary loads consist of hot water circulation pumps and dump radiators. The external loads were part of the metered Reporting Period data. However, it appears that the hourly values provided for the external auxiliary loads were determined by the Participant's consultant, based on power ratings from equipment specifications and operating status. Both the internal and external auxiliary load values appear to be reasonable based on the CHP system installed.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	924	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	924	MWh	
Uncertainty of the Electricity Savings	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	956	MWh	As per the M&V Plan.
Electricity Savings as a Percentage of Anticipated Electricity Savings	97	%	
Average Demand Savings	105	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	114	kW	Summer peak demand period is defined as Monday to Friday, 1:00 pm -7:00 pm, June 1 to August 31.

The 1<sup>st</sup> Annual Reporting Period Electricity Savings are 924 MWh and represent 97% of the Anticipated Electricity Savings. The underperformance is the result of the Reporting Period average operating electrical output being 116 kW (based on a 95% uptime), which is lower than the anticipated average operating electrical output of 117 kW (based on a 93% uptime).

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{CHP Gross Energy (MWh)} + \text{CHP Utilized Thermal Output (MWh)}] / \text{CHP Fuel Energy Input (MWh)}$$

**Table 5. Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	963	MWh	Obtained from Table 3.
CHP Utilized Thermal Output	1,214	MWh	
CHP Fuel Energy Input (HHV)	3,341	MWh	Calculated using a regression model, which correlates energy input with gross electrical output, developed using energy input data provided in the engine performance specifications. See comment below table.
Total System Efficiency	65.1	%	

The CHP system achieved a TSE of 65.1%, which meets the Program Rules minimum requirement of 65%. Note that the fuel energy input determined using natural gas readings is significantly lower than the energy input obtained using the regression model, suggesting that the natural gas readings are erroneous and

possibly not corrected to standard conditions. Therefore, the fuel energy input used in the TSE calculation is based on the regression model relative to engine performance specifications.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, and verified Eligible Costs, the Incentive payable to the Participant is \$80,736. The Master Payment Requisition will be issued once the Participant's invoice for the Incentive amount is provided.

Table 6 outlines the Incentive payment calculation using the latest available information.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	924	1 <sup>st</sup> Annual Reporting Period Electricity Savings.
Approved Amount	\$191,200	From the Project Approval Letter.
Limiter 1 - Electricity Savings	\$184,815	\$200 per MWh of Electricity Savings, capped at 120% of Approved Amount.
Estimated Eligible Project Costs	\$1,376,868	From the Project Approval Letter.
Actual Eligible Project Costs	\$737,887	Based on the review of invoices for the 1 <sup>st</sup> payment.
Limiter 2 - Project Costs	\$295,155	40% of minimum of Estimated and Actual Eligible Project Costs.
Net Benefits	\$52,447	Equal to the electricity savings, calculated using a billing rate of \$133/MWh, plus the Other Benefits less Other Costs from the Project Approval Letter.
Limiter 3 – 1-year Project Payback	\$685,439	Eligible Costs minus Net Benefits.
Gross Project Incentive	\$184,815	Minimum of the three limiters.
Project Incentives paid	\$104,079	Paid for 1 <sup>st</sup> Quarterly Reporting Period.
Study Incentive paid	N/A	Paid for Engineering Study. <sup>3</sup>
<b>Incentive payable</b>	<b>\$80,736</b>	Gross incentive minus incentives paid.

Table 7 provides the Incentive payment schedule.

<sup>3</sup> No deduction under "saveONenergy Process & Systems Upgrades Program, FINAL v2.0 April 6, 2018."

**Table 7. Incentive Payment Schedule**

<b>Deferred Payment Schedule</b>	<b>Projected Date</b>	<b>% of Approved Amount</b>
<b>Payment 1</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period



## Cogeneration System

**Project ID:** Toronto-PROJECT-601953  
November 14, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited



**Prepared by:**  
CLEARresult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

**Prepared in accordance with:**  
Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018



## Approvals

	Written by Technical Reviewer	Reviewed by:
Name:	[REDACTED]	[REDACTED]
Date:	November 3, 2022	November 3, 2022
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
November 14, 2022	First M&V Report issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of June 9, 2021 to June 18, 2022, are 1,008 MWh, which represents 99% of the Anticipated Electricity Savings.

The original Reporting Period has been extended by 235 hours (approximately 10 days). The combined heat and power (CHP) System was not operational for 235 hours from November 23 to December 3, 2021, due to an exhaust gas heat exchanger leakage. Refer to Table 2 for details.

The Incentive payable (balance payment) to the Participant for this Reporting Period is \$102,767. Refer to the Appendix for Incentive calculation details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	June 9 to September 8, 2021	249	103%	\$30,100
1 <sup>st</sup> Annual	June 9, 2021, to June 18, 2022	1,008	99%	\$122,000

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan Rev.1 dated February 15, 2019, which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of the Project is June 9, 2021, which was established on August 17, 2021.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$121/MWh obtained from the Project Letter of Approval.

## Metered Data Analysis

[REDACTED], from Toronto Hydro, provided the M&V data on July 20, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements and includes the following:

- Hourly gross electrical output of the CHP System (kW)
- Hourly recovered heat from the CHP System (kWh)
- Hourly natural gas consumption by the CHP System (m<sup>3</sup>)
- Hourly external auxiliary loads (kW)

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	June 9, 2021, 0:00		
Reporting Period End	June 18, 2022, 18:59		Extended by 235 hours. See note below.
Reporting Period Duration	8,760	hours	End date minus start date, excluding the shutdown period from Nov. 23, 23:00 to Dec. 3, 17:59, 2021.
Available Data	8,760	hours	
Missing Data	0	hours	
Hours of Operation	8,409	hours	96% of the Reporting Period Duration.

The CHP System was shutdown from November 23, 23:00 to December 3, 17:59, 2021, to replace the exhaust gas heat exchanger which was leaking glycol.

The shutdown period of 235 hours represents 2.7% of the original Reporting Period. The Technical Reviewer excluded the 235-hour shutdown period and extended the Reporting Period by the same amount, i.e., 235 hours from June 9, 0:00 to June 18, 18:59, 2022.

## Performance of the Measure

The Electricity Savings of the Project is calculated based on the Reporting Period Energy, as follows:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

## Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The electrical generation of the CHP System for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comments
Gross Electrical energy	1,042	MWh	
Auxiliary Loads Energy	34	MWh	3.2% of the Gross Electrical Energy.
Reporting Period Energy	1,008	MWh	<i>Gross Electrical Energy - Auxiliary Loads Energy</i>
Uncertainty of the Reporting Period Energy	± 2.5%		The Uncertainty is the accuracy of the electrical meter.
Average Generation	115	kW	<i>Reporting Period Energy ÷ Reporting Period Duration</i>
Summer Peak Demand Generation	114	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm - 7:00 pm.

The auxiliary loads consist of internal and external auxiliary loads. The internal auxiliary loads, which consist of two onboard pumps and controls, are not metered. They are estimated by [REDACTED], the supplier of the CHP system, to be 1.5 kW. The Technical Reviewer accepted this value and applied 1.5 kW per CHP operating hour to calculate the internal auxiliary load energy.

The external auxiliary loads consist of hot water circulation pumps and dump radiators. The external loads were part of the metered Reporting Period data. However, it appears that the hourly values provided for the external auxiliary loads were determined by [REDACTED] the Participant's consultant, based on power ratings from equipment specifications and operating status. Both the internal and external auxiliary load values appear to be reasonable based on the CHP system installed.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comments
Baseline Energy	0	MWh	
Reporting Period Energy	1,008	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,008	MWh	
Uncertainty of the Electricity Savings	± 2.5%		The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	1,019	MWh	Obtained from the Project Letter of Approval.
Electricity Savings as a Percentage of Anticipated Electricity Savings	99%		
Average Demand Savings	115	kW	<i>Electricity Savings ÷ Reporting Period Duration</i>
Summer Peak Demand Savings	114	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm - 7:00 pm.

The Electricity Savings of the 1<sup>st</sup> Annual Reporting Period are 1,008 MWh and represent 99% of the Anticipated Electricity Savings.

The slight under-performance resulted from lower than anticipated annual operating hours. The operating hours of the CHP System during the Reporting Period (8,409 hours) were 2% lower than anticipated (8,592 hours). However, the CHP System was anticipated to operate with an average operating net electrical output of 118.8 kW whereas the Reporting Period average operating electrical output was 119.9 kW (i.e., 1% more).

The Project was originally planned for a total nominal capacity of 250 kW CHP system, consisting of two 125 kW internal combustion engines (ICEs), with one unit as an emergency backup. In the completed Project, one 125 kW ICE unit was installed.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{CHP System Gross Electrical Energy} + \text{CHP System Thermal Output Used}] / \text{CHP System Energy Input (HHV)}$$

Table 5 outlines the TSE calculation of the CHP System.

**Table 5. Total System Efficiency**

Description	Value	Unit	Comments
CHP System Gross Electrical Energy	1,042	MWh	From Table 3.
CHP System Thermal Output Used	1,434	MWh	
CHP System Natural Gas Consumption	340,206	m <sup>3</sup>	
Natural Gas HHV	10.75	kWh/m <sup>3</sup>	From the M&V Plan.
CHP System Energy Input (HHV)	3,657	MWh	
Total System Efficiency	68%		

The CHP system achieved a Total System Efficiency of 68%, which meets the Program Rules minimum requirement of 65%.

## Next Reporting Period and Next Steps

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, and review of the Actual Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is \$102,767. The Master Payment Requisition will be issued upon receipt of the Participant's invoice to the LDC for this balance payment amount.

The Project Incentive Amount of \$201,648 was calculated in accordance with the Program Rules and is limited by the "\$200/MWh of Electricity Savings", up to a maximum of 120% of Approved Incentive Amount.

Table 6 outlines the Incentive payment calculation using the latest available information.

**Table 6. Incentive Calculation**

Description	Value	Comments
Electricity Savings (MWh)	1,008	Annual Electricity Savings, from Table 4.
Approved Incentive Amount (\$)	203,800	From the Project Letter of Approval.
Limiter 1 - Electricity Savings (\$)	201,648	\$200 per MWh of Electricity Savings, limited to 120% of the Approved Incentive Amount.
Actual Eligible Costs (\$)	724,644	Reviewed invoices provided by the Participant.
Estimated Eligible Costs (\$)	984,769	From the Project Letter of Approval.
Limiter 2 - Eligible Costs (\$)	289,858	40% of minimum Actual and Estimated Eligible Costs.
Project Net Benefits (\$)	43,771	<i>Electricity Billed Savings + Other Benefits (from Letter of Approval) – Other Costs (from Letter of Approval)</i>
Limiter 3 – 1-year Payback (\$)	680,873	<i>Actual Eligible Costs - Project Net Benefits</i>
<b>Project Incentive (\$)</b>	201,648	Minimum of the three limiters.
<b>Incentives paid to date (\$)</b>	98,881	Paid for the 1 <sup>st</sup> Quarterly Reporting Period.
<b>Incentive payable (Balance Payment) (\$)</b>	102,767	<i>Project Incentive – Incentives paid to date</i>

Table 7 shows the payment schedule as defined in the Project Letter of Approval and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment</b>	After issuance of the final (Y1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.



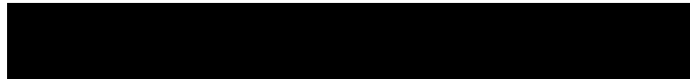




CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES

# Measurement & Verification Report

## 1<sup>st</sup> Annual Reporting Period



## CHP System

**Project ID:** Toronto-PROJECT-601955

April 10, 2023

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited (THES)



**Prepared by:**

Aladaco Consulting Inc.

**Prepared in accordance with:**

Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018

## Approvals

	Written by	Reviewed by
Name:	[REDACTED]	[REDACTED]
Date:	April 10 <sup>th</sup> 2023	April 10 <sup>th</sup> 2023
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
April 10, 2023	M&V Report first issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of May 27, 2021, to June 9, 2022, are 1,011 MWh, which represents 86% of the Anticipated Electricity Savings.

The Incentive payable to the Participant for this Reporting Period is \$96,316, calculated in accordance to Program Rules. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings and Incentive payments to Date**

Reporting Period	Start and End Dates <sup>1</sup>	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>2</sup>	Electricity Cost Savings <sup>3</sup>
1 <sup>st</sup> Quarterly	May 27 to August 30, 2021	265	90%	\$34,980
1 <sup>st</sup> Annual	Jul 1, 2022 to Jun 30, 2023	1,011	86%	\$133,461

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Adjusted Baseline Energy and the Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of May 27, 2021 was established on August 9, 2021.

The 1<sup>st</sup> Quarterly Report was issued on October 20, 2021.

<sup>1</sup> The 1<sup>st</sup> Quarterly Reporting Period was extended by 89 hours (approximately 3.7 days) and the 1<sup>st</sup> Annual Reporting Period was extended by 331 hours (approximately 13.8 days). See Meter Data Analysis for more details.

<sup>2</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>3</sup> Based on \$132/MWh obtained from the Project Application Review.

## Metered Data Analysis

[REDACTED] a representative of THES, provided the M&V data on September 1, 2022 to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	May 27, 2021 00:00		Start date of the Reporting Period.
Reporting Period End	June 9, 2022 18:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date, excluding the 331 shutdown hours outlined below.
Available Data	8,760	hours	
Missing Data	486	hours	5.5% of the Reporting Period Duration. Missing Recovered Heat data only.
Hours of Operation	8,459	hours	96.6% of the Reporting Period Duration

[REDACTED], the CHP equipment provider, provided a summary of unscheduled maintenance that was completed on the CHP system during the 1<sup>st</sup> Annual Reporting Period. All the dates the CHP was not operating normally or the system was shut off for repairs is provided below:

- August 21, 2021, 2:00 to August 24, 2021, 21:00 (89 hours)
- August 31, 2021, 6:00 to September 2, 2021, 17:00 (59 hours)
- February 28, 2022, 20:00 to March 3, 2022, 15:00 (67 hours)
- April 1, 2022, 23:00 to April 4, 2022, 16:00 (65 hours)
- April 16, 2022, 22:00 to April 18, 2022, 20:00 (46 hours)
- April 27, 2022, 13:00 to April 27, 2022, 15:00 (2 hours)
- May 5, 2022, 20:00 to May 5, 2022, 23:00 (3 hours)

The 1<sup>st</sup> Annual Reporting period was extended by 331 hours to account for these shutdown periods.

In addition to the dates noted above, the domestic hot water heat exchanger was bypassed from August 21 to September 16, 2021 while [REDACTED] waited for a replacement heat exchanger to arrive. The 486 hours the heat recovery system was not operational is addressed further in this report, under Total System Efficiency.

## Performance of the Measures

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the Baseline Energy is 0 MWh/year.

### Reporting Period Energy

The Reporting Period Energy is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,047	MWh	CHP System Gross Electrical Output (See comment below table)
Auxiliary Loads Energy	36	MWh	Equal to 3.5% of the Gross Electrical Energy (See comment below table).
Reporting Period Energy	1,011	MWh	Gross Electrical Energy – Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	120	kW	Reporting Period Energy divided by Reporting Period Duration.
Summer Peak Generation	117	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

The auxiliary loads consist of internal and external auxiliary loads. The external auxiliary loads consist of hot water circulation pumps and dump radiators and were provided hourly as part of the metered Reporting Period data. However, the internal auxiliary loads, which consist of two onboard pumps and controls, are not metered. [REDACTED] estimates these to be 1.5 kW.

The Technical Reviewer used the hourly external auxiliary loads provided and an additional 1.5 kW per CHP operating hour to calculate the total auxiliary load energy. The total annual auxiliary energy is 3.5% of the annual Gross electricity energy, which appears to be reasonable based on the CHP system installed.

### Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	1,011	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,011	MWh	
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	1,176	MWh	Obtained from the M&V Plan
Electricity Savings as a Percentage of Anticipated Electricity Savings	86%	-	
Average Demand Savings	120	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	117	kW	Equal to Summer Peak Generation from Table 3.

The 1<sup>st</sup> Annual Electricity Savings are 1,011 MWh and represent 86% of the Anticipated Electricity Savings.

The Project was originally planned for a total nominal capacity of 160 kW, consisting of two 125 kW ICEs, one of which to be permanently derated to 35 kW. In the completed Project, only one 125 kW ICE was installed. The under-performance resulted from lower than anticipated average electrical output of the CHP System. The average gross electrical power generated during the Reporting Period (120 kW) is approximately 17% lower than the anticipated average output in the Application Review (145 kW).

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$TSE (\%) = [Gross\ Electrical\ Energy + CHP\ Thermal\ Output\ Utilized] / CHP\ Energy\ Input$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,047	MWh	See the comment below.
CHP Thermal Output Utilized	1,434	MWh	
CHP Energy Input	3,393	MWh	Calculated using the metered volumetric flowrate of natural gas and Natural Gas Higher Heating Value (HHV) of 10.75 kWh/m <sup>3</sup> , obtained from the M&V Plan.
Total System Efficiency	73.2%	-	

Due to damage to the heat exchanger and the wait for replacement equipment, the Participant was not able to utilize the thermal output of the CHP system for 468 hours. During this period, the average hourly heat

recovered was 1.5 kW; however, the average available heat from the CHP based on the electricity output and the CHP part load specifications was 165 kW. As a result, the system achieved a TSE of 73.2%, which meets the Program Rules minimum requirement of 65%, which is considered to be conservative.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.



## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, the Incentive payable to the Participant is \$96,316.

The Incentive is based on the \$200/MWh of Electricity Savings limiter. Table 6 outlines the Incentive payment calculation.

**Table 6. Incentive Calculation**

Description	Value	Comment
Annual Electricity Savings (MWh)	1,011	From Table 4
<b>Actual Eligible Costs</b>	<b>\$1,025,644</b>	Per the vendor invoices.
Electricity Billed Savings	\$133,452	Based on the Project Approval Letter Electricity Billing Rate of \$132/MWh
Other Benefits	\$55,201	From the Project Approval Letter
Other Costs	\$162,417	From the Project Approval Letter
Net Project Benefits	\$26,236	Electricity Billed Savings +Other Benefits – Other Costs
<b>Approved Incentive Amount</b>	<b>\$235,200</b>	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$202,200	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Eligible Costs	\$410,258	40% of the minimum of Actual and Estimated Eligible costs.
Limited 3 – Project Payback	\$999,408	Eligible costs minus Net Project Benefits
Project Incentive	\$202,200	Minimum of the three limiters.
Project Incentive paid to Date	\$105,884	Paid for 1st Quarterly Reporting Period.
<b>Final Incentive payable</b>	<b>\$96,316</b>	Project Incentive minus Incentive paid to date.

The table below shows the payment schedule as defined in the contract and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.

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DELIVERY  
PARTNER™

CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period



## Cogeneration System

**Project ID:** Toronto-PROJECT-601962  
November 22, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited



**Prepared by:**  
CLEARresult (the Technical Reviewer)  
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**Prepared in accordance with:**  
Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018

## Approvals

	Written by Technical Reviewer	Reviewed by:
Name:	[REDACTED]	[REDACTED]
Date:	November 22, 2022	November 22, 2022
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
November 22, 2022	First M&V Report issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of June 18, 2021 to June 17, 2022, are 1,003 MWh, which represents 101% of the Anticipated Electricity Savings.

The Incentive payable (balance payment) to the Participant for this Reporting Period is \$97,866. Refer to the Appendix for Incentive calculation details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	June 18 to September 17, 2021	259	225%	\$34,700
1 <sup>st</sup> Annual	June 18, 2021, to June 17, 2022	1,003	101%	\$134,400

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan Rev.0 dated April 5, 2019, which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of the Project is June 18, 2021, which was established on August 30, 2021.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$134/MWh obtained from the Project Letter of Approval.

## Metered Data Analysis

[REDACTED], from Toronto Hydro, provided the M&V data on July 20, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements and includes the following:

- Hourly gross electrical output of the CHP System (kW)
- Hourly recovered heat from the CHP System (kWh)
- Hourly natural gas consumption of the CHP System (m<sup>3</sup>)
- Hourly external auxiliary loads (kW)

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	June 18, 2021, 0:00		
Reporting Period End	June 17, 2022, 23:59		
Reporting Period Duration	8,760	hours	
Available Data	8,732	hours	
Missing Data	28	hours	0.3% of the Reporting Period Duration.
Hours of Operation	8,455	hours	97% of the Reporting Period Duration.

The CHP data collection system was not recording the metered data during the period from June 12, 9:00 to June 13, 12:59, 2022. The missing data represents 28 hours or 0.3% of the Reporting Period. The Technical Reviewer assumed that the CHP System was not generating electricity during the missing period, to be conservative.

## Performance of the Measure

The Electricity Savings of the Project is calculated based on the Reporting Period Energy, as follows:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The electrical generation of the CHP System for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comments
Gross Electrical Energy	1,029	MWh	
Auxiliary Loads Energy	27	MWh	2.6% of the Gross Electrical Energy.
Reporting Period Energy	1,003	MWh	<i>Gross Electrical Energy - Auxiliary Loads Energy</i>
Uncertainty of the Reporting Period Energy	± 2.5%		The Uncertainty is the accuracy of the electrical meter.
Average Generation	114	kW	<i>Reporting Period Energy ÷ Reporting Period Duration</i>
Summer Peak Demand Generation	115	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm - 7:00 pm.

The auxiliary loads consist of internal and external auxiliary loads. The internal auxiliary loads, which consist of two onboard pumps and controls, are not metered. They are estimated by [REDACTED], the supplier of the CHP system, to be 1.5 kW. The Technical Reviewer accepted this value and applied 1.5 kW per CHP operating hour to calculate the internal auxiliary load energy.

The external auxiliary loads consist of hot water circulation pumps and dump radiators. The external loads were part of the metered Reporting Period data. However, it appears that the hourly values provided for the external auxiliary loads were determined by [REDACTED], the Participant's consultant, based on power ratings from equipment specifications and operating status. Both the internal and external auxiliary load values appear to be reasonable based on the CHP system installed.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.



**Table 4. Electricity Savings**

Description	Value	Unit	Comments
Baseline Energy	0	MWh	
Reporting Period Energy	1,003	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,003	MWh	
Uncertainty of the Electricity Savings	± 2.5%		The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	995	MWh	Obtained from the M&V Plan, Rev.0, dated April 5, 2019.
Electricity Savings as a Percentage of Anticipated Electricity Savings	101%		
Average Demand Savings	114	kW	<i>Electricity Savings ÷ Reporting Period Duration</i>
Summer Peak Demand Savings	115	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm - 7:00 pm.

The Electricity Savings of the 1<sup>st</sup> Annual Reporting Period are 1,003 MWh and represent 101% of the Anticipated Electricity Savings.

The slight over-performance resulted from higher than anticipated annual operating hours of the CHP System. The operating hours of the CHP System during the Reporting Period (8,455 hours) were approximately 12% greater than anticipated (7,529 hours). However, the CHP System was anticipated to operate with an average operating net electrical output of 132.1 kW whereas the Reporting Period average operating electrical output was 118.6 kW (i.e., 10% less).

It should be noted that the Project was originally planned for a total nominal capacity of 160 kW CHP System, consisting of a single internal combustion engine (ICE). In the completed Project, one 125 kW ICE unit was installed.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{CHP System Gross Electrical Energy} + \text{CHP System Thermal Output Used}] / \text{CHP System Energy Input (HHV)}$$

Table 5 outlines the TSE calculation of the CHP System.

**Table 5. Total System Efficiency**

Description	Value	Unit	Comments
CHP System Gross Electrical Energy	1,029	MWh	From Table 3.
CHP System Thermal Output Used	1,585	MWh	
CHP System Natural Gas Consumption	313,799	m <sup>3</sup>	
Natural Gas HHV	10.75	kWh/m <sup>3</sup>	From the M&V Plan.
CHP System Energy Input (HHV)	3,373	MWh	
Total System Efficiency	77%		

The CHP system achieved a Total System Efficiency of 77%, which meets the Program Rules minimum requirement of 65%.

## Next Reporting Period and Next Steps

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, and review of the Actual Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is \$97,866. The Master Payment Requisition will be issued upon receipt of the Participant's invoice to the LDC for this balance payment amount.

The Project Incentive Amount of \$200,532 was calculated in accordance with the Program Rules and is limited by the "\$200/MWh of Electricity Savings", up to a maximum of 120% of Approved Incentive Amount.

Table 6 outlines the Incentive payment calculation using the latest available information.

**Table 6. Incentive Calculation**

Description	Value	Comments
<b>Electricity Savings (MWh)</b>	1,003	Annual Electricity Savings, from Table 4.
<b>Approved Incentive Amount (\$)</b>	199,000	From the Project Letter of Approval.
<b>Limiter 1 - Electricity Savings (\$)</b>	200,532	\$200 per MWh of Electricity Savings, limited to 120% of the Approved Incentive Amount.
<b>Actual Eligible Costs (\$)</b>	721,725	Reviewed invoices provided by the Participant.
<b>Estimated Eligible Costs (\$)</b>	830,930	From the Project Letter of Approval.
<b>Limiter 2 - Eligible Costs (\$)</b>	288,690	40% of minimum Actual and Estimated Eligible Costs.
<b>Project Net Benefits (\$)</b>	65,349	<i>Electricity Billed Savings + Other Benefits (from Letter of Approval) – Other Costs (from Letter of Approval)</i>
<b>Limiter 3 – 1-year Payback (\$)</b>	656,376	<i>Actual Eligible Costs - Project Net Benefits</i>
<b>Project Incentive (\$)</b>	200,532	Minimum of the three limiters.
<b>Incentives paid to date (\$)</b>	102,666	Paid for the 1 <sup>st</sup> Quarterly Reporting Period.
<b>Incentive payable (Balance Payment) (\$)</b>	97,866	<i>Project Incentive – Incentives paid to date</i>

Table 7 shows the payment schedule as defined in the Project Letter of Approval and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment</b>	After issuance of the final (Y1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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Capitalized terms used in this document have the meaning given to them either in the Save on Energy Process and Systems Upgrade Program Rules, or the IPMVP Core Concepts dated October 2016 and Uncertainty Assessment for IPMVP, dated April 2018, as applicable.

***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.



Toronto Hydro-Electric System Limited

14 Carlton Street

Toronto, Ontario M5B 1K5



## **Third Party Evaluation Reports**

This document includes the following third party evaluation reports:

### **Process and Systems Upgrades Program:**

- #601964
- #601965
- #601978
- #601981
- #602011
- #602015



CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period

## Cogeneration System

**Project ID:** Toronto-PROJECT-601964  
August 30, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited

**Prepared by:**  
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Prepared per Program Rules version "saveONenergy Process & Systems Upgrades Program, FINAL v2.0 April 6, 2018"

## Approvals

	Written by:	Reviewed by:
Name:	[REDACTED]	[REDACTED]
Date:	August 30, 2022	August 30, 2022
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
August 30, 2022	First M&V Report issuance.	0	[REDACTED]



## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of June 3, 2021, to June 24, 2022, are 996 MWh, which represents 98% of the Anticipated Electricity Savings.

Note that the original 1<sup>st</sup> Annual Reporting Period was scheduled to end on June 2, 2021. However, the Reporting Period had to be extended to June 24, 2022, as the cogeneration system unexpectedly shut down from August 20 to 25, 2021, and from November 20 to December 7, 2021. The shutdown in August, which lasted 117 hours, was the result of low oil pressure caused by the failure of pump P1. On November 20, 2021, a leak was detected in the engine exhaust gas heat exchanger, forcing the system to be shut down until December 7, 2021, for 408 hours.

The Incentive payable to the Participant for this Reporting Period is \$102,015. Refer to the Appendix for the Incentive calculation.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Jun 3 to Sep 2, 2021	245	96%	\$33,100
1 <sup>st</sup> Annual	Jun 3, 2021, to June 24, 2022	996	98%	\$134,451

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$135/MWh obtained from the Project Approval Letter.

## In-Service Date Confirmation

The In-Service Date was set to June 3, 2021, on August 30, 2021, by the Technical Reviewer.

## Metered Data Analysis

[REDACTED] from Toronto Hydro-Electric System Limited, provided the M&V data on July 20, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	June 3, 2021, 00:00		Start date of the Reporting Period
Reporting Period End	June 24, 2022, 20:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date, excluding the periods of unexpected shutdown.
Available Data	8,760	hours	
Missing Data	0	hours	0% of the Reporting Period Duration
Hours of Operation	8,338	hours	95.2% of the Reporting Period Duration

On August 20, 2021, the cogeneration system unexpectedly shut down due to low oil pressure as a result of a failure in pump P1. The system was repaired and put into service on August 25, 2021. The Reporting Period was extended by 117 hours in order to exclude the period of the unexpected shutdown.

There was a second unexpected shutdown of the cogeneration system on November 20, 2021, due to insufficient glycol pressure. The investigation revealed that the exhaust gas heat exchanger had developed a leak. The affected equipment was replaced, and the system resumed normal operation on December 7, 2021. The Reporting Period was extended by 408 hours to account for this unexpected outage.

## Performance of the Measure

The electrical performance of the project is based on the reporting period energy, as follows:

$$\boxed{\text{Electricity Savings}} = \boxed{\text{Reporting Period Energy}} \pm \boxed{\text{Non-Routine Adjustments}}$$

## Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The electrical generation of the cogeneration system for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,022	MWh	
Auxiliary Loads Energy	26	MWh	2.5% of the CHP Gross Electrical Output. See the comment below table.
Reporting Period Energy	996	MWh	Gross Electrical Energy – Reporting Period Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Average Generation	114	kW	Reporting Period Energy ÷ Reporting Period Duration
Summer Peak Demand Generation	109	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

The auxiliary loads consist of internal and external auxiliary loads. The internal auxiliary loads, which consist of two onboard pumps and controls, are not metered. They are estimated by [REDACTED], the supplier of the CHP system, to be 1.5 kW. The Technical Reviewer accepted this value and applied 1.5 kW per CHP operating hour to calculate the internal auxiliary load energy. The external auxiliary loads consist of hot water circulation pumps and dump radiators. The external loads were part of the metered Reporting Period data. However, it appears that the hourly values provided for the external auxiliary loads were determined by [REDACTED], the Participant's consultant, based on power ratings from equipment specifications and operating status. Both the internal and external auxiliary load values appear to be reasonable based on the CHP system installed.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	996	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	996	MWh	
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Annual Electricity Savings	1,016	MWh/Year	Obtained from the M&V Plan, Rev 0, dated April 5, 2019.
Electricity Savings as a Percentage of Anticipated Electricity Savings	98%	-	
Average Demand Savings	114	kW	Obtained from Table 3.
Summer Peak Demand Savings	109	kW	Obtained from Table 3.

The 1<sup>st</sup> Annual Electricity Savings are 996 MWh and represent 98% of the Anticipated Electricity Savings. The underperformance is due to less than anticipated operating hours of the cogeneration system. The cogeneration system was anticipated to operate with an uptime of 98%, whereas the uptime in the Reporting Period was only 95%.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{CHP Gross Electrical Energy (MWh)} + \text{Utilized Thermal Output (MWh)}] / \text{CHP Fuel Energy Input (MWh)}$$

**Table 5. Total System Efficiency**

Description	Value	Unit	Comment
Gross Electrical Energy	1,022	MWh	
Utilized Thermal Output	1,560	MWh	
Natural Gas Higher Heating Value (HHV)	10.84	kWh/m <sup>3</sup>	From the latest published HHV data for natural gas by [REDACTED].
Fuel Energy Input (HHV)	3,416	MWh	Calculate using the metered volumetric natural gas consumption and the natural gas HHV.
Total System Efficiency	75.6%	-	

The CHP system achieved a Total System Efficiency of 75.6%, which meets the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required.

## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual M&V Report, the Incentive payable to the Participant is \$102,015. The Master Payment Requisition will be issued once the Participant's invoice for the Incentive amount is provided.

The Incentive is based on the \$200/MWh of the Electricity Savings limiter. Table 6 outlines the Incentive payment calculation.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	996	1 <sup>st</sup> Annual Reporting Period Electricity Savings.
<b>Approved Amount</b>	\$203,200	From the Project Approval Letter
Estimated Eligible Project Costs	\$830,930	From the Project Approval Letter.
Actual Eligible Project Costs	\$984,900.67	Based on review of invoices for the 1 <sup>st</sup> Payment Recommendation
Electricity Billed Savings	\$134,451	Based on the electricity billing rate of \$135/MWh from the Project Approval Letter
Other Benefits	\$53,227	From the Project Approval Letter
Other Costs	\$128,037	From the Project Approval Letter
Net Benefits	\$59,641	Electricity Billed Savings + Other Benefits – Other Costs
Limiter 1 - Electricity Savings	\$199,186	\$200 per MWh of Electricity Savings, capped at 120% of the Approved Amount.
Limiter 2 - Project Costs	\$332,372	40% of the minimum of Estimated Eligible Project Costs and Actual Eligible Project Costs.
Limiter 3 - Project Payback	\$771,289	Eligible Project Costs minus Net Benefits.
Project Incentive	\$199,186	Minimum of the three limiters.
Incentive Paid for the 1 <sup>st</sup> Quarterly Reporting Period	<b>\$97,171</b>	
<b>Balance Incentive payable</b>	<b>\$102,015</b>	As per Table 7.

Table 7 provides the Incentive payment schedule.

**Table 7. Incentive Payment Schedule**

<b>Deferred Payment Schedule</b>	<b>Projected Date</b>	<b>% of Approved Amount</b>
<b>Payment 1</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.







# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period

[Redacted]

[Redacted]

[Redacted]

## Cogeneration

## System

**Project ID:** Toronto-PROJECT-601965  
September 19, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited

[Redacted]

**Prepared by:**  
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Prepared per Program Rules version "saveONenergy Process & Systems Upgrades Program, FINAL v2.0  
April 6, 2018"

## Approvals

	Written by Technical Reviewer	Reviewed by Technical Reviewer
Name:	[REDACTED]	[REDACTED]
Date:	September 19, 2022	September 16, 2022
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
September 19, 2022	First M&V Report issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of June 24, 2021, to July 19, 2022, are 1,009 MWh, which represents 108% of the Anticipated Electricity Savings. The Total System Efficiency (TSE) achieved for the 1<sup>st</sup> Annual Reporting Period is 73.3%, which meets the Program Rules minimum requirement of 65%.

Note that the original 1<sup>st</sup> Annual Reporting Period was scheduled to end on June 23, 2022. However, the Reporting Period had to be extended to July 19, 2022, as the combined heat and power (CHP) system was unexpectedly shutdown as per the details in Table 1.

**Table 1. Unexpected Shutdowns**

Start Date	End Date	Hours	Description
September 1, 2021	September 15, 2021	352	Wiring harness failure and supply issues.
January 15, 2022	January 26, 2022	264	Cylinder head failure and supply issues.

The Incentive payable to the Participant for this Reporting Period is \$101,398. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 2.

**Table 2. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Jun 24 to Oct 8, 2021	253	107%	\$33,800
1 <sup>st</sup> Annual	Jun 24, 2021 to Jul 19, 2022	1,009	108%	\$135,150

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$134/MWh obtained from the Project Approval Letter.

- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date was set to June 24, 2021, on September 1, 2021, by the Technical Reviewer.

## Metered Data Analysis

[REDACTED] the LDC representative, provided the M&V data on September 1, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 3 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 3. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Jun 24, 2021, 0:00		Start date of the Reporting Period.
Reporting Period End	Jul 19, 2022, 15:59		End date of the Reporting Period.
Reporting Period Duration	9,376	hours	End date minus start date.
Available Data	9,376	hours	
Missing Data	0	hours	0% of the Reporting Period Duration.
Unexpected Shutdown	616	hours	
Hours of Operation	8,464	hours	97% of the Reporting Period Duration excluding the 616 hours unexpected shutdown period.

## Performance of the Measure

The electrical performance of the project is based on the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The electrical generation of the CHP System for this Reporting Period is presented in Table 4.

**Table 4. Reporting Period Energy**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,035	MWh	
CHP Auxiliary Loads Energy	27	MWh	2.6% of the CHP Gross Electrical Energy. See details below Table 4.
Reporting Period Energy	1,009	MWh	CHP Gross Electrical Energy – CHP Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter.
Average Generation	115	kW	Reporting Period Energy ÷ Reporting Period Duration
Summer Peak Demand Generation	116	kW	Summer peak demand period is defined as Monday to Friday, 1:00 pm - 7:00 pm, June 1 to August 31.

The auxiliary loads consist of internal and external auxiliary loads. The internal auxiliary loads, which consist of two onboard pumps and controls, are not metered. They are estimated by the supplier of the CHP system to be 1.5 kW. The Technical Reviewer accepted this value for purposes of assessing the internal auxiliary load energy. The external auxiliary loads consist of hot water circulation pumps and dump radiators. The external loads were part of the metered Reporting Period data. However, it appears that the hourly values provided for the external auxiliary loads were determined by the Participant's consultant, based on power ratings from equipment specifications and operating status. Both the internal and external auxiliary load values appear to be reasonable based on the CHP system installed.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 5. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 5. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	1,009	MWh	Obtained from Table 4.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,009	MWh	
Uncertainty of the Electricity Savings	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	937	MWh	As per the M&V Plan.
Electricity Savings as a Percentage of Anticipated Electricity Savings	108	%	
Average Demand Savings	115	kW	Equal to Average Generation from Table 4.
Summer Peak Demand Savings	116	kW	Summer peak demand period is defined as Monday to Friday, 1:00 pm - 7:00 pm, June 1 to August 31.

The 1<sup>st</sup> Annual Reporting Period Electricity Savings are 1,009 MWh and represent 108% of the Anticipated Electricity Savings. The overperformance is the result of the Reporting Period average operating electrical output being 119 kW with 97% uptime, whereas the anticipated average operating electrical output was 146 kW with 73% uptime. Note that the Project was originally planned for one 160 kW internal combustion engine (ICE) cogeneration unit. In the completed Project, one 125 kW ICE was installed.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{CHP Gross Energy (MWh)} + \text{CHP Utilized Thermal Output (MWh)}] / \text{CHP Fuel Energy Input (MWh)}$$

**Table 6. Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,035	MWh	Obtained from Table 4.
CHP Utilized Thermal Output	1,598	MWh	
CHP Fuel Energy Input (HHV)	3,593	MWh	Calculated using a regression model, which correlates energy input with gross electrical output, developed using energy input data provided in the engine performance specifications. See comment below table.
Total System Efficiency	73.3	%	

The CHP system achieved a TSE of 73.3%, which meets the Program Rules minimum requirement of 65%. Note that the fuel energy input determined using natural gas readings is lower than the energy input

obtained using the regression model, suggesting that the natural gas readings are possibly not corrected to standard conditions. Therefore, the fuel energy input used in the TSE calculation is based on the regression model relative to engine performance specifications.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, and verified Eligible Costs, the Incentive payable to the Participant is \$101,398. The Master Payment Requisition will be issued once the Participant's invoice for the Incentive amount is provided.

Table 7 outlines the Incentive payment calculation using the latest available information.

**Table 7. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	1,009	1 <sup>st</sup> Annual Reporting Period Electricity Savings.
Approved Amount	\$187,400	From the Project Approval Letter.
Limiter 1 - Electricity Savings	\$201,722	\$200 per MWh of Electricity Savings, capped at 120% of Approved Amount.
Estimated Eligible Project Costs	\$830,930	From the Project Approval Letter.
Actual Eligible Project Costs	\$636,220	Based on the review of invoices for the 1 <sup>st</sup> payment.
Limiter 2 - Project Costs	\$254,488	40% of minimum of Estimated and Actual Eligible Project Costs.
Net Benefits	\$63,460	Equal to the electricity savings, calculated using a billing rate of \$134/MWh, plus the Other Benefits less Other Costs from the Project Approval Letter.
Limiter 3 – 1-year Project Payback	\$572,760	Eligible Costs minus Net Benefits.
Gross Project Incentive	\$201,722	Minimum of the three limiters.
Project Incentives paid	\$100,324	Paid for 1 <sup>st</sup> Quarterly Reporting Period.
Study Incentive paid	N/A	Paid for Engineering Study. <sup>3</sup>
<b>Incentive payable</b>	<b>\$101,398</b>	Gross incentive minus incentives paid.

Table 8 provides the Incentive payment schedule.

<sup>3</sup> No deduction under "saveONenergy Process & Systems Upgrades Program, FINAL v2.0 April 6, 2018."



**Table 8. Incentive Payment Schedule**

<b>Deferred Payment Schedule</b>	<b>Projected Date</b>	<b>% of Approved Amount</b>
<b>Payment 1</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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Capitalized terms used in this document have the meaning given to them either in the Save on Energy Process and Systems Upgrade Program Rules, or the IPMVP Core Concepts dated October 2016 and Uncertainty Assessment for IPMVP, dated April 2018, as applicable.

***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period



## Cogeneration System

**Project ID:** Toronto-PROJECT-601978  
September 16, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited (the LDC)



**Prepared by:**  
CLEARresult  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

Prepared per Program Rules version "saveONenergy Process & Systems Upgrades Program, FINAL v2.0  
April 6, 2018

## Approvals

	Written by Technical Reviewer	Reviewed by Senior Engineer
Name:	[REDACTED]	[REDACTED]
Date:	September 12, 2022	September 15, 2022
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
September 16, 2022	M&V Report first issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of June 30, 2021 to July 6, 2022, are 953 MWh, which represents 89% of the Anticipated Electricity Savings. The Total System Efficiency (TSE) achieved in the 1<sup>st</sup> Annual Reporting Period is 71.6%, which meets the Program Rules minimum requirement of 65%.

Note that the original 1<sup>st</sup> Annual Reporting Period was scheduled to end on June 29, 2022. However, the Reporting Period had to be extended to July 6, 2022, as the combined heat and power (CHP) system unexpectedly shut down from February 13 to 19, 2022. The shutdown, which lasted 150 hours, was the result of a failed spring in the cylinder head that induced metal into the combustion chamber. Due to COVID-19 supply constraints, the issue could not be rectified until February 19, 2022.

The Incentive payable to the Participant for this Reporting Period is \$ 94,436.00. Refer Appendix for the Incentive calculation.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Jun 30 to Sep 29, 2021	243	90%	\$29,100
1 <sup>st</sup> Annual	Jun 30, 2021, to July 6, 2022	953	89%	\$114,400

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan

<sup>2</sup> Based on \$120/MWh obtained from the Approval Letter

## In-Service Date Confirmation

The In-Service Date was set to June 30, 2021, on August 16, 2021, by the Technical Reviewer.

## Metered Data Analysis

[REDACTED] the LDC representative, provided the M&V data on September 1, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	June 30, 2021, 00:00		
Reporting Period End	July 6, 2022, 5:59		
Reporting Period Duration	8,760	hours	End date minus start date. Excludes the 150-hour unexpected shutdown period
Available Data	8,760	hours	
Missing Data	0	hours	
Hours of Operation	8,461	hours	96.6% of the Reporting Period Duration

The CHP system was unexpectedly shutdown for 150 hours, between 12 p.m. on February 13, 2022 and 6 p.m. on February 19, 2022. The shutdown was a result of was the result of a failed spring in the cylinder head that induced metal into the combustion chamber. Due to COVID-19 supply constraints, the issue could not be rectified until February 19, 2022. These 150 hours were excluded from the Reporting Period and the end date of the original M&V Reporting Period was extended by 150 hours to 6 p.m. on July 6, 2022, to compensate for the 150-hour downtime.

## Performance of the Measure

The electrical performance of the project is calculated using the following equation:

$$\boxed{\text{Electricity Savings}} = \boxed{\text{Reporting Period Energy}} \pm \boxed{\text{Non-Routine Adjustments}}$$

## Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The Reporting Period Energy of the CHP system for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	987	MWh	
Auxiliary Loads Energy	33	MWh	Equal to 3.4% of the Gross Electrical Energy.
Reporting Period Energy	953	MWh	Gross Electrical Energy – Auxiliary Loads Energy
Uncertainty of the Reporting Period Energy	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter.
Average Generation	109	kW	Reporting Period Energy ÷ Reporting Period Duration
Summer Peak Demand Generation	112	kW	Summer peak demand period is defined as Monday to Friday, 1:00 pm - 7:00 pm, June 1 to August 31.

## Electricity Savings

The Reporting Period Energy and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Reporting Period Energy	953	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	953	MWh	
Uncertainty of the Electricity Savings	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	1,069	MWh	Obtained from the Table 5 of the M&V Plan, Rev0, dated February 15, 2019.
Electricity Savings as a Percentage of Anticipated Electricity Savings	89	%	
Average Demand Savings	109	kW	Equal to Average Generation from Table 3
Summer Peak Demand Savings	112	kW	Equal to Summer Peak Demand Generation from Table 3.

The 1<sup>st</sup> Annual Electricity Savings are 953 MWh, which represent 89% of the Anticipated Electricity Savings.



The reason for the underperformance could be a result of a change in scope of the Project. The original Project scope was based on installation of a 140 kW CHP system, consisting of two 75 kW internal combustion engines (ICEs), both of which would have been permanently derated to 70 kW. Instead, one 125 kW ICE was installed. Additionally, the anticipated uptime and average operating electrical output were 124.5 kW and 98%, respectively. However, in this 1<sup>st</sup> Annual Reporting Period, these values were 113 kW and 96.6%, respectively.

## Total System Efficiency

The TSE of the CHP system is calculated according to the following equation:

$$TSE (\%) = [Gross\ Electrical\ Energy\ (MWh) + Utilized\ Thermal\ Output\ (MWh)] / Fuel\ Energy\ Input\ (MWh)$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
Gross Electrical Energy	987	MWh	Obtained from Table 3
Utilized Thermal Output	1,319	MWh	
Natural gas Higher Heating Value (HHV)	10.75	kWh/m <sup>3</sup>	As per the M&V Plan.
Fuel Energy Input	3,220	MWh	Total volumetric natural gas consumption x Natural gas HHV
<b>Total System Efficiency</b>	71.6	%	

The CHP system achieved a TSE of 71.6%, which meets the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required unless requested by the IESO

## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, and review of the Eligible Costs), the Balance Incentive payable to the Participant is 94,436.00. The Master Payment Requisition will be issued once the Participant's invoice for the Incentive amount is provided.

Table outlines the Incentive payment calculation using the latest available information.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	953	1 <sup>st</sup> Annual Reporting Period Electricity Savings.
<b>Approved Amount</b>	\$213,800	From the Approval Letter.
Incentive Limiter 1 - Electricity Savings	\$190,656	\$200 per MWh of Electricity Savings, capped at 120% of the Approved Amount.
<b>Estimated Eligible Project Costs</b>	\$788,274	From the Approval Letter
Actual Eligible Project Costs	\$635,169	Based on the review of invoices from the 1 <sup>st</sup> Payment Recommendation.
Incentive Limiter 2 - Project Costs	\$254,068	40% of minimum of Estimated and Actual Eligible Costs.
<b>Electricity Billing Rate (\$/MWh)</b>	120	From the Approval Letter
<b>Electricity Billed Savings</b>	\$114,393	Electricity Savings x Electricity Billing Rate
<b>Other Benefits</b>	\$45,267	From the Approval Letter
<b>Other Costs</b>	\$146,470	From the Approval Letter
Net Benefits	\$13,190	Electricity Billed Savings + Other Benefits – Other Costs .
Incentive Limiter 3 – 1-Year Project Payback	\$621,979	Eligible Project Costs - Net Benefits.
Project Incentive	\$190,656	Minimum of the three Incentive limiters.
Project Incentive Paid to Date	\$96,220	Paid for 1 <sup>st</sup> Quarterly Reporting Period.
<b>Balance Incentive payable</b>	<b>\$94,436</b>	Gross incentive minus incentives paid.

Table 7 provides the Incentive payment schedule.

Payment	Projected Milestone	Payment Amount
<b>First Payment</b>	After issuance of the initial (1 <sup>st</sup> Quarterly) M&V Report.	50% of Participant Incentive, . The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Balance Payment</b>	After issuance of the final (1 <sup>st</sup> Annual) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period

[Redacted]

[Redacted]

[Redacted]

## Cogeneration

## System

**Project ID:** Toronto-PROJECT-601981  
September 13, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited  
[Redacted]

**Prepared by:**  
CLEARResult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

Prepared per Program Rules version "saveONenergy Process & Systems Upgrades Program, FINAL v2.0 April 6, 2018"

## Approvals

	Written by Technical Reviewer	Reviewed by Technical Reviewer
Name:	[REDACTED]	[REDACTED]
Date:	September 13, 2022	September 13, 2022
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
September 13, 2022	First M&V Report issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of May 26, 2021, to July 24, 2022, are 976 MWh, which represents 109% of the Anticipated Electricity Savings. The Total System Efficiency (TSE) achieved for the 1<sup>st</sup> Annual Reporting Period is 63.7%, which does not meet the Program Rules minimum requirement of 65%.

Note that the original 1<sup>st</sup> Annual Reporting Period was scheduled to end on May 25, 2022. However, the Reporting Period had to be extended to July 24, 2022, as the combined heat and power (CHP) system was unexpectedly shutdown as per the details in Table 1.

**Table 1. Unexpected Shutdowns**

Start Date	End Date	Hours	Description
September 6, 2021	September 23, 2021	425	Broken shaft in pump and supply issues.
November 24, 2021	December 3, 2021	216	Generator shorted to ground and supply issues.
February 24, 2022	March 9, 2022	313	Failed inverter control board and supply issues.
May 14, 2022	June 2, 2022	467	Failed cylinder in engine and supply issues.

The Incentive payable to the Participant for this Reporting Period is \$96,227. Refer to the Appendix for the Incentive calculation, which includes the penalty for not achieving the minimum 65% TSE requirement.

The Electricity Savings for each Reporting Period to date are presented in Table 2.

**Table 2. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	May 26 to Aug 25, 2021	259	172%	\$31,600
1 <sup>st</sup> Annual	May 26, 2021 to Jul 24, 2022	976	109%	\$119,100

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$122.01/MWh obtained from the Project Approval Letter.



- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date was set to May 26, 2021, on September 2, 2021, by the Technical Reviewer.

## Metered Data Analysis

[REDACTED] the LDC representative, provided the M&V data on September 1, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 3 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 3. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	May 26, 2021, 00:00		Start date of the Reporting Period.
Reporting Period End	Jul 24, 2022, 4:59		End date of the Reporting Period.
Reporting Period Duration	10,181	hours	End date minus start date.
Available Data	10,181	hours	
Missing Data	0	hours	0% of the Reporting Period Duration.
Unexpected Shutdown	1,421	hours	
Hours of Operation	8,525	hours	97% of the Reporting Period Duration excluding the 1,421 hours unexpected shutdown period.

## Performance of the Measure

The electrical performance of the project is based on the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The electrical generation of the CHP System for this Reporting Period is presented in Table 4.

**Table 4. Reporting Period Energy**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,011	MWh	
CHP Auxiliary Loads Energy	34	MWh	3.4% of the CHP Gross Electrical Energy. See details below Table 3.
Reporting Period Energy	976	MWh	CHP Gross Electrical Energy – CHP Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter.
Average Generation	111	kW	
Summer Peak Demand Generation	113	kW	Summer peak demand period is defined as Monday to Friday, 1:00 pm - 7:00 pm, June 1 to August 31.

The auxiliary loads consist of internal and external auxiliary loads. The internal auxiliary loads, which consist of two onboard pumps and controls, are not metered. They are estimated by the supplier of the CHP system to be 1.5 kW. The Technical Reviewer accepted this value and applied 1.5 kW per CHP operating hour to calculate the internal auxiliary load energy. The external auxiliary loads consist of hot water circulation pumps and dump radiators. The external loads were part of the metered Reporting Period data. However, it appears that the hourly values provided for the external auxiliary loads were determined by the Participant's consultant, based on power ratings from equipment specifications and operating status. Both the internal and external auxiliary load values appear to be reasonable based on the CHP system installed.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 5. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 5. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	976	MWh	Obtained from Table 4.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	976	MWh	
Uncertainty of the Electricity Savings	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	893	MWh	As per the M&V Plan.
Electricity Savings as a Percentage of Anticipated Electricity Savings	109	%	
Average Demand Savings	111	kW	Equal to Average Generation from Table 4.
Summer Peak Demand Savings	113	kW	Summer peak demand period is defined as Monday to Friday, 1:00 pm -7:00 pm, June 1 to August 31.

The 1<sup>st</sup> Annual Reporting Period Electricity Savings are 976 MWh and represent 109% of the Anticipated Electricity Savings. The overperformance is the result of the Reporting Period average operating electrical output being 119 kW (based on a 97% uptime), which is higher than the anticipated average operating electrical output of 102 kW (based on a 100% uptime).

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{CHP Gross Energy (MWh)} + \text{CHP Utilized Thermal Output (MWh)}] / \text{CHP Fuel Energy Input (MWh)}$$

**Table 6. Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,011	MWh	Obtained from Table 4.
CHP Utilized Thermal Output	1,198	MWh	
Natural Gas Higher Heating Value (HHV)	10.75	kWh/m <sup>3</sup>	As per the M&V Plan.
CHP Fuel Energy Input (HHV)	3,466	MWh	
Total System Efficiency	63.7	%	

The CHP system achieved a TSE of 63.7%, which does not meet the Program Rules minimum requirement of 65%. As such, the incentive is discounted by 5% as indicated in Table 7.

**Table 7. Discount in Incentive based on TSE Range**

<b>TSE Range</b>	<b>% Discount in Incentive</b>
62.5% ≤ TSE < 65.0%	5% discount
60.0% ≤ TSE < 62.5%	10% discount
57.5% ≤ TSE < 60.0%	15% discount
TSE < 57.5%	Considered a default of the Participant agreement

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, and verified Eligible Costs, the Incentive payable to the Participant is \$96,227. The Master Payment Requisition will be issued once the Participant's invoice for the Incentive amount is provided.

Table 8 outlines the Incentive payment calculation using the latest available information.

**Table 8. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	976	1 <sup>st</sup> Annual Reporting Period Electricity Savings.
Approved Amount	\$178,600	From the Project Approval Letter.
Limiter 1 - Electricity Savings	\$195,291	\$200 per MWh of Electricity Savings, capped at 120% of Approved Amount.
Estimated Eligible Project Costs	\$883,463	From the Project Approval Letter.
Actual Eligible Project Costs	\$702,518	Based on the review of invoices..
Limiter 2 - Project Costs	\$281,007	40% of minimum of Estimated and Actual Eligible Project Costs.
Net Benefits	\$33,775	Equal to the electricity savings, calculated using a billing rate of \$122.01/MWh, plus the Other Benefits less Other Costs from the Project Approval Letter.
Limiter 3 – 1-year Project Payback	\$668,743	Eligible Costs minus Net Benefits.
Gross Project Incentive	\$195,291	Minimum of the three limiters.
Adjusted Gross Project Incentive	\$185,527	5% TSE penalty applied.
Project Incentives paid	\$89,300	Paid for 1 <sup>st</sup> Quarterly Reporting Period.
Study Incentive paid	N/A	Paid for Engineering Study. <sup>3</sup>
<b>Incentive payable</b>	<b>\$96,227</b>	Gross incentive minus incentives paid.

Table 9 provides the Incentive payment schedule.

<sup>3</sup> No deduction under "saveONenergy Process & Systems Upgrades Program, FINAL v2.0 April 6, 2018."

**Table 9. Incentive Payment Schedule**

<b>Deferred Payment Schedule</b>	<b>Projected Date</b>	<b>% of Approved Amount</b>
<b>Payment 1</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.







CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period

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## Compressed Air Project Phase II

---

**Project ID:** Toronto-PROJECT-602011

October 05, 2020

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited  
[REDACTED]

**Prepared by:**

CLEARresult (the Technical Reviewer)  
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*Prepared per Program Rules version "saveONenergy Process & Systems Upgrades Program, FINAL v2.0 April 6, 2018".*

## Revision History

Date	Name/Description	Revision	Author
October 5, 2020	M&V Report First Issuance	0	[REDACTED]

## Approvals

Name	Title	Signature	Date
[REDACTED]	Energy Engineer	[REDACTED]	October 5, 2020

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of September 1, 2019 to August 31, 2020, are 1,113 MWh, which represents 110% of the Anticipated Electricity Savings.

The Incentive payable to the Participant for this Reporting Period is \$222,549. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Sep 1 to Nov 30, 2019	301	120%	\$26,000
1 <sup>st</sup> Annual	Sep 1, 2019 to Aug 31, 2020	1,113	110%	\$96,000

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan, which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Adjusted Baseline Energy and the Reporting Period Energy.
- The electrical performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date is September 1, 2019, which was established on November 22, 2019.

## Metered Data Analysis

[REDACTED] (the Participant representative) provided the raw process data to the CMVP for analysis, which included hourly compressor electrical power and discharge pressure for the eight compressors, compressed air flow rate at four points, and hourly dryer power. Additional measurements and specifications were provided for non-routine adjustments related to changes in compressed air usage from the Baseline Period. The provided data is compliant with the M&V Plan requirements.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$86.4/MWh obtained from the Project Application Review.

## Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period duration, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	September 1, 2019 0:00		Start date of the Reporting Period
Reporting Period End	August 31, 2020 23:59		End date of the Reporting Period
Reporting Period Duration	8,784	hours	End date minus start date
Available Data	8,699	hours	
Missing Data	85	hours	1% of the Reporting Period Duration
Hours of Operation	8,528	hours	97% of the Reporting Period Duration

The missing data represents 85 hours, or 1% of the Reporting Period. For periods of missing data, the compressed air system's equipment was assumed to be operating at the average power for that equipment over the Reporting Period.

## Performance of the Measures

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Adjusted Baseline Energy

As defined in the M&V Plan, the Baseline Energy is adjusted to the operating conditions of the Reporting Period, as shown in Table 3. The Adjusted Baseline Energy is calculated using the energy model defined in the M&V Plan, section B.6.2. The energy model is used to predict compressor power given the average daily compressed air flow, with air flow adjustments for the different measures. Note that measure 3 in the M&V Plan was not implemented, and measure 2 was modified to include redesigned blowers. This average compressor power is multiplied by the daily hours of operation to obtain daily compressor energy.

Added to the compressor energy is an adjustment for the energy consumption of measure 4, which is based on the number of dust collector transfers per day. The Adjusted Baseline Energy of the refrigerated dryer is also added to the compressor energy.

**Table 3. Adjusted Baseline Energy**

Description	Value	Unit	Comment
Compressors (measure 1, measure 2, non-routine adjustments)	16,158	MWh	Calculated using air flow-based energy model from M&V Plan: <i>Compressor power (kW) = 0.1527 × adjusted daily average flow rate (scfm) + 308.92</i> Includes air flow adjustments for measures 1 and 2, and non-routine adjustments.
Compressors (measure 4)	101	MWh	Based on reduction in daily number of dust collector transfers.
Refrigerated Dryer	780	MWh	Calculated using average baseline dryer power (91 kW) and new dryer hours of operation (8,569 hours).
Adjusted Baseline Energy	17,038	MWh	Sum of compressor and dryer energy.

**Reporting Period Energy**

The Reporting Period Energy is itemized in Table 4 below. Note that missing hours for each compressor and the dryer were conservatively extrapolated to the full Reporting Period duration of 8,784 hours.

**Table 4. Reporting Period Energy**

Description	Measured consumption, MWh	Available Data, hours	Extrapolated Consumption, MWh	Comment
Compressor 1	723	8,776	724	
Compressor 2	7,934	8,776	7,941	
Compressor 3	4,872	8,776	4,877	
Compressor 4	1,448	8,776	1,449	
Compressor 5	138	8,731	139	
Compressor 6	148	8,731	149	
Compressor 7	116	8,731	117	
Compressor 8	173	8,699	175	
Refrigerated Dryer	355	8,776	356	Calculated from measured amperage, assumed 575 V and 0.87 power factor.
Reporting Period Energy			15,926	Sum of extrapolated consumption.
Uncertainty			± 1.5%	Estimated uncertainty due to metering and adjustment uncertainty.

### Non-Routine Adjustments

There were several modifications to the compressed air system since the M&V Plan was issued. These changes require Non-Routine Adjustments, and they are accounted for by adjusting the average compressed air flow input parameter to the energy model regression equation. These changes and their compressed air flow impact are itemized in Table 5.

**Table 5. Compressed Air Flow Impact for Non-Routine Adjustments**

Name	Description	Date Range	Flow Adjustment, scfm
<b>Q1 Reporting Period</b>			
Air knives	Two air knives installed on bin feeder to clear pack material build-up. Operational when bin feeder is running, 6,600 hours/year. Rated at 139 scfm.	Aug. 2018 to Aug. 31, 2020	109.2
Air spargers	Two air spargers installed on PRD stack to clear pack material build-up. Operate intermittently on timer.	Sept. 2018 to Aug. 31, 2020	17.4
Packlift blower	Originally the Secondary Packlift Blower operated on compressed air, but it was changed to operate using a fan blower. Rated as a reduction of 283 scfm.	Sept. 2018 to Aug. 31, 2020	-283.0
Air lines on bandsaw	Two 5/16" air lines, regulated down to 50 psig, added to conveyor to clear pack material build-up on bandsaw T-01.	Dec. 2018 to Aug. 31, 2020	146.0
Baler replacement	Baler cylinder was replaced and now runs off plant compressed air. Runs continuously when line is running. Rated at 47 scfm.	Jan. 2019 to Aug. 31, 2020	47.0
Air horn	Air horn added for emergency cooling of melter brick. Runs continuously. Rated at 126 scfm. Adjustment effective from Sept. 11, 2019.	Sept. 11, 2019 to mid-2020	126.0
<b>Y1 Reporting Period</b>			
Air horns 2.0	The air horns are ASI-1000 models, rated for 90 psi air, which are rated for 64 scfm. Three air horns were installed on Feb. 1, 2020, with a fourth installed on Feb. 18, 2020. One air horn was removed on Mar. 5, 2020.	Feb. 1, 2020 to Mar. 5, 2020	64.0
Gas burners	Each burner has a 3/8" and a 1/4" compressed air line feeding it. It is approximated that each burner consumes 245.7 scfm. One burner was installed on Feb. 1, 2020 and the second on Feb. 19, 2020. Both burners were removed Feb. 24, 2020. Both burners were re-installed on Feb. 27, 2020 but solely for this day. On Mar. 5, 2020, one burner was installed solely for this day.	Feb. 1, 2020 to Mar. 5, 2020	245.7
Air lances	The air lances were manufactured on site, with an orifice size of 1/2". It is approximated that each air lance consumes 172 scfm. Three air lances were installed on Feb. 1, 2020.	Feb 1., 2020 to Aug. 31, 2020	172.0

## Electricity Savings

The Adjusted Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 6. Non-Routine Adjustments have been applied as compressed air flow adjustments to the energy model, as described in the Non-Routine Adjustment section above. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 6. Electricity Savings**

Description	Value	Unit	Comment
Adjusted Baseline Energy	17,038	MWh	From Table 4.
Reporting Period Energy	15,926	MWh	From Table 3.
Non-Routine Adjustments	0	MWh	Non-Routine Adjustments are accounted for through additional compressed air flow, included in the Adjusted Baseline Energy calculation. See Table 5.
Electricity Savings	1,113	MWh	<i>Adjusted Baseline Energy – Reporting Period Energy ± Non-Routine Adjustments</i>
Electricity Savings Uncertainty	± 80%		Calculated using the Adjusted Baseline Energy uncertainty (± 5%) and the Reporting Period Energy uncertainty (± 1.5%), obtained from the M&V Plan.
Anticipated Electricity Savings	1,008	MWh	From Table 1.
Electricity Savings as a Percentage of Anticipated Electricity Savings	110%		
Average Demand Savings	127	kW	<i>Electricity Savings ÷ Reporting Period duration</i>
Reporting Period Peak Demand	1,818	kW	Average demand during the summer Peak Demand Period, defined as weekdays, 1pm – 7pm, June 1 – August 31.
Baseline Peak Demand	2,132	kW	From the M&V Plan.
Summer Peak Demand Savings	314	kW	<i>Reporting Period Peak Demand - Baseline Peak Demand</i>

The 1<sup>st</sup> Annual Electricity Savings are 1,113 MWh and represent 110% of the Anticipated Electricity Savings.

The main reason for the overperformance is most likely due to the high uncertainty associated with the measurement and verification methodology of this Project, where a small change in the input of the calculation can generate large changes in the Electricity Savings. The high uncertainty is due to the small amount of Electricity Savings (6.5%) compared to the Adjusted Baseline Energy.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## APPENDIX

### Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period and review of the Eligible Costs, the Incentive payable to the Participant is \$222,549, less any payment made to date. Note that this is based on the \$200/MWh incentive limiter, capped at 120% of the Anticipated Electricity Savings.

The Technical Reviewer used the Project Application Review metrics to estimate the Incentive, which are summarized in Table 7.

**Table 7. Incentive Estimation Metrics**

<b>Billing Rate (\$/MWh)</b>	86.4
<b>Other Costs &amp; Benefits (\$/year)</b>	0
<b>Eligible Costs (\$)</b>	466,451 <sup>3</sup>
<b>Payment Option</b>	Deferred

Table 8 provides the Incentive payment schedule.

**Table 8: Incentive Payment Schedule**

<b>Deferred Payment Schedule</b>	<b>Projected Date</b>	<b>% of Approved Amount</b>
<b>Payment 1</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

<sup>3</sup> Eligible Costs based on the review of the invoices provided.



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Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.



## M&V Report

1<sup>st</sup> Annual Report

April 25, 2019 – April 24, 2020



## Electric Heating Controls Upgrade Phase 2

---


**Project ID:** Toronto-PROJECT-602015

May 8, 2020

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited (the LDC)



**Prepared by:**

CLEAResult Canada Inc.

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*Prepared per Program Rules version “saveONenergy Process & Systems Upgrades Program, FINAL v2.0 April 6, 2018”.*

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## Revision History

Date	Name/Description	Revision	Author
May 8, 2020	M&V Report first issuance.	0	[REDACTED]

## Approvals

Name	Title	Signature	Date
[REDACTED]	Energy Engineer	[REDACTED]	May 5, 2020

# 1. Executive Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of April 25, 2019 to April 24, 2020 are 386 MWh which represent 92% of the Anticipated Electricity Savings.

The total Incentive payable to the Participant for the 1<sup>st</sup> Annual Reporting Period is estimated at \$77,165.42. The final payment is \$27,005.42, pending issuance of the Master Payment Requisition.

## 2. Project Overview

### 2.1. Baseline Energy and Anticipated Electricity Savings

The annual Baseline Energy and the Anticipated Electricity Savings are obtained from the M&V Plan Rev. 0, dated December 28, 2018, and are presented in Table 1.

**Table 1. Annual Baseline Energy, and Anticipated Electricity Savings**

Description	Value	Unit
Baseline Energy	4,219	MWh/year
Anticipated Electricity Savings	418	MWh/year

This M&V Report assesses the actual Electricity Savings based on raw data provided by the Participant and the methodology described in the M&V Plan. This is an IPMVP Option C methodology of calculating the Electricity Savings.

This M&V Report calculates the actual Electricity Savings divided by the Anticipated Electricity Savings, which is the ratio by which the incentive is pro-rated, capped at 120%.

### 2.2. In-Service Date and Previous Reporting Period

The In-Service Date is April 25, 2019, which was established on September 23, 2019.

The 1<sup>st</sup> Quarterly Reporting Period was from April 25 to July 24, 2019, representing 91 days (2,184 hours).

### 2.3. Current Reporting Period

The 1<sup>st</sup> Annual Reporting Period is from April 25, 2019 to April 24, 2020, representing 366 days (8,784 hours).

## 3. Reporting Period Energy

### 3.1. Results

██████████ (the LDC representative) provided the raw process data to the CMVP for analysis. Table 2 presents an overview of the data analysis related to the duration of the Reporting Period and equipment hours of operation.

**Table 2. Reporting Period Hours and Missing Data**

Description	Value	Unit	Comments
Reporting Period Start	April 25, 2019 0:00		
Reporting Period End	April 24, 2020 23:59		
Reporting Period Duration	8,784	hours	
Available Meter Data	8,784	hours	100% of the Reporting Period Duration.
Missing Data	0	hours	0% of the Reporting Period.
Hours of Operation	8,784	hours	100% of the Available Meter Data.

The Reporting Period Energy is shown in Table 3 below.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comments
Reporting Period Energy	3,659	MWh	Total Facility electricity consumption (utility meter 9154617).
Uncertainty	± 0.5%		Utility meters are assumed to have an uncertainty of ± 0.5%.

## 4. Electricity Savings

### 4.1. Adjusted Baseline Energy

The Adjusted Baseline Energy is calculated using the energy model defined in the M&V Plan, section B.5.1. The energy model is based on average daily temperature, obtained for the Toronto City weather station (WMO 71508) from Environment and Climate Change Canada. The Adjusted Baseline Energy for this Reporting Period is 4,044 MWh.

### 4.2. Results

The Electricity Savings are calculated according to the following equation:

Since there has been no change in the Static Factors as defined in the M&V Plan Section B.5.2, Non-Routine Adjustments are not required for this Reporting Period. The Reporting Period Energy, Adjusted Baseline Energy and Electricity Savings results are presented in Table 4.

**Table 4. Calculation of Electricity Savings**

Description	Value	Unit	Comments
Adjusted Baseline Energy	4,044	MWh	From Section 4.1.
Reporting Period Energy	3,659	MWh	From Table 3.
Non-Routine Adjustments	0	MWh	None.
Electricity Savings	386	MWh	
Electricity Savings Uncertainty	± 109%		From the Baseline Energy uncertainty (± 10.4%) and the Reporting Period Energy uncertainty (± 0.5%).
Anticipated Electricity Savings	418	MWh	From Table 1.
Electricity Savings as a Percentage of Anticipated Electricity Savings	92%		Note that the Incentive Payment is pro-rated from the contracted amount based on this percentage.
Average Demand Savings	44	kW	<i>Electricity Savings ÷ Hours of operation.</i>
Summer Peak Demand Savings	0	kW	The Measures are not operational during the summer Peak Demand Period, and any differences are due to overall Facility demand changes in the Reporting Period. As a result, any peak demand savings evaluated in the analysis cannot be interpreted as such, since the system is not operational.

### 4.3. Incentive Payment

The 1<sup>st</sup> Annual Reporting Period Incentive is outlined in Table 5. CLEAResult has received the Invoice Reconciliation Form and the invoices.

**Table 5. Incentive Payments for Deferred Payment**

Deferred Payment Schedule	Description	Amount (\$)
<b>Payment 1</b>	50% of Participant Incentive, calculated based on Electricity Savings in the first quarterly M&V Report.	\$50,160.00 (PAID)
<b>Final Payment (Holdback)</b>	The balance payment is the difference between the actual Participant Incentive, calculated on the basis of the first annual M&V Report, and the total payments made to date.	\$27,005.42

### 4.4. Conclusion

The Electricity Savings are 386 MWh and represent 92% of the Anticipated Electricity Savings for the Reporting Period.

It should be noted that the Uncertainty on the Electricity Savings is significant, as explained in the M&V Plan. This is because the Electricity Savings are small relative to the Baseline Energy, shown in Table 1.



## 4.5. Electricity Savings to Date

The Electricity Savings to date are presented in Table 6.

**Table 6. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings		
		MWh	% of Contract Savings Value <sup>1</sup>	Cost Savings (\$) <sup>2</sup>
1 <sup>st</sup> Quarterly	April 25, 2019 to July 24, 2019	56	296%	\$5,400
1 <sup>st</sup> Annual	April 25, 2019 to April 24, 2020	386	92%	\$37,000

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on the Electricity Billing Rate of \$96/MWh obtained from the Project Review.



Toronto Hydro-Electric System Limited

14 Carlton Street

Toronto, Ontario M5B 1K5



## **Third Party Evaluation Reports**

This document includes the following third party evaluation reports:

### **Process and Systems Upgrades Program:**

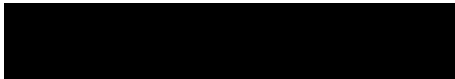
- #601601
- #601602
- #601814
- #601869
- #601883
- #601885
- #601910
- #601911



CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES

# Measurement & Verification Report

## 1<sup>st</sup> Annual Reporting Period



## Cogeneration System

**Project ID:** Toronto-█-601601

July 14, 2023

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited (THES)



**Prepared by:**

Aladaco Consulting Inc.



## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of August 27, 2021 to August 26, 2022, are 1,118 MWh, which represents 99% of the Anticipated Electricity Savings.

The In-Service Date was originally set to January 1, 2020. However, the Participant requested the Reporting Period begin August 27, 2021, due to necessary equipment repairs as well as a result of the COVID-19 pandemic affecting normal operations.

The Incentive payable to the Participant for this Reporting Period is \$112,600. Refer to the Appendix for details.

The Electricity Savings meet the 80% performance threshold required by the Program Rules.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings and Incentive payments to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Aug 27 to Nov 26, 2021	285	100%	\$40,185
1 <sup>st</sup> Annual	Aug 27, 2021 to Aug 26, 2022	1,118	99%	\$157,638

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Adjusted Baseline Energy and the Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of January 1, 2020, was established on November 17, 2020.

1<sup>st</sup> Quarterly Report was issued on January 27, 2022 with an updated in-service date of August 27, 2021.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$141/MWh obtained from the Project Application Review.

## Metered Data Analysis

[REDACTED] a representative of THES, provided the M&V data on January 25, 2023 to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	August 27, 2021 00:00		Start date of the Reporting Period.
Reporting Period End	August 26, 2022 23:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date
Available Data	8,760	hours	
Missing Data	0	hours	0% of the Reporting Period Duration
Hours of Operation	8,529	hours	97.4% of the Reporting Period Duration

## Performance of the Measures

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the Baseline Energy is 0 MWh/year.

### Reporting Period Energy

The Reporting Period Energy is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,176	MWh	CHP System Gross Electrical Output (See comment below table)
Auxiliary Loads Energy	58	MWh	Equal to 4.9% of the Gross Electrical Energy (See comment below table).
Reporting Period Energy	1,118	MWh	Gross Electrical Energy – Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	128	kW	Reporting Period Energy divided by Reporting Period Duration.
Summer Peak Generation	121	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

The ICE supplier confirmed via email on January 18, 2022, that the metered power output from the ICE is gross power (i.e., does not exclude any internal or external auxiliary loads). As a conservative approach, auxiliary loads were assumed to be 3% of the 125 kW ICE gross capacity. The auxiliary loads were applied for each unit individually (ie. if one unit was operating the loads were 3.75 kWh and 7.5 kWh if both units were operating simultaneously). Because the System performed well above the 80% performance requirement, the Technical Reviewer deemed this approach sufficient.

### Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	1,118	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,118	MWh	Equal to the Reporting Period Energy.
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	1,126	MWh	Obtained from the M&V Plan
Electricity Savings as a Percentage of Anticipated Electricity Savings	99%	-	
Average Demand Savings	128	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	121	kW	Equal to Summer Peak Generation from Table 3.

The 1<sup>st</sup> Annual Electricity Savings are 1,118 MWh and represent 99% of the Anticipated Electricity Savings.



## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$TSE (\%) = [Gross\ Electrical\ Energy + CHP\ Thermal\ Output\ Utilized] / CHP\ Energy\ Input$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,176	MWh	See the comment below.
CHP Thermal Output Utilized	1,384	MWh	
CHP Energy Input	3,582	MWh	Calculated using the metered volumetric flowrate of natural gas and Natural Gas Higher Heating Value (HHV) of 37.3 MJ/m <sup>3</sup> (10.36 kWh/m <sup>3</sup> ), obtained from the Canada Energy Regulator's Energy conversion tables.
Metered Total System Efficiency	71.5%	-	

The system achieved a TSE of 71.5%, which exceeds the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

The Incentive payable for the 1<sup>st</sup> Annual M&V Reporting Period is \$112,600. Table 6 outlines the payment schedule as defined in the contract and Program Rules, for reference.

**Table 6. Incentive Payment Schedule**

<b>Deferred Payment Schedule</b>	<b>Projected Date</b>	<b>Incentive Amount</b>
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.

## Disclaimer and Limitations

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***Please note:***

Capitalized terms used in this document have the meaning given to them either in the Save on Energy Process and Systems Upgrade Program Rules, or the IPMVP Core Concepts dated October 2016 and Uncertainty Assessment for IPMVP, dated April 2018, as applicable.

***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.







CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES

# Measurement & Verification Report

## 1<sup>st</sup> Annual Reporting Period



### Cogeneration System

**Project ID:** Toronto-601602

July 20, 2023

Revision 1

**Prepared for:**

Toronto Hydro-Electric System Limited (THES)



**Prepared by:**

Aladaco Consulting Inc.



## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of September 8, 2021 to September 7, 2022, are 1,431 MWh, which represents 110% of the Anticipated Electricity Savings.

The In-Service Date was originally set to January 28, 2020. However, the Participant requested the Reporting Period begin September 8, 2021, due to necessary equipment repairs as well as a result of the COVID-19 pandemic affecting normal operation.

The Incentive payable to the Participant for this Reporting Period is \$130,200. Refer to the Appendix for details.

The Electricity Savings meet the 80% performance threshold required by the Program Rules.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings and Incentive payments to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Sept 8 to Dec 12, 2021 <sup>3</sup>	394	122%	\$56,400
1 <sup>st</sup> Annual	Sept 8, 2021 to Sept 7, 2022	1,431	110%	\$204,633

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Adjusted Baseline Energy and the Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of January 28, 2020, was established on November 17, 2020.

1<sup>st</sup> Quarterly Report was issued on January 28, 2022 with an updated in-service date of September 8, 2021.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$143/MWh obtained from the Project Application Review.

<sup>3</sup> There were 115 hours of missing data points in the raw data. Therefore, the 1<sup>st</sup> Quarterly Reporting Period was extended by 115 hours.



# Metered Data Analysis

██████████ a representative of THES, provided the M&V data on January 25, 2023 to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

## Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	September 8, 2021 00:00		Start date of the Reporting Period.
Reporting Period End	September 7, 2022 23:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date
Available Data	8,645	hours	
Missing Data	115	hours	1.3% of the Reporting Period Duration.
Hours of Operation	8,557	hours	97.7% of the Reporting Period Duration

115 hours of data, or 1.3% of the Reporting Period, is missing. Since this represents less than 10% of the total data for the Reporting Period, the available data was used for the analysis and the missing hours assumed to represent 0 MWh savings, per Section B.6.2. of the M&V Plan.

## Performance of the Measures

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the Baseline Energy is 0 MWh/year.

### Reporting Period Energy

The Reporting Period Energy is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,493	MWh	CHP System Gross Electrical Output (See comment below table)
Auxiliary Loads Energy	63	MWh	Equal to 4.2% of the Gross Electrical Energy (See comment below table).
Reporting Period Energy	1,431	MWh	Gross Electrical Energy – Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	165	kW	Reporting Period Energy divided by Reporting Period Duration.
Summer Peak Generation	100	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

The ICE supplier confirmed via email on January 18, 2022, that the metered power output from the ICE is gross power (i.e., does not exclude any internal or external auxiliary loads). As a conservative approach, auxiliary loads were assumed to be 3% of the 125 kW ICE gross capacity. The auxiliary loads were applied for each unit individually (ie. if one unit was operating the loads were 3.75 kWh and 7.5 kWh if both units were operating simultaneously). Because the System performed well above the 80% performance requirement, the Technical Reviewer deemed this approach sufficient.

### Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	1,431	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,431	MWh	Equal to the Reporting Period Energy.
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	1,302	MWh	Obtained from the M&V Plan
Electricity Savings as a Percentage of Anticipated Electricity Savings	110%	-	
Average Demand Savings	165	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	100	kW	Equal to Summer Peak Generation from Table 3.

The 1<sup>st</sup> Annual Electricity Savings are 1,431 MWh and represent 110% of the Anticipated Electricity Savings.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$TSE (\%) = [Gross\ Electrical\ Energy + CHP\ Thermal\ Output\ Utilized] / CHP\ Energy\ Input$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,493	MWh	
CHP Thermal Output Utilized	1,843	MWh	
CHP Energy Input	4,450	MWh	Calculated using the metered volumetric flowrate of natural gas and Natural Gas Higher Heating Value (HHV) of 37.3 MJ/m <sup>3</sup> (10.36 kWh/m <sup>3</sup> ), obtained from the Canada Energy Regulator's Energy Conversion tables.
Metered Total System Efficiency	75.0%	-	

The system achieved a TSE of 75.0%, which exceeds the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period and review of the Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is \$130,200, pending issuance of the Master Payment Requisition.

The Incentive is based on the \$200/MWh of Anticipated Electricity Savings limiter. Table 6 outlines the Incentive payment calculation.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	1,431	From Table 4
<b>Estimated Eligible Costs</b>	<b>\$1,541,326</b>	From the SCP Agreement, Schedule "B".
Actual Eligible Costs	\$9,622,565	From the 1 <sup>st</sup> Master Payment Requisition.
Electricity Billed Savings	\$204,633	Based on the Project Review Electricity Billing Rate of \$143/MWh
Other Costs	\$120,764	From the SCP Agreement, Schedule "B".
Net Project Benefits	\$83,869	Electricity Billed Savings - Other Costs
<b>Approved Incentive Amount</b>	<b>\$260,400</b>	From the SCP Agreement, Schedule "B".
Limiter 1 - Electricity Savings	\$260,400	100% of the Approved Incentive Amount, if Performance is >80%..
Limiter 2 - Eligible Costs	\$616,530	40% of the minimum of Actual and Estimated Eligible costs.
Limited 3 - Project Payback	\$1,457,457	Eligible costs minus Net Project Benefits
Project Incentive	\$260,400	Minimum of the three limiters.
Incentives paid to date	<b>\$ 130,200</b>	From the 1 <sup>st</sup> Master Payment Requisition.
<b>Incentive payable (Balance Payment) (\$)</b>	<b>\$130,200</b>	Project Incentive - Incentives paid to date

The table below shows the payment schedule as defined in the contract and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.

## Disclaimer and Limitations

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This document was prepared based on information available to Aladaco Consulting Inc. at the time of preparation, and is subject to all limitations, assumptions and qualifications contained herein. In addition, financial or other projections contained herein are based upon assumptions concerning future events and circumstances over which Aladaco Consulting Inc. has no control. Such projections are by their nature uncertain and should be treated accordingly and read in the full context of this document, including such projects.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period

[Redacted]

[Redacted]

[Redacted] Cogeneration System

April 26, 2023

Revision 0

**Project ID:**

TorontoHydro-SCP-601814-[Redacted]-Cogeneration System-Y1-MVR

**Prepared for:**

Toronto Hydro-Electric System Limited  
[Redacted]

**Prepared by:**

Aladaco Consulting Inc.

**Prepared in accordance with:**

Save On Energy Process & Systems Upgrades Program, Program Requirements (FINAL v2.0 April 6, 2018)

## Approvals

	Written by	Reviewed by
Name:	[REDACTED]	[REDACTED]
Date:	April 26, 2023	April 27 <sup>th</sup> , 2023
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
April 26, 2023	First M&V Report issuance.	0	[REDACTED]



## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of November 1, 2021 to November 14, 2022 are 311 MWh, which represents 125% of the Anticipated Electricity Savings. The Incentive payable to the Participant for this Reporting Period is \$30,394, calculated in accordance to Program Rules. Refer to the Appendix for details.

Note that the Participant submitted an Application<sup>1</sup> for this Project on September 1, 2020, which was after the Application submission deadline however, in an email dated July 19, 2021, the IESO confirmed their acceptance of the Application and Anticipated Electricity Savings.

The original Reporting Period of November 1, 2021, to November 1, 2022, was extended by 14 days to November 14, 2022. The 14-day extension was a result of 14 days of erroneous data provided during the Q1 Reporting Period, for the period from January 22 to February 5, 2022. The combined heat and power (CHP) System operated during this period, however, the metered data recorded erroneous values due to an unexpected defect in the PLC system.

During the course of construction of the Cogeneration System, the Applicant installed and commissioned an Absorption Chiller which now forms part of the combined Cogeneration System originally shown in Figure 1 of the M&V Plan. The Absorption Chiller was not previously considered in the M&V Plan nor in the previously issued Q1 M&V Report. As the Absorption Chiller is receiving waste heat energy from the turbines exhaust gases and providing cooling to the facility the decision was made to include the equipment within this report. Aladaco Consulting received confirmation from Toronto Hydro to include the Absorption Chiller in an email dated April 20, 2023. This item is covered in more detail in the Non-Routine Adjustments section.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings and Incentive payments to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>2</sup>	Electricity Cost Savings <sup>3</sup>
1 <sup>st</sup> Quarterly	November 1, 2021 to February 14, 2022	101	118%	\$15,600
1 <sup>st</sup> Annual	November 1, 2021 to November 14, 2022	311	125%	\$48,240

<sup>1</sup> The Application was submitted under the Conservation First Framework (CFF), Final V2.0.

<sup>2</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>3</sup> Based on \$155/MWh obtained from the Project Approval Letter.

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan rev.0, dated February 15, 2019, which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Adjusted Baseline Energy and the Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of November 1, 2021, was established on February 7, 2022.

## Metered Data Analysis

██████████, a representative of Toronto Hydro, provided the M&V data on February 15, 2023 to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Nov. 1, 2021, 0:00		Start date of the Reporting Period.
Reporting Period End	Nov. 14, 2022, 23:00		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date less data removed
Available Data	8,760	hours	
Missing Data	336	hours	4% of the Reporting Period Duration
Hours of Operation	8,741	hours	99.8% of the Reporting Period Duration

The original Q1 data included 237 hours of erroneous data for the period from January 22, 3:00 to January 31, 23:00, 2022. The CHP system operated during this period, however, the metered data recorded erroneous values for all the parameters, due to an unexpected defect in the PLC system. The erroneous data represented 10.7% of the Q1 dataset. This data was replaced by 237 hours of valid data

during the period February 1 to February 14, 2022 (336 hours). Thus the remaining 3 Quarters of data required to complete the Year 1 Reporting Period begins February 14, 2022 through November 14, 2022.

## Performance of the Measures

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Reporting Period Energy} - \text{Baseline Energy} \pm \text{Non-Routine Adjustments}$$

### Reporting Period Energy

The electrical consumption of the System for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	505	MWh	Calculated using hourly Net Electrical Energy and Auxiliary Load Energy of 5.5 kW per CHP system operating hour.
Gas Turbine Auxiliary Loads Energy	48	MWh	9.5% of the Gross Electrical Energy.
Absorption Chiller Electrical Load	14	MWh	<i>Absorption Chiller Electrical Load = 3.8 kW of Chiller Electrical Power x (Chiller Operating Hours)</i> As per Absorption Chiller Specification Sheet. See note below.
Reporting Period Energy	443	MWh	CHP Net Electrical Output.
Uncertainty of the Reporting Period Energy	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter.
Average Demand	50.6	kW	Reporting Period Energy divided by Reporting Period Duration.
Summer Peak Demand	44	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm -7:00 pm,

Additional loads for chilled water and cooling tower pumps were not considered as they form part of the larger facility's chilled water loop. The Participant reported that the operation of these pumps did not increase as a result of the addition of the Absorption Chiller. Additionally, Chiller Data was not provided for the period of November 1, 2021 to January 1, 2022. It was assumed that the chiller was not operational over this period as there is no cooling demand at the facility during the winter months.

### Non-Routine Adjustments

The Facility currently operates two CHP systems, each consisting of a micro-turbine generator and a heat recovery system. The two CHP systems are identical in capacity, i.e., 65 kW each. One of the CHP systems (Unit #1) was implemented under a previous PSU Project (Toronto-SCP-601491) and has confirmed In-

Service Date of June 2, 2018. The review of this M&V Report is for the second CHP system (Unit #2), implemented under the second PSU Project (Toronto-SCP-601814).

As per the M&V Plan Rev.0 dated February 15, 2019, Unit #1 has priority over Unit #2 for the purposes of determining the Reporting Period Energy, whereby if the combined electricity generated by the two CHP systems exceeds the full load output of a single CHP system, then the apportionment of electricity generation between the two generators will be such that Unit #1 will be allocated the full load output, while Unit #2 will be allocated the remainder of the electricity generation. For each hour in the dataset, the full load output of the Unit#1 was determined based on the outside air temperature (OAT). The relationship between OAT and electrical output was established in the Project Review.

The Baseline Energy for Unit #2 is considered 0 kWh as Unit #2 has no prior generation. However, the adjustment of electricity generation for the two CHP systems, based on priority, was treated as a Non-Routine Adjustment. The Non-Routine Adjustment is calculated to be -132 MWh for the 1st Annual Reporting Period.

The inclusion of the Absorption Chiller, which was not previously considered in previous reports relating to this project, primarily affected the Total System Efficiency calculations. There was a slight adjustment to the Reporting Period Energy to account for additional system loads, however after accounting for the previously discussed Non-Routine Adjustment the final Adjusted Reporting Period Energy did not change as a result of the Absorption Chiller addition.

The Total System Efficiency (TSE) calculation required adjustment to account for the inclusion of Absorption Chiller. The Recovered Thermal Output is the cooling energy generated in the Absorption Chiller through the use of waste heat from the Micro-Turbine exhaust. The Participant was only able to provide data for the combined energy contribution from both Micro-Turbines to the Chilled Water supply, so to account for Unit #2's contribution for TSE purposes the total Chilled Water Energy was proportionally attributed based on the amount of generation produced per hour. The following data was provided by the Participant for the Absorption Chiller:

**Table 4. Absorption Chiller Data**

Description	Quantity	Unit	Comment
Chilled Water Flow Rate	6 minutes of 1-second interval readings on Sept. 28, 2021 from 16:63:58 to 16:56:57	Gal/min	
Chilled Water Out	15-minute intervals (January 1, 2022 to November 14, 2022)	Deg F	Chilled water temperature from the absorption chiller
Chilled Water In	15-minute intervals (January 1, 2022 to November 14, 2022)	Deg F	Chilled water temperature to the absorption chiller

The Flow Rate data provided by the Participant was from the commissioning of the Absorption Chiller and a non-permanent meter for which no specifications were provided. As the pumps associated with the Absorption Chiller are not VFD equipped it is assumed that the Flow Rate is constant when the Chiller is in operation. This is further supported by the metered flow rate closely matching the specified flow rate from the Absorption Chiller specification sheet.

Chilled water temperatures are metered by the Absorption Chiller using Resistance Temperature Detectors for which no specifications or accuracy information was provided.

To determine the TSE contribution from the Absorption Chiller the following formula was used:

$$\text{Eq. 1} \quad \text{Unit\#2 Absorption Chiller Recovered Thermal Output (MWh)} = (\text{Total Chilled Water Heat Recovery}) \times (\text{Unit \#2 Proportional Energy Contribution}) \text{ ( over the Reporting Period )}$$

$$\text{Eq. 1a} \quad \text{Total Chilled Water Heat Recovery (MWh)} = \text{Sum of (Chiller Hours of Operation)} \times \text{Chilled Water Delta T} \times \text{Chilled Water Flow Rate} \times (\text{Chilled Water Density}) \times \text{Chilled Water Specific Heat}$$

$$\text{Eq. 1b} \quad \text{Chilled Water Density} = \text{The density of water taken at the average temperature of the chilled water during all (Chiller Operating Hours)}$$

$$\text{Eq. 1c} \quad \text{Chiller Operating Hours} = \text{Chiller was assumed to be operating whenever the Chilled Water Out was a lower temperature than the Chilled Water In}$$

$$\text{Eq. 1d} \quad \text{Unit \#2 Proportional Energy Contribution} = \text{Unit \#2 Gross Electrical Energy} \div (\text{Unit \#1 Gross Electrical Energy} + \text{Unit \#2 Gross Electrical Energy})$$

The Adjusted Total System Efficiency was calculated as:

$$\text{Eq. 2} \quad \text{Adjusted TSE (\%)} = [ \text{Gross Electrical Energy} + \text{Total Recovered Thermal Output} + \text{Unit \#2 Absorption Chiller Recovered Thermal Output} ] \div \text{Total Natural Gas Energy Input}$$

## Electricity Savings

The Reporting Period Energy, the Non-Routine Adjustment, and the Electricity Savings are presented in Table 5. The original M&V Plan prescribed IPMVP Option B methodology of calculating the Electricity Savings, however after the Non-Routine Adjustments and the inclusion of the Absorption Chiller this report uses an IPMVP Option A methodology, with Net Electrical Generation, Natural Gas Consumption, Heating Water Temperature, and Chilled Water Temperatures being the measured variables. Chiller Operating Hours, Water flow rates and parasitic loads were unmetered and based on spot measurements, equipment specifications, or inferred from other metered data.

**Table 5. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	443	MWh	Obtained from Table 3.
Non-Routine Adjustment	-132	MWh	Calculated as per the M&V Plan and as described in the Non-Routine Adjustments section.
Electricity Savings	311	MWh	
Uncertainty of the Electricity Savings	± 2.5%		The Uncertainty is the accuracy of the electrical meter.

Anticipated Electricity Savings	249	MWh	Obtained from the M&V Plan
Electricity Savings as a Percentage of Anticipated Electricity Savings	125%		
Average Demand Savings	36	kW	Electricity Savings divided by Reporting Period Duration.
Summer Peak Demand Savings	22	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm -7:00 pm,

The 1<sup>st</sup> Annual Electricity Savings are 311 MWh and represent 125% of the Anticipated Electricity Savings.

The main reason for the overperformance is the increased operating hours of Unit #2 Micro-Turbine during the facility cooling season. This operation was facilitated by the use of the Absorption Chiller which allowed for greater generation with only a minor impact to TSE. Unit #2 had a 99.8% uptime as compared to a 50.7% uptime estimated at Application Review.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 3 } TSE (\%) = [\text{CHP System Gross Electrical Energy} + \text{CHP System Usable Thermal Output}] / \text{CHP System Natural Gas Consumption}$$

The Adjusted TSE including Non-Routine Adjustments is calculated according to the following equation:

$$\text{Eq. 2 } \text{Adjusted TSE} (\%) = [\text{Gross Electrical Energy} + \text{Total Recovered Thermal Output} + \text{Unit \#2 Absorption Chiller Recovered Thermal Output}] \div \text{Total Natural Gas Energy Input}$$

**Table 6. Total System Efficiency**

Description	Value	Unit	Comment
Unit #2 Gross Electrical Energy	505	MWh	
Total Recovered Thermal Output	814	MWh	
Unit #2 Natural Gas Consumption	230,867	m <sup>3</sup>	
Natural Gas HHV	10.75	kWh/m <sup>3</sup>	From the M&V Plan
Total Natural Gas Energy Input (HHV)	2,481	MWh	
Total System Efficiency	53.2%		
Absorption Chiller Recovered Thermal Output	317	MWh	Unit#2 absorption chiller recovered thermal output
<b>Adjusted Total System Efficiency</b>	<b>66.0%</b>		

Inclusion of the Absorption Chiller increased the Adjusted TSE value above the required minimum 57.5% required by Program Rules. The main reason for the underperformance of the TSE is due to the increased operation of the Cogeneration System, particularly during the summer months. During Application Review it was assumed that the Cogeneration System would only operate during the winter and shoulder seasons when the facility had heating demand.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1st Annual Reporting Period, the recommended Incentive Amount of \$30,394 was calculated in accordance with the Program Rules and is limited by the “\$200/MWh of Electricity Savings”, up to a maximum of 120% of Approved Incentive amount. The Final Incentive Payment is the Gross Project Incentive of \$59,760, less the Q1 Incentive Payment. The Final Incentive Payment is pending the issuance of the Master Payment Requisition.

Description	Value	Comment
Electricity Savings (MWh)	311	Annual Electricity Savings, as defined in this Report
Limiter 1 - Electricity Savings	\$62,245	\$200 per MWh of Electricity Savings
Actual Project Costs	\$405,911	From the Invoice Reconciliation Form
Limiter 2 - Project Costs	\$162,364	40% of Eligible costs
Net benefits	\$21,240	Includes electricity savings at \$155/MWh and Other Costs from Project Letter of Approval
Limiter 3 - Project Payback	\$384,671	Eligible costs minus net benefits
Limiter 4 – 120% of Pre-Approved Incentive	\$59,760	From Project Letter of Approval
Gross Project Incentive	\$59,760	Minimum of the four limiters
Total Payments to Date	\$29,367	From Q1 Master Payment Requisition
<b>Incentive Payable</b>	<b>\$30,394</b>	<i>Gross Project Incentive – Total Payments to Date</i>

The table below shows the payment schedule as defined in the contract and Program Rules, for reference.

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.



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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





**CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM**

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period

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[REDACTED]

[REDACTED]

[REDACTED]

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**Project ID:** Toronto-SCP-601869

June 20, 2023  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Ltd. (the LDC)

**Prepared by:**  
Aladaco Consulting Inc (The Technical Reviewer)

## Revision History

Date	Description	Revision	Author
June 20, 2023	M&V Report first issuance.	0	[REDACTED]

## Approvals

	Written by Technical Reviewer	Reviewed by Technical Reviewer
<b>Name</b>	[REDACTED]	[REDACTED]
<b>Date</b>	June 20, 2023	June 20 <sup>th</sup> , 2023
<b>Signature</b>	[REDACTED]	[REDACTED]

## Summary

The Electricity Savings for the Year 1 Reporting Period of March 29, 2022 to March 28, 2023, are 207.78 MWh, which represent 73.7% of the Anticipated Electricity Savings.

Note that the Project's In-Service Date was November 23, 2021. However, the start of the Year 1 Period was delayed to March 29, 2022 due to a significant underperformance resulting from the following:

- A 7-hour shutdown every night during the period November 23 to December 29, 2021 as the sound enclosure on the combined heat and power (CHP) system was not fully constructed and the shutdown was required to abide by the noise bylaws.
- A complete shutdown of the CHP system during the period December 30, 2021 to February 15, 2022, to modify the CHP system's enclosure in order to discharge the exhaust gas further away from the building.
- On March 10, 2022, Enbridge gas had shut off the main gas supply, which resulted in tripping of the CHP system. A mechanical contractor who was at the Facility to restart the boilers after the gas supply was restored tempered with the CHP system's controller, in an attempt to bring the system back into operation. As a result, the CHP system was started but was operating under its old scheduled hours (overnight shutdown) until March 28, 2022, when the problem was identified and corrected.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings
1 <sup>st</sup> Quarterly	Mar 29, 2022 to Jun 28, 2022	51	75%	\$7,196 <sup>2</sup>
1 <sup>st</sup> Annual	Mar 29, 2022 to Mar 28, 2023	207.78	73.7%	\$29,089 <sup>2</sup>

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data for the Reporting Period.
- The Reporting Period Energy.

<sup>1</sup> Percentage of the Anticipated Electricity Savings shown in the M&V Plan.

<sup>2</sup> Based on the Electricity Billing Rate of \$140/MWh from the Project Review.

- The electrical and thermal performance of the Measure.
- The Incentive based on the performance of the Measure.

## In-Service Date Confirmation

The In-Service Date of November 23, 2021 was established on January 28, 2022.

## Metered Data Analysis

[REDACTED], the LDC representative, provided the raw data to the Technical Reviewer for analysis. The raw data includes the following hourly interval data for the combined heat and power (CHP) system:

- Gross electricity generation
- Natural gas consumption
- Heat utilized

The data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Mar 29, 2022, 00:00		
Reporting Period End	Mar 28, 2023, 23:00		
Reporting Period Duration	8,760.0	hours	
Available Data	8,760.0	hours	
Downtime	258.0	hours	Data reported as "0", assumed unit not running, equivalent to 2.9% of the time.
Hours of Operation	8,502.0	hours	Unit running 97.1% of the Reporting Period duration.

## Performance of the Measure

The electrical performance of this generation project is based on the following equation:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Reporting Period Energy

The Reporting Period Energy for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	216.91	MWh	
Auxiliary Loads Energy	9.13	MWh	Represents 4.2% of the Gross Electrical Energy. See comment below.
Reporting Period Energy	207.78	MWh	Gross Electrical Energy - Auxiliary Loads Energy
Uncertainty of the Reporting Period Energy	± 2.5%		The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	24.8	kW	Reporting Period Energy ÷ Reporting Period Duration
Summer Peak Demand Generation	30.8	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm -7:00 pm.

The M&V data did not include metered data for the CHP system auxiliary loads. However, the Participant's representative provided the following information regarding the auxiliary loads:

- The metered electrical output readings are net of the dry cooler load.
- The auxiliary loads, which need to be accounted for to calculate the net electricity generation consists of two hot water circulation pumps, with a total nameplate rating of 1.44 hp.

The Technical Reviewer calculated that total auxiliary loads electricity consumption of 9.13MWh by multiplying the nameplate rating of the pumps with the Reporting Period operating hours.

### Electricity Savings

The Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings. Since there has been no change in the Static Factors as defined in the M&V Plan Section B.5.1, Non-Routine Adjustments are not required for this Reporting Period.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Reporting Period Energy	207.78	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	207.78	MWh	
Uncertainty of the Electricity Savings	± 2.5%		The Uncertainty is mostly due to the accuracy of the meters.
Anticipated Electricity Savings	282.00	MWh	Per the M&V Plan.
Electricity Savings as Percentage of Anticipated Electricity Savings	73.7%		
Average Demand Savings	24.8	kW	Equal to Average Generation, obtained from Table 3.
Summer Peak Demand Savings	30.8	kW	Equal to Summer Peak Demand Generation, obtained from Table 3.

The Electricity Savings of the Year 1 Reporting Period are 207.78 MWh, which represent 73.7% of the Anticipated Electricity Savings.

The underperformance resulted from a lower than anticipated net operating electrical output of the CHP system. The CHP system was anticipated to have an average net operating electrical output of 32 kW. However, the Reporting Period average net operating electrical output was 24.8 kW.

## Total System Efficiency

The CHP System's Total System Efficiency (TSE) is calculated according to the following equation.

$$TSE (\%) = [Gross\ Electrical\ Energy + Recovered\ Heat\ Utilized] / [Fuel\ Energy\ Input]$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
Gross Electrical Energy	216.91	MWh	Obtained from Table 3.
Recovered Heat Utilized	336.44	MWh	
Fuel Energy Input	780.42	MWh	Calculated using the total volumetric natural gas consumption and a natural gas higher heating value (HHV) of 10.75 kWh/m <sup>3</sup> shown in the M&V Plan.
Total System Efficiency	70.9%		This value is higher than the minimum 65% required by the Program.

The Technical Reviewer obtained a TSE of 70.9%, which is higher than the minimum 65% required by the Program.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.



## Appendix - Incentive Payment

The Participant is eligible for an Incentive Payment of \$41,555 for this Reporting Period, calculated in accordance with the terms of the Project Agreement.

**Table 6. Incentive Calculation**

Y1 Electricity Savings (MWh)	207.78
Electricity Billing Rate (\$/MWh)	\$140
Electricity Billed Savings	\$29,089
Net Other Benefits and Costs – Per Contract <sup>3</sup>	\$5,762
Net Project Benefits	\$34,851
Estimated Eligible Costs – Per Contract	\$231,938
Actual Eligible Costs – Per Invoice Reconciliation Form	\$327,035
Approved Incentive Amount – Per Letter of Approval	\$56,400
Incentive Limiter 1 - \$200/MWh	\$41,555
Incentive Limiter 2 - 40% of Eligible Costs (lower of Estimated or Actual)	\$92,775
Incentive Limiter 3 - 1-year Payback	\$197,087
Project Incentive (Minimum of 3 limiters)	\$41,555
5% Penalty for TSE < 65%	\$0
Adjusted Incentive	\$41,555
Q1 Incentive Paid <sup>4</sup>	\$0
Payable Incentive - Balance Year 1	\$41,555

<sup>3</sup> Note that there are discrepancies in the project benefits and costs values within the Project Contract, Application Review, and Application Letter of Approval. The Technical Reviewer used the values from the Project Contract to assess Incentive Limiter 3, however has confirmed that there is no impact on the incentive payable in any case (i.e. using any of the values specified within these documents).

<sup>4</sup> Note that no Q1 incentive was paid as the Q1 Performance Ratio was below 80%.

Table 7 provides the Incentive payment schedule.

**Table 7. Incentive Payment Schedule**

<b>Deferred Payment Schedule</b>	<b>Projected Date</b>	<b>% of Calculated Amount</b>
<b>Payment 1 (Not Paid)</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. Not paid due to project not achieving 80% performance.
<b>Final Payment (Payable)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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IPMVP defined terms:

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.

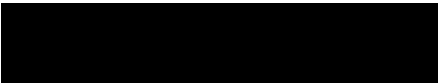




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CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period



## Cogeneration System

**Project ID:** Toronto-PROJECT-601883

July 4, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electrical System Ltd. (the LDC)

**Prepared by:**  
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### Revision History

Date	Description	Revision	Author
July 4, 2022	M&V Report first issuance.	0	[REDACTED]

### Approvals

	Written by Technical Reviewer	Reviewed by Engineering Manager
<b>Name</b>	[REDACTED]	[REDACTED]
<b>Date</b>	June 28, 2022	June 30, 2022
<b>Signature</b>	[REDACTED]	

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of April 7, 2021, to April 6, 2022, are 497 MWh, which represent 95% of the Anticipated Electricity Savings. The Total System Efficiency achieved for the 1<sup>st</sup> Annual Reporting Period is 58%, which does not meet the Program Rules requirement of 65%.

The Participant is eligible for an Incentive Payment of \$38,243 for this Reporting Period, calculated in accordance with the terms of the Project Agreement. See the Appendix for the Incentive calculation, which includes the penalty for not achieving the minimum 65% Total System Efficiency (TSE) requirement.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings
1 <sup>st</sup> Quarterly	Apr 7 to Jun 6, 2021	116	87	\$15,045 <sup>2</sup>
1 <sup>st</sup> Annual	Apr 7, 2021 to Apr 6, 2022	497	95	\$64,408 <sup>2</sup>

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data for the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the Measure.
- The Incentive based on the performance of the Measure.

## In-Service Date Confirmation

The In-Service Date of April 7, 2021, was established on November 2, 2021, conditional upon the submission of the Environmental Compliance Approval (ECA). The ECA was submitted by the Participant on December 16, 2021.

<sup>1</sup> Percentage of the Anticipated Electricity Savings shown in the M&V Plan.

<sup>2</sup> Based on the Electricity Billing Rate of \$129.7/MWh shown in the Approval Letter.

## Metered Data Analysis

[REDACTED] the LDC representative, provided the raw data to the Technical Reviewer for analysis. The raw data includes the following hourly data for the CHP system:

- Net electricity generation
- Natural gas consumption
- Heat utilized

The data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Apr 7, 2021, 00:00		
Reporting Period End	Apr 6, 2022, 23:59		
Reporting Period Duration	8,760	hours	
Available Data	8,760	hours	
Missing Data	0	hours	
Hours of Operation	8,738	hours	99.7% of the Reporting Period duration.

## Performance of the Measure

The electrical performance of this generation project is based on the following equation:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Reporting Period Energy

The Reporting Period Energy for this Reporting Period is presented in Table 3.



**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
CHP Net Electrical Energy	497	MWh	The electrical metering data provided represents the electricity generation, net of auxiliary loads
Auxiliary Loads Energy	48	MWh	Equal to 5.5 kW per operating hour (see comment below table)
CHP Gross Electrical Energy	545	MWh	Net Electrical Energy + Auxiliary Loads Energy
Reporting Period Energy	497	MWh	Equal to the Net Electrical Energy
Uncertainty of the Reporting Period Energy	± 2.5%		The Uncertainty is mostly due to the accuracy of the meters.
<b>Average Generation</b>	57	kW	Reporting Period Energy ÷ Reporting Period Duration
<b>Summer Peak Demand Generation</b>	46	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm -7:00 pm.

The Participant provided an auxiliary load estimate of 5 to 6 kW and confirmed that the metered electrical output is net of the auxiliary loads, which is a typical arrangement for the Capstone C65 micro-turbine system. The Technical Reviewer applied an auxiliary load of 5.5 kW per operating hour to calculate the Auxiliary Load Energy.

### Electricity Savings

The Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings. Since there has been no change in the Static Factors as defined in the M&V Plan Section B.5.1, Non-Routine Adjustments are not required for this Reporting Period.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Reporting Period Energy	497	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	497	MWh	
Uncertainty of the Electricity Savings	± 2.5%		The Uncertainty is mostly due to the accuracy of the meters.
Anticipated Electricity Savings	524	MWh	Prorated Anticipated Electricity Savings per the M&V Plan.
Electricity Savings as Percentage of Anticipated Electricity Savings	95%		
Average Demand Savings	57	kW	Equal to Average Generation, obtained from Table 3.
Summer Peak Demand Savings	46	kW	Equal to Summer Peak Demand Generation, obtained from Table 3.

The Electricity Savings of the 1<sup>st</sup> Annual Reporting Period are 497 MWh, which represent 95% of the Anticipated Electricity Savings.

The underperformance resulted from lower than anticipated average operating net electrical output. The CHP system was anticipated to produce an average operating net electrical output of 60 kW whereas the Reporting Period average operating net electrical output was 57 kW.

## Total System Efficiency

The CHP System's Total System Efficiency (TSE) is calculated according to the following equation.

$$TSE (\%) = [Gross\ Electrical\ Energy + Recovered\ Heat\ Utilized] / [Fuel\ Energy\ Input]$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
Gross Electrical Energy	545	MWh	Obtained from Table 3.
Recovered Heat Utilized	805	MWh	
Fuel Energy Input	2,314	MWh	Calculated from total volumetric natural gas consumption and a natural gas higher heating value (HHV) of 10.75 kWh/m <sup>3</sup> specified in the M&V Plan.
<b>Total System Efficiency</b>	58.3%		This value is lower than the 65% threshold required by the Program.

The Technical Reviewer obtained a TSE of 58.3%, which is lower than the minimum 65% required by the Program. However, the Participant is eligible for an Incentive, subject to a 15%<sup>3</sup> penalty. See the Appendix for the Incentive calculation.

## Next Reporting Period

The 1<sup>st</sup> Annual Reporting Period is the final Reporting Period and there is no further M&V reporting, unless requested by the IESO.

<sup>3</sup> Based on Program Rules, a TSE that is greater than equal to 57.5% but less than 60%, results in a 15% penalty on the Incentive.

## Appendix - Incentive Payment

The Participant is eligible for an Incentive Payment of \$38,243 for this Reporting Period, calculated in accordance with the terms of the Project Agreement. The Incentive calculation is shown in Table A1.

**Table A1. Incentive Calculation**

Reporting Period Electricity Savings (MWh)	497
Electricity Billing Rate (\$/MWh)	129.7
Electricity Billed Savings	\$64,408
Net Other Benefits and Costs	-\$37,347 <sup>4</sup>
Project Benefits	\$27,061
Estimated Eligible Costs	\$480,000 <sup>4</sup>
Actual Eligible Costs	\$865,654.69
Approved Incentive Amount	\$104,800 <sup>4</sup>
Incentive 1 - \$200/MWh (Capped at 120% of the contracted Incentive amount)	\$99,318
Incentive 2 - 40% of Minimum of Actual and Estimated Eligible Costs	\$192,000
Incentive 3 - 1-year Payback	\$452,939
Project Incentive (Minimum of 3 limiters)	\$99,318
Incentive Penalty for TSE (15%)	\$14,898
Adjusted Project Incentive	\$84,420
First Payment (Recommended for First Quarterly Reporting Period)	\$46,177
Balance Payment	\$38,243

<sup>4</sup> From the Approval Letter

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report Year 1 Reporting Period



## Cogeneration System

**Project ID:** Toronto-PROJECT-601885

April 27, 2023  
Revision 0

**Prepared for:**  
Toronto Hydro-Electrical System Ltd. (the LDC)

**Prepared by:**  
Aladaco Consulting Inc. (the Technical Reviewer)

## Revision History

Date	Description	Revision	Author
April 27, 2023	Y1 M&V Report first issuance.	0	[REDACTED]

## Approvals

	Written by Technical Reviewer	Reviewed by Technical Reviewer
<b>Name</b>	[REDACTED]	[REDACTED]
<b>Date</b>	April 27, 2023	April 28, 2023
<b>Signature</b>	[REDACTED]	[REDACTED]

## Summary

The Electricity Savings for Year 1 Reporting Period of February 1, 2022 to January 31, 2023, are 942.24 MWh, which represent 91.0%% of the Anticipated Electricity Savings.

The Participant is eligible for an Incentive Payment of \$72,998 for this Reporting Period, calculated in accordance with the terms of the Project Agreement. Note that the Incentive Payment was impacted by a 5% Total System Efficiency Penalty (TSE) for a TSE of 64.8%. See the Appendix for the Incentive calculation.

Note that the Project's In-Service Date was September 16, 2021. However, the start of the Reporting Period was delayed to February 1, 2022, to allow the Participant to rectify issues with the heat recovery system and natural gas readings, which were identified as the In-service Date confirmation.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings
1 <sup>st</sup> Quarterly	Feb 1 to Apr 30, 2022	259	102	\$31,024 <sup>2</sup>
1 <sup>st</sup> Annual	Feb 1, 2022 to Jan 31, 2023	942	91	\$113,069 <sup>2</sup>

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data for the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the Measure.
- The Incentive based on the performance of the Measure.

## In-Service Date Confirmation

The In-Service Date of September 16, 2021 was established on January 25, 2022. However, the start of the Year 1 Reporting Period was delayed to February 1, 2022.

<sup>1</sup> Percentage of the Anticipated Electricity Savings shown in the M&V Plan.

<sup>2</sup> Based on the Electricity Billing Rate of \$120/MWh shown in the Approval Letter.



## Metered Data Analysis

[REDACTED], the LDC representative, provided the raw data to the Technical Reviewer for analysis. The raw data includes the following hourly data for the CHP system:

- Net electricity generation
- Natural gas consumption
- Heat Recovered

The data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Feb 1, 2022, 01:00		One hour after actual Reporting Period
Reporting Period End	Feb 1, 2023, 00:00		One hour after actual Reporting Period
Reporting Period Duration	8,760	hours	
Available Data	8,757	hours	
Missing Data	3	hours	Assumed Missing Data = Units Not Running
Hours of Operation	8,757	hours	99.97% of the Reporting Period duration.

## Performance of the Measure

The electrical performance of this generation project is based on the following equation:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Reporting Period Energy

The Reporting Period Energy for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
CHP Net Electrical Energy	942.24	MWh	The electrical metering data provided represents the electricity generation, net of auxiliary loads
Auxiliary Loads Energy	93.63	MWh	Equal to 5.5 kW per micro-turbine per operating hour (see comment below table)
CHP Gross Electrical Energy	1,035.87	MWh	Net Electrical Energy + Auxiliary Loads Energy
Reporting Period Energy	942.24	MWh	Equal to the Net Electrical Energy
Uncertainty of the Reporting Period Energy	± 2.5%		The Uncertainty is mostly due to the accuracy of the meters.
<b>Average Generation</b>	107.6	kW	Reporting Period Energy ÷ Reporting Period Duration
<b>Summer Peak Demand Generation</b>	84.7	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm -7:00 pm.

The Participant provided an auxiliary load estimate of 5 to 6 kW and confirmed that the metered electrical output is net of the auxiliary loads, which is a typical arrangement for the Capstone C65 micro-turbine system. The Technical Reviewer applied an auxiliary load of 5.5 kW per micro-turbine per operating hour to calculate the Auxiliary Load Energy. Data shows that during Year 1 only 1 Unit was in operation during 490 hours. This was taken into account to calculate the total Auxiliary Load consumption.

### Electricity Savings

The Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings. Since there has been no change in the Static Factors as defined in the M&V Plan Section B.5.1, Non-Routine Adjustments are not required for this Reporting Period.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Reporting Period Energy	942.24	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	942.24	MWh	
Uncertainty of the Electricity Savings	± 2.5%		The Uncertainty is mostly due to the accuracy of the meters.
Anticipated Electricity Savings	1,035	MWh	Annual Anticipated Electricity Savings per Letter of Approval
Electricity Savings as Percentage of Anticipated Electricity Savings	91.0%		

Average Demand Savings	107.6	kW	Equal to Average Generation, obtained from Table 3.
Summer Peak Demand Savings	84.7	kW	Equal to Summer Peak Demand Generation, obtained from Table 3.

The Electricity Savings of Year 1 Period are 942.24 MWh, which represent 91.0% of the Anticipated Electricity Savings.

The underperformance resulted from lower than anticipated average operating net electrical output. The CHP system was anticipated to produce an average operating net electrical output of 118 kW (per Application Review document) whereas the Reporting Period average operating net electrical output was 107.6 kW. An important factor was that only 1 Unit was in operation during 490 hours, which was not anticipated.

## Total System Efficiency

The CHP System's Total System Efficiency (TSE) is calculated according to the following equation.

$$TSE (\%) = [Gross\ Electrical\ Energy + Recovered\ Heat\ Utilized] / [Fuel\ Energy\ Input]$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
Gross Electrical Energy	1,035.87	MWh	Obtained from Table 3.
Recovered Heat Utilized	1,753.24	MWh	
Fuel Energy Input	4,306.55	MWh	Calculated from total volumetric natural gas consumption and a natural gas higher heating value (HHV) of 10.75 kWh/m specified in the M&V Plan.
<b>Total System Efficiency</b>	64.8%		This value is lower than the minimum 65% required by the Program.

The Total System Efficiency (TSE) was determined to be 64.8%, which falls short of the anticipated TSE of 73.1% (per Application Review document). In an effort to understand the reason for the difference, we compared the Y1 values with the anticipated values and found:

- Total Gross Generation is 7% lower than anticipated.
- Total Heat Recovered is 10% lower than anticipated.
- Natural Gas consumption is 3% higher than anticipated.

While it is difficult to draw a conclusion without a detailed analysis, it seems that both the electrical efficiency and the thermal efficiency of the units are responsible as they don't correlate with higher gas consumption as could be expected.

Note that there were some issues<sup>3</sup> with the natural gas readings and heat recovery system which were identified as the In-service Date confirmation stage, which resulted in an invalid Total System Efficiency value. However, these issues appear to have been rectified by the Participant before the start date of the Year 1 Reporting Period.

Per the PSU Project Terms and Conditions Section 3.3 c) a 5% discount is applied to the Participant Incentive where the M&V Report demonstrates the CHP project achieves a TSE between 62.5 and 65% (rounded to the second decimal). More information on the incentive calculation can be found in the Appendix.

## Next Reporting Period

This is the final Reporting Period. No additional data is required.

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<sup>3</sup> Refer to email with subject heading "[REDACTED]"

## Appendix - Incentive Payment

The Participant is eligible for an Incentive Payment of \$72,998 for this Reporting Period, calculated in accordance with the terms of the Project Agreement.

**Table 6. Incentive Calculation**

Y1 Electricity Savings (MWh)	942
Electricity Billing Rate (\$/MWh)	120
Electricity Billed Savings	\$113,069
Net Other Benefits and Costs – Per Letter of Approval	-\$71,647
Net Project Benefits	\$41,422
Actual Eligible Costs – Per Cost Reconciliation Form	\$1,336,461
Approved Incentive Amount – Per Letter of Approval	\$207,000
Incentive Limiter 1 - \$200/MWh (Capped at 120% of the contracted Incentive amount)	\$188,448
Incentive Limiter 2 - 40% of Actual Eligible Costs	\$534,585
Incentive Limiter 3 - 1-year Payback	\$1,295,040
Project Incentive (Minimum of 3 limiters)	\$188,448
5% Penalty for TSE < 65%	\$9,422
Adjusted Incentive	\$179,026
Q1 Incentive Paid	\$106,028
Payable Incentive - Balance Year 1	\$72,998

Table 7 provides the Incentive payment schedule.

**Table 7. Incentive Payment Schedule**

<b>Deferred Payment Schedule</b>	<b>Projected Date</b>	<b>% of Calculated Amount</b>
<b>Payment 1 (Paid)</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive was calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Payable)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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IPMVP defined terms:

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.







CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES

# Measurement & Verification Report

## 1<sup>st</sup> Annual Reporting Period



# Cogeneration System

**Project ID:** Toronto-PROJECT-601910

June 05, 2023

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited (THES)



**Prepared by:**

Aladaco Consulting Inc.

**Prepared in accordance with:**

Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018

## Approvals

	Written by	Reviewed by
Name:	[REDACTED]	[REDACTED]
Date:	June 5, 2023	June 1, 2023
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
June 1, 2023	M&V Report first issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of December 26, 2021, to December 25, 2022, are 798 MWh, which represents 90% of the Anticipated Electricity Savings.

The Incentive payable to the Participant for this Reporting Period is \$84,727, calculated in accordance to Program Rules. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings and Incentive payments to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Dec 26, 2021 to Mar 25, 2022	205	84%	\$25,056
1 <sup>st</sup> Annual	Dec 26, 2021 to Dec 25, 2022	798	90%	\$97,763

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Adjusted Baseline Energy and the Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of December 26, 2021, was established on February 8, 2022.

The 1<sup>st</sup> Quarterly Report was issued on July 8, 2022.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$122.51/MWh obtained from the Project Application Review.

## Metered Data Analysis

██████████, a representative of THES, provided the M&V data on May 10, 2023 to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Dec 26, 2021 00:00		Start date of the Reporting Period.
Reporting Period End	Dec 25, 2022 23:59		End date of the Reporting Period
Reporting Period Duration	8,760	Hours	End date minus start date.
Available Data	8,668	Hours	
Missing Data	92	Hours	1.1% of the Reporting Period Duration.
Hours of Operation	8,667	Hours	99.99% of the Reporting Period Duration

## Performance of the Measures

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The Reporting Period Energy is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	821	MWh	CHP System Gross Electrical Output (See comment below table)
Auxiliary Loads Energy	23	MWh	Equal to 2.0% of the Gross Electrical Energy (See comment below table).
Reporting Period Energy	798	MWh	Gross Electrical Energy – Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	91	kW	Reporting Period Energy divided by Reporting Period Duration.
Summer Peak Generation	95	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

The Participant's consultant, [REDACTED], has indicated that the electrical output readings included in the M&V dataset are net of internal auxiliary loads, which includes the coolant pumps and heat rejection fans. However, there are system pumps that are powered externally and whose power draw was spot metered<sup>3</sup> to be 2.62 kW. The Gross Electrical Energy of 821 MWh is net of the internal auxiliary loads. The 23 MWh Auxiliary Loads Energy was calculated based on the 2.62 kW external auxiliary load and 8,667 operating hours.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

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<sup>3</sup> The spot metering of the pumps was done at another Facility operated by [REDACTED] where a similar type of CHP system, involving Yanmar CP35D1 engines, and a similar hot water heat recovery system were present.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	798	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	798	MWh	
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	891	MWh	Obtained from the M&V Plan
Electricity Savings as a Percentage of Anticipated Electricity Savings	90%	-	
Average Demand Savings	91	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	95	kW	Equal to Summer Peak Generation from Table 3.

The 1<sup>st</sup> Annual Electricity Savings are 798 MWh and represent 90% of the Anticipated Electricity Savings.

The Project was originally planned for a total nominal capacity of 125 kW, consisting of two 125 kW internal combustion engines, one of which to be used for emergency backup only. In the completed Project, three 35 kW ICEs were installed with a nominal capacity of 105 kW. The under-performance resulted from lower than anticipated average electrical output of the CHP System. The average electrical power generated during the Reporting Period (91 kW) is approximately 12% lower than the anticipated average output in the Application Review (104 kW).

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$TSE (\%) = [Gross\ Electrical\ Energy + CHP\ Thermal\ Output\ Utilized] / CHP\ Energy\ Input$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	821	MWh	See comment below table.
CHP Thermal Output Utilized	1,064	MWh	
CHP Energy Input	2,850	MWh	See comment below table.
Total System Efficiency	66.1%	-	

The CHP Energy Input was determined using the Natural Gas Higher Heating Value (HHV) of 10.75 kWh/m<sup>3</sup>, obtained from the M&V Plan. The TSE of 66.1% exceeds the minimum 65% Program Requirement.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, the Incentive payable to the Participant is \$84,727.

The Incentive is based on the \$200/MWh of Electricity Savings limiter. Table 6 outlines the Incentive payment calculation.

**Table 6. Incentive Calculation**

Description	Value	Comment
Annual Electricity Savings (MWh)	798	From Table 4
<b>Actual Eligible Costs</b>	<b>\$585,669</b>	Per the vendor invoices.
Electricity Billed Savings	\$97,763	Based on the Project Approval Letter Electricity Billing Rate of \$122.51/MWh
Other Benefits	\$37,354	From the Project Approval Letter
Other Costs	\$116,586	From the Project Approval Letter
Net Project Benefits	\$18,531	Electricity Billed Savings +Other Benefits – Other Costs
<b>Approved Incentive Amount</b>	<b>\$178,200</b>	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$159,600	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Eligible Costs	\$234,268	40% of the minimum of Actual and Estimated Eligible costs.
Limited 3 - Project Payback	\$567,138	Eligible costs minus Net Project Benefits
Project Incentive	\$159,600	Minimum of the three limiters.
Project Incentive paid to Date	\$74,873	Paid for 1st Quarterly Reporting Period.
<b>Final Incentive payable</b>	<b>\$84,727</b>	Project Incentive minus Incentive paid to date.

The table below shows the payment schedule as defined in the contract and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.



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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.



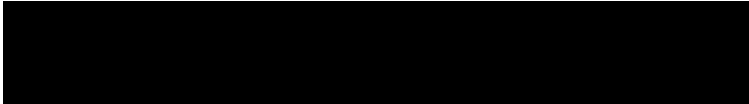
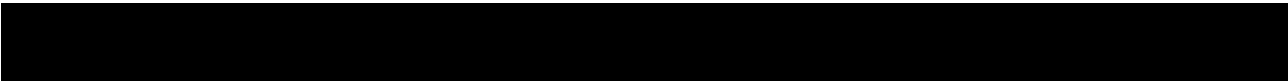




CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES

# Measurement & Verification Report

## 1<sup>st</sup> Annual Reporting Period



### Cogeneration

### System

**Project ID:** Toronto-PROJECT-601911

June 05, 2023

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited (THES)



**Prepared by:**

Aladaco Consulting Inc.

**Prepared in accordance with:**

Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018

## Approvals

	Written by	Reviewed by
Name:	██████████	██████████
Date:	June 5, 2023	June 1, 2023
Signature:	██████████	██████████

## Revision History

Date	Description	Revision	Technical Reviewer
June 1, 2023	M&V Report first issuance.	0	██████████

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of December 24, 2021, to December 23, 2022, are 1,095 MWh, which represents 119% of the Anticipated Electricity Savings.

The Incentive payable to the Participant for this Reporting Period is \$127,346, calculated in accordance to Program Rules. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings and Incentive payments to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Dec 24, 2021 to Mar 23, 2022	257	100%	\$32,933
1 <sup>st</sup> Annual	Dec 24, 2021 to Dec 23, 2022	1,095	119%	\$140,152

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Adjusted Baseline Energy and the Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of December 24, 2021, was established on February 16, 2022.

The 1<sup>st</sup> Quarterly Report was issued on July 8, 2022.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$128/MWh obtained from the Project Application Review.

## Metered Data Analysis

[REDACTED] a representative of THES, provided the M&V data on May 10, 2023 to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Dec 24, 2021 00:00		Start date of the Reporting Period.
Reporting Period End	Dec 23, 2022 23:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date.
Available Data			
<i>Electrical and Thermal Meters</i>	8,687	hours	
<i>Natural Gas Meter</i>	7,684	hours	
Missing Data			
<i>Electrical and Thermal Meters</i>	73	hours	0.8% of the Reporting Period Duration.
<i>Natural Gas Meter</i>	1,076	hours	12.3% (See comment below table)
Hours of Operation	8,683	hours	99.95% of the Reporting Period Duration

When providing the raw data, [REDACTED] noted that natural gas data from May 12 to June 23, 2022 was missing. This was due to the existing gas meter failing and the delay to replace the meter. The missing data represents 1,076 hours or 12.3% of the Reporting Period. The Technical Reviewer has used the CHP electrical output and the part-load data for the Yanmar CP35D1 in order to calculate the natural gas consumption during this period.

## Performance of the Measures

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

## Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The Reporting Period Energy is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,118	MWh	CHP System Gross Electrical Output (See comment below table)
Auxiliary Loads Energy	23	MWh	Equal to 2.0% of the Gross Electrical Energy (See comment below table).
Reporting Period Energy	1,095	MWh	Gross Electrical Energy – Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	125	kW	Reporting Period Energy divided by Reporting Period Duration.
Summer Peak Generation	124	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

The Participant's consultant, [REDACTED] has indicated that the electrical output readings included in the M&V dataset are net of internal auxiliary loads, which includes the coolant pumps and heat rejection fans. However, there are system pumps that are powered externally and whose power draw was spot metered<sup>3</sup> to be 2.62 kW. The Gross Electrical Energy of 1,118 MWh is net of the internal auxiliary loads. The 23 MWh Auxiliary Loads Energy was calculated based on the 2.62 kW external auxiliary load and 8,683 operating hours.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

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<sup>3</sup> The spot metering of the pumps was done at another Facility operated by [REDACTED] where a similar type of CHP system, involving Yanmar CP35D1 engines, and a similar hot water heat recovery system were present.



**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	1,095	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,095	MWh	
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	920	MWh	Obtained from the M&V Plan
Electricity Savings as a Percentage of Anticipated Electricity Savings	119%	-	
Average Demand Savings	126	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	124	kW	Equal to Summer Peak Generation from Table 3.

The 1<sup>st</sup> Annual Electricity Savings are 1,095 MWh and represent 119% of the Anticipated Electricity Savings.

The Project was originally planned for a total nominal capacity of 130 kW, consisting of three 65 kW micro-turbines, one of which to be used for emergency backup only. In the completed Project, four 35 kW ICEs were installed with a nominal capacity of 140 kW. The over-performance resulted from higher than anticipated average electrical output of the CHP System. The average electrical power generated during the Reporting Period (125 kW) is approximately 19% higher than the anticipated average output in the Application Review (105 kW).

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$TSE (\%) = [Gross\ Electrical\ Energy + CHP\ Thermal\ Output\ Utilized] / CHP\ Energy\ Input$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,118	MWh	See comment below table.
CHP Thermal Output Utilized	1,499	MWh	
CHP Energy Input	3,694	MWh	See comment below table.
Total System Efficiency	70.8%	-	

The CHP Energy Input was calculated using two methods, based on the availability of natural gas flowrate data:

- When the metered volumetric flowrate data was available, the energy input was determined using the Natural Gas Higher Heating Value (HHV) of 10.75 kWh/m<sup>3</sup>, obtained from the M&V Plan.
- When the meter flowrate data was not available, the energy input was calculated using the CHP units' electrical output and the part-load data for the Yanmar CP35D1.

The TSE of 70.8% exceeds the minimum 65% Program Requirement.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, the Incentive payable to the Participant is \$127,346.

The Incentive is based on the \$200/MWh of Electricity Savings limiter. Table 6 outlines the Incentive payment calculation.

**Table 6. Incentive Calculation**

Description	Value	Comment
Annual Electricity Savings (MWh)	1,095	From Table 4
<b>Actual Eligible Costs</b>	<b>\$753,479</b>	Per the vendor invoices.
Electricity Billed Savings	\$140,160	Based on the Project Approval Letter Electricity Billing Rate of \$128/MWh
Other Benefits	\$50,888	From the Project Approval Letter
Other Costs	\$139,908	From the Project Approval Letter
Net Project Benefits	\$51,140	Electricity Billed Savings +Other Benefits – Other Costs
<b>Approved Incentive Amount</b>	<b>\$184,000</b>	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$219,000	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Eligible Costs	\$301,392	40% of the minimum of Actual and Estimated Eligible costs.
Limited 3 - Project Payback	\$720,339	Eligible costs minus Net Project Benefits
Project Incentive	\$219,000	Minimum of the three limiters.
Project Incentive paid to Date	\$91,654	Paid for 1st Quarterly Reporting Period.
<b>Final Incentive payable</b>	<b>\$127,346</b>	Project Incentive minus Incentive paid to date.

The table below shows the payment schedule as defined in the contract and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.

## Disclaimer and Limitations

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***Please note:***

Capitalized terms used in this document have the meaning given to them either in the Save on Energy Process and Systems Upgrade Program Rules, or the IPMVP Core Concepts dated October 2016 and Uncertainty Assessment for IPMVP, dated April 2018, as applicable.

***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.



Toronto Hydro-Electric System Limited  
14 Carlton Street  
Toronto, Ontario M5B 1K5



## **Third Party Evaluation Reports**

This document includes the following third party evaluation reports:

### **Process and Systems Upgrades Program:**

- #601916
- #601917
- #601921
- #601922
- #601923
- #601924
- #601930
- #601932



CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period

[Redacted]

[Redacted]

## Cogeneration System

**Project ID:** Toronto-PROJECT-601916

July 28, 2023

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited (THES)

[Redacted]

**Prepared by:**

Aladaco Consulting Inc.

**Prepared in accordance with:**

Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018

## Approvals

	Written by	Reviewed by
Name:	[REDACTED]	[REDACTED]
Date:	July 28, 2023	July 28 <sup>th</sup> , 2023
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
July 28, 2023	M&V Report first issuance.	0	[REDACTED]



## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of July 1, 2022, to June 30, 2023, are 814 MWh, which represents 90% of the Anticipated Electricity Savings.

The in-service date is December 22, 2022; however, THES approved a Reporting Period of July 1, 2022 to June 30, 2023 due to an error in the grid import settings identified by [REDACTED], the Participant's consultant.

The Incentive payable to the Participant for this Reporting Period is \$87,700, calculated in accordance to Program Rules. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings and Incentive payments to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	July 1 to Sept 30, 2022	195	83%	\$24,777
1 <sup>st</sup> Annual	July 1, 2022 to Jun 30, 2023	814	90%	\$103,427

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Adjusted Baseline Energy and the Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of the Project is December 22, 2021, which was established on January 31, 2022.

The 1<sup>st</sup> Quarterly Report was issued on September 9, 2022, for a Reporting Period of December 22, 2021 to March 21, 2022.

A revised 1<sup>st</sup> Quarterly Report was issued on March 13, 2023, for a Reporting Period of July 1 to September 30, 2022.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$127.06/MWh obtained from the Project Letter of Approval.

## Metered Data Analysis

[REDACTED], a representative of THES, provided the M&V data on July 12, 2023 to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Jul 1, 2022 00:00		Start date of the Reporting Period.
Reporting Period End	Jun 30, 2023 23:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date, excluding the shutdown periods noted below.
Available Data	8,693	hours	See comments below.
Shutdown Periods	945	hours	10.9% of the Available Data. See comments below.
Missing Data	67	hours	0.8% of the Reporting Period Duration.
Hours of Operation	8,691	hours	99.2% of the Reporting Period Duration.

[REDACTED] provided a summary of unscheduled shutdowns that occurred during the 1<sup>st</sup> Annual Reporting Period. All the dates the CHP was not operating normally or the system was shut off for repairs are provided below:

- November 1, 6:00 to November 7, 12:59, 2022 (151 hours) due failure of Unit #3,
- November 17, 15:00 to November 22, 12:59, 2022 (118 hours) due failure of Unit #3,
- January 4, 7:00 to January 12, 13:59, 2023 (199 hours) due failure of Unit #2, and
- February 24, 14:00 to March 16, 10:59, 2023 (477 hours) due failure of Unit #2.

The shutdown periods represent 945 hours total, which is divided between two separate data sets as follows:

- Unit #2 – 676 hours which represents 7.8% of the total data for the Reporting Period, and
- Unit #3 – 269 hours which represents 3.1% of the total data for the Reporting Period.

In addition to the dates noted above, there were 67 hours of missing data, or 0.8% of the Reporting Period, with no explanation provided by [REDACTED]. Since the total unavailable for each data sets represents less than 10% of the total data for the Reporting Period, the analysis was completed per Section B.6.2. of the M&V Plan, in the following way (agreed to by THES):



are powered externally and whose power draw was spot metered<sup>3</sup> to be 2.62 kW. Therefore, the Technical Reviewer used the hourly external auxiliary load of 2.62 kW per CHP operating hour to calculate the total auxiliary load energy.

### Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	814	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	814	MWh	
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	904	MWh	Obtained from Table 5 of the M&V Plan
Electricity Savings as a Percentage of Anticipated Electricity Savings	90%	-	
Average Demand Savings	93	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	93	kW	Equal to Summer Peak Generation from Table 3.

The 1<sup>st</sup> Annual Electricity Savings are 814 MWh and represent 90% of the Anticipated Electricity Savings.

The Project was originally planned for a total nominal capacity of 130 kW, consisting of three 65 kW micro-turbines, one operating as emergency backup only. In the completed Project, three 35 kW internal combustion engines were installed with a nominal capacity of 105 kW. The under-performance is due to this re-design which resulted in a lower than anticipated average electrical output of the CHP System. The average electrical power generated during the Reporting Period (93 kW) is approximately 10% lower than the anticipated average output in the Application Review (103 kW) which reflects the 19% decrease in system capacity.

<sup>3</sup> The spot metering of the pumps was done at another Facility operated by [REDACTED] and where a similar type of CHP system, involving Yanmar CP35D1 engines and a similar hot water heat recovery system.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$TSE (\%) = [Gross\ Electrical\ Energy + CHP\ Thermal\ Output\ Utilized] / CHP\ Energy\ Input$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	811	MWh	See comments below table.
CHP Thermal Output Utilized	1,028	MWh	See comments below table.
CHP Energy Input	2,749	MWh	Calculated using the metered volumetric flowrate of natural gas and Natural Gas Higher Heating Value (HHV) of 10.75 kWh/m <sup>3</sup> , obtained from the M&V Plan. See comments below table.
Total System Efficiency	66.9%	-	

The CHP energy input and outputs are the sums of the available data, they have not been extrapolated to account for the shutdown periods. The system achieved a TSE of 66.9%, which exceeds the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period and review of the Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is \$87,700, pending issuance of the Master Payment Requisition.

The Incentive is based on the \$200/MWh of Electricity Savings limiter. Table 6 outlines the Incentive payment calculation.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	814	From Table 4
<b>Eligible Costs</b>	<b>\$588,652</b>	<b>From the 1<sup>st</sup> Master Payment Requisition.</b>
Electricity Billed Savings	\$103,427	Based on the Project Approval Letter Electricity Billing Rate of \$127.06/MWh
Other Benefits	\$49,478	From the Project Approval Letter
Other Costs	\$121,113	From the Project Approval Letter
Net Project Benefits	\$31,792	Electricity Billed Savings + Other Benefits - Other Costs
<b>Approved Incentive Amount</b>	<b>\$180,800</b>	<b>From the Project Approval Letter</b>
Limiter 1 - Electricity Savings	\$162,800	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Eligible Costs	\$235,461	40% of the minimum of Actual and Estimated Eligible costs.
Limiter 3 - Project Payback	\$556,860	Eligible costs minus Net Project Benefits
TSE Incentive Discount	\$0	0% discount for TSE ≥ 65.0%
<b>Project Incentive</b>	<b>\$162,800</b>	<b>Minimum of the three limiters – TSE Incentive Discount</b>
Incentives paid to date	\$75,100	From the 1 <sup>st</sup> Master Payment Requisition.
<b>Incentive payable (Balance Payment) (\$)</b>	<b>\$87,700</b>	<b>Project Incentive - Incentives paid to date</b>

The table below shows the payment schedule as defined in the contract and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.



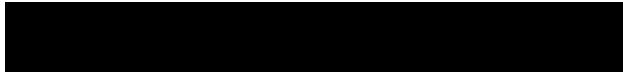
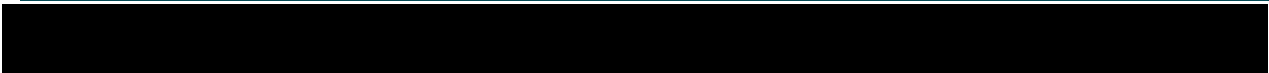




CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES

# Measurement & Verification Report

## 1<sup>st</sup> Annual Reporting Period



## Cogeneration System

**Project ID:** Toronto-PROJECT-601917

July 06, 2023

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited (THES)



**Prepared by:**

Aladaco Consulting Inc.

**Prepared in accordance with:**

Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018

## Approvals

	Written by	Reviewed by
Name:	[REDACTED]	[REDACTED]
Date:	July 6 <sup>th</sup> , 2023	July 6 <sup>th</sup> , 2023
Signature:	[REDACTED]	

## Revision History

Date	Description	Revision	Technical Reviewer
July 6 <sup>th</sup> , 2023	M&V Report first issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of December 23, 2021 to December 22, 2023, are 1,004 MWh, which represents 108% of the Anticipated Electricity Savings.

The Incentive payable to the Participant for this Reporting Period is \$94,394, calculated in accordance to Program Rules. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings and Incentive payments to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Dec 23, 2021, to Mar 22, 2022	262	114%	\$32,488
1 <sup>st</sup> Annual	Dec 23, 2021, to Dec 22, 2022	1,004	108%	\$124,496

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Adjusted Baseline Energy and the Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of the Project is December 23, 2021, which was established on February 2, 2022.

1<sup>st</sup> Quarterly Report was issued on December 7, 2022.

## Metered Data Analysis

[REDACTED] a representative of THES, provided the M&V data on May 10, 2023 to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$124/MWh obtained from the Project Letter of Approval.

## Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Dec 23, 2021 00:00		Start date of the Reporting Period.
Reporting Period End	Dec 22, 2022 23:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date.
Available Data	8,620	hours	
Missing Data	140	hours	1.6% of the Reporting Period Duration.
Hours of Operation	8,617	hours	98.37% of the Reporting Period Duration

There were 140 hours of missing data, or 1.6% of the Reporting Period, which represents less than 10% of the total data for the Reporting Period. The available data was used for the analysis and the missing hours assumed to represent 0 MWh savings, per Section B.6.2. of the M&V Plan.

## Performance of the Measures

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the Baseline Energy is 0 MWh/year.

### Reporting Period Energy

The Reporting Period Energy is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,026	MWh	CHP System Gross Electrical Output (See comment below table)
Auxiliary Loads Energy	22	MWh	Equal to 2.2% of the Gross Electrical Energy (See comment below table).
Reporting Period Energy	1,004	MWh	Gross Electrical Energy – Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	115	kW	Reporting Period Energy divided by Reporting Period Duration.
Summer Peak Generation	119	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

[REDACTED] has indicated that the electrical output readings included in the M&V dataset are net of internal auxiliary loads, which includes the coolant pumps and heat rejection fans. However, there are system pumps that are powered externally and whose power draw was spot metered<sup>3</sup> to be 2.62 kW. Therefore, the Technical Reviewer used the hourly external auxiliary load of 2.62 kW per CHP operating hour to calculate the total auxiliary load energy.

### Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	1,004	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,004	MWh	
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	932	MWh	Obtained from Table 5 of the M&V Plan
Electricity Savings as a Percentage of Anticipated Electricity Savings	108%	-	
Average Demand Savings	115	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	119	kW	Equal to Summer Peak Generation from Table 3.

<sup>3</sup> The spot metering of the pumps was done at another Facility operated by [REDACTED] and [REDACTED] where a similar type of CHP system, involving Yanmar CP35D1 engines and a similar hot water heat recovery system.

The 1<sup>st</sup> Annual Electricity Savings are 1,004 MWh and represent 108% of the Anticipated Electricity Savings.

The Project was originally planned for a total nominal capacity of 125 kW, consisting of a single 125 kW internal combustion engine (ICE). In the completed Project, four 35 kW ICEs were installed with a nominal capacity of 140 kW. The over-performance is due to this re-design which resulted in higher than anticipated average electrical output of the CHP System. The average electrical power generated during the Reporting Period (115 kW) is approximately 8% higher than the anticipated average output in the Application Review (106 kW) which reflects the 12% increase in system capacity.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$TSE (\%) = [Gross\ Electrical\ Energy + CHP\ Thermal\ Output\ Utilized] / CHP\ Energy\ Input$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,026	MWh	See the comment below.
CHP Thermal Output Utilized	1,443	MWh	
CHP Energy Input	3,419	MWh	Calculated using the metered volumetric flowrate of natural gas and Natural Gas Higher Heating Value (HHV) of 10.75 kWh/m <sup>3</sup> , obtained from the M&V Plan.
Total System Efficiency	72.2%	-	

The system achieved a TSE of 72.2%, which exceeds the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period and review of the Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is \$94,394, pending issuance of the Master Payment Requisition.

The Incentive is based on the \$200/MWh of Electricity Savings limiter. Table 6 outlines the Incentive payment calculation.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	1,004	From Table 4
<b>Eligible Costs</b>	<b>\$816,746</b>	From the 1 <sup>st</sup> Master Payment Requisition.
Electricity Billed Savings	\$124,496	Based on the Project Approval Letter Electricity Billing Rate of \$124/MWh
Other Benefits	\$47,391	From the Project Approval Letter
Other Costs	\$133,504	From the Project Approval Letter
Net Project Benefits	\$38,383	Electricity Billed Savings + Other Benefits - Other Costs
<b>Approved Incentive Amount</b>	<b>\$186,400</b>	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$200,800	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Eligible Costs	\$326,698	40% of the minimum of Actual and Estimated Eligible costs.
Limited 3 - Project Payback	\$778,363	Eligible costs minus Net Project Benefits
Project Incentive	\$200,800	Minimum of the three limiters.
Incentives paid to date	<b>\$106,406</b>	From the 1 <sup>st</sup> Master Payment Requisition.
<b>Incentive payable (Balance Payment) (\$)</b>	<b>\$94,394</b>	Project Incentive - Incentives paid to date

The table below shows the payment schedule as defined in the contract and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.

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***Please note:***

Capitalized terms used in this document have the meaning given to them either in the Save on Energy Process and Systems Upgrade Program Rules, or the IPMVP Core Concepts dated October 2016 and Uncertainty Assessment for IPMVP, dated April 2018, as applicable.

***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.







CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES

# Measurement & Verification Report

## 1<sup>st</sup> Annual Reporting Period

[Redacted]

[Redacted] Cogeneration System

**Project ID:** Toronto-PROJECT-601921

October 10, 2023

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited (THES)

[Redacted]

**Prepared by:**

Aladaco Consulting Inc.

**Prepared in accordance with:**

Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018



## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of March 25, 2022 to March 24, 2023, are 1,035 MWh, which represents 108% of the Anticipated Electricity Savings.

The original in-service date was December 24, 2021. However, one of the four units was not working properly after commissioning and THES has approved a Reporting Period starting March 25, 2022. This change was approved after the 1<sup>st</sup> Quarterly Report was issued.

The Incentive payable to the Participant for this Reporting Period is \$125,374, calculated in accordance to Program Rules. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings and Incentive payments to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Dec 24, 2021 to Mar 23, 2022	221	85%	\$26,741
1 <sup>st</sup> Annual	Mar 25, 2022, to Mar 24, 2023	1,035	108%	\$125,235

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Adjusted Baseline Energy and the Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of the Project is December 24, 2021, which was established on March 9, 2022.

The 1<sup>st</sup> Quarterly Report was issued on September 21, 2022.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$121/MWh obtained from the Project Letter of Approval.

## Metered Data Analysis

[REDACTED], a representative of THES, provided the M&V data on June 1, 2023 to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Mar 25, 2022 00:00		Start date of the Reporting Period.
Reporting Period End	Mar 24, 2023 23:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date, excluding the shutdown periods noted below.
Available Data	8,116	hours	
Shutdown Periods	556	hours	6.9% of the Available Data.
Missing Data	88	hours	1.1% of the Reporting Period Duration.
Hours of Operation	8,115	hours	98.92% of the Reporting Period Duration – Shutdown Periods

[REDACTED] the Participant's consultant, provided a summary of unscheduled shutdowns that occurred during the 1<sup>st</sup> Annual Reporting Period. All the dates the CHP was not operating normally or the system was shut off for repairs are provided below:

- May 5, 7:00 to May 10, 12:59, 2022 (126 hours) due damage to the telemetry controller, which needed to be sent for repairs.
- May 26, 7:00 to June 3, 11:59, 2022 (197 hours) due to a gas leak.
- December 17, 14:00 to December 22, 10:59, 2022 (117 hours) due to a short circuit failure.
- December 23, 14:00 to December 28, 9:59, 2022 (116 hours) due an air/fuel sensor failure.

The shutdown periods represent 556 hours total, which represents 6.9%, or less than 10%, of the total data for the Reporting Period. In addition to the dates noted above, there were 88 hours of missing data, or 1.1% of the Reporting Period, with no explanation provided by [REDACTED]

Since the total unavailable data represents less than 10% of the total data for the Reporting Period, the analysis was completed per Section B.6.2. of the M&V Plan, in the following way:

- The remaining 92.0% of data was used to predict the CHP system operation during the unscheduled shutdowns using a linear extrapolation, and
- The missing hours are assumed to represent 0 MWh savings.

## Performance of the Measures

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the Baseline Energy is 0 MWh/year.

### Reporting Period Energy

The Reporting Period Energy is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,058	MWh	CHP System Annualized Gross Electrical Output (See comment below table)
Auxiliary Loads Energy	23	MWh	Equal to 2.1% of the Annualized Gross Electrical Energy (See comment below table).
Reporting Period Energy	1,035	MWh	Gross Electrical Energy – Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	118	kW	Reporting Period Energy divided by Reporting Period Duration.
Summer Peak Generation	130	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

[REDACTED] has indicated that the electrical output readings included in the M&V dataset are net of internal auxiliary loads, which includes the coolant pumps and heat rejection fans. However, there are system pumps that are powered externally and whose power draw was spot metered<sup>3</sup> to be 2.62 kW. Therefore, the Technical Reviewer used the hourly external auxiliary load of 2.62 kW per CHP operating hour to calculate the total auxiliary load energy.

### Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

<sup>3</sup> The spot metering of the pumps was done at another Facility operated by [REDACTED] and [REDACTED] where a similar type of CHP system, involving Yanmar CP35D1 engines and a similar hot water heat recovery system.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	1,035	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,035	MWh	
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	956	MWh	Obtained from Table 5 of the M&V Plan
Electricity Savings as a Percentage of Anticipated Electricity Savings	108%	-	
Average Demand Savings	118	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	130	kW	Equal to Summer Peak Generation from Table 3.

The 1<sup>st</sup> Annual Electricity Savings are 1,035 MWh and represent 108% of the Anticipated Electricity Savings.

The Project was originally planned for a total nominal capacity of 130 kW, consisting of three 65 kW micro-turbines, one operating as emergency backup only. In the completed Project, four 35 kW internal combustion engines were installed with a nominal capacity of 140 kW. The over-performance is due to this re-design which resulted in a higher than anticipated average electrical output of the CHP System. The average electrical power generated during the Reporting Period (118 kW) is approximately 8% higher than the anticipated average output in the Application Review (109 kW) which reflects the 8% increase in system capacity.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$TSE (\%) = [Gross\ Electrical\ Energy + CHP\ Thermal\ Output\ Utilized] / CHP\ Energy\ Input$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	991	MWh	See the comment below.
CHP Thermal Output Utilized	1,186	MWh	
CHP Energy Input	3,281	MWh	Calculated using the metered volumetric flowrate of natural gas and Natural Gas Higher Heating Value (HHV) of 10.75 kWh/m <sup>3</sup> , obtained from the M&V Plan.
Total System Efficiency	66.4%	-	

The CHP energy input and outputs are the sums of the available data, they have not been extrapolated to account for the shutdown periods. The system achieved a TSE of 66.4%, which exceeds the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.



## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period and review of the Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is \$125,374, pending issuance of the Master Payment Requisition.

The Incentive is based on the \$200/MWh of Electricity Savings limiter. Table 6 outlines the Incentive payment calculation.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	1,035	From Table 4
<b>Eligible Costs</b>	<b>\$808,168</b>	From the 1 <sup>st</sup> Master Payment Requisition.
Electricity Billed Savings	\$125,235	Based on the Project Approval Letter Electricity Billing Rate of \$121/MWh
Other Benefits	\$51,336	From the Project Approval Letter
Other Costs	\$140,491	From the Project Approval Letter
Net Project Benefits	\$36,080	Electricity Billed Savings + Other Benefits - Other Costs
<b>Approved Incentive Amount</b>	<b>\$191,200</b>	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$207,000	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Eligible Costs	\$323,267	40% of the minimum of Actual and Estimated Eligible Costs.
Limited 3 - Project Payback	\$772,088	Eligible Costs minus Net Project Benefits
TSE Incentive Discount	\$0	No discount for TSE $\geq$ 65.0%
<b>Project Incentive</b>	<b>\$207,000</b>	<b>Minimum of the three limiters – TSE Incentive Discount</b>
Incentives paid to date	\$81,626	From the 1 <sup>st</sup> Master Payment Requisition.
<b>Incentive payable (Balance Payment) (\$)</b>	<b>\$125,374</b>	Project Incentive - Incentives paid to date

The table below shows the payment schedule as defined in the contract and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES

# Measurement & Verification Report

## 1<sup>st</sup> Annual Reporting Period

### Cogeneration System

**Project ID:** Toronto-PROJECT-601922

June 22, 2023

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited (THES)

**Prepared by:**

Aladaco Consulting Inc.

**Prepared in accordance with:**

Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018

## Approvals

	Written by	Reviewed by
Name:	[REDACTED]	[REDACTED]
Date:	June 22 <sup>nd</sup> , 2023	June 22 <sup>nd</sup> , 2023
Signature:	[REDACTED]	

## Revision History

Date	Description	Revision	Technical Reviewer
June 21, 2023	M&V Report first issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of December 24, 2021 to December 23, 2022, are 1,003 MWh, which represents 112% of the Anticipated Electricity Savings.

The Incentive payable to the Participant for this Reporting Period is \$108,537, calculated in accordance to Program Rules. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings and Incentive payments to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Dec 24, 2021, to Mar 23, 2022	263	102%	\$32,612
1 <sup>st</sup> Annual	Dec 24, 2021, to Dec 23, 2022	1,003	112%	\$124,372

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Adjusted Baseline Energy and the Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of the Project is December 24, 2021, which was established on March 9, 2022.

1<sup>st</sup> Quarterly Report was issued on December 7, 2022.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$124/MWh obtained from the Project Application Review.

## Metered Data Analysis

[REDACTED] a representative of THES, provided the M&V data on May 10, 2023 to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Dec 24, 2021 00:00		Start date of the Reporting Period.
Reporting Period End	Dec 23, 2022 23:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date.
Available Data	8,475	hours	
Missing Data	285	hours	3.3% of the Reporting Period Duration.
Hours of Operation	8,474	hours	96.74% of the Reporting Period Duration

## Performance of the Measures

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the Baseline Energy is 0 MWh/year.

### Reporting Period Energy

The Reporting Period Energy is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,025	MWh	CHP System Gross Electrical Output (See comment below table)
Auxiliary Loads Energy	22	MWh	Equal to 2.2% of the Gross Electrical Energy (See comment below table).
Reporting Period Energy	1,003	MWh	Gross Electrical Energy – Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	114	kW	Reporting Period Energy divided by Reporting Period Duration.
Summer Peak Generation	118	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

The Participant's consultant, [REDACTED], has indicated that the electrical output readings included in the M&V dataset are net of internal auxiliary loads, which includes the coolant pumps and heat rejection fans. However, there are system pumps that are powered externally and whose power draw was spot metered<sup>3</sup> to be 2.62 kW. Therefore, the Technical Reviewer used the hourly external auxiliary load of 2.62 kW per CHP operating hour to calculate the total auxiliary load energy.

### Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	1,003	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,003	MWh	Equal to the Reporting Period Energy
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	899	MWh	Obtained from Table 5 of the M&V Plan
Electricity Savings as a Percentage of Anticipated Electricity Savings	112%	-	
Average Demand Savings	114	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	118	kW	Equal to Summer Peak Generation from Table 3.

<sup>3</sup> The spot metering of the pumps was done at another Facility operated by [REDACTED] and where a similar type of CHP system, involving Yanmar CP35D1 engines and a similar hot water heat recovery system.



The 1<sup>st</sup> Annual Electricity Savings are 1,003 MWh and represent 112% of the Anticipated Electricity Savings.

The Project was originally planned for a total nominal capacity of 130 kW, consisting of three 65 kW micro-turbines, one of which to be standby only. In the completed Project, four 35 kW ICEs were installed with a nominal capacity of 140 kW. The over-performance resulted from higher than anticipated average electrical output of the CHP System. The average electrical power generated during the Reporting Period (114 kW) is approximately 12% higher than the anticipated average output in the Application Review (103 kW).

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$TSE (\%) = [Gross\ Electrical\ Energy + CHP\ Thermal\ Output\ Utilized] / CHP\ Energy\ Input$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,025	MWh	See the comment below.
CHP Thermal Output Utilized	1,474	MWh	
CHP Energy Input	3,347	MWh	Calculated using the metered volumetric flowrate of natural gas and Natural Gas Higher Heating Value (HHV) of 10.75 kWh/m <sup>3</sup> , obtained from the M&V Plan.
Total System Efficiency	74.7%	-	

The system achieved a TSE of 74.7%, which exceeds the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period and review of the Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is \$108,537, pending issuance of the Master Payment Requisition.

The Incentive is based on the \$200/MWh of Electricity Savings limiter. Table 6 outlines the Incentive payment calculation.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	1,003	From Table 4
<b>Eligible Costs</b>	<b>\$774,683</b>	From the 1 <sup>st</sup> Master Payment Requisition (Actual Estimated Costs are lower than Estimated Eligible Costs)
Electricity Billed Savings	\$124,372	Based on the Project Approval Letter Electricity Billing Rate of \$124/MWh
Other Benefits	\$47,873	From the Project Approval Letter
Other Costs	\$133,319	From the Project Approval Letter
Net Project Benefits	\$38,926	Electricity Billed Savings + Other Benefits - Other Costs
<b>Approved Incentive Amount</b>	<b>\$179,800</b>	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$200,600	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Eligible Costs	\$309,873	40% of the minimum of Actual and Estimated Eligible costs.
Limited 3 - Project Payback	\$735,757	Eligible costs minus Net Project Benefits
Project Incentive	\$200,600	Minimum of the three limiters.
Incentives paid to date	<b>\$92,063</b>	From the 1 <sup>st</sup> Master Payment Requisition.
<b>Incentive payable (Balance Payment) (\$)</b>	<b>\$108,537</b>	Project Incentive - Incentives paid to date

The table below shows the payment schedule as defined in the contract and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.

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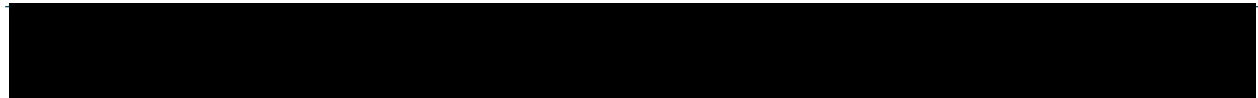
***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.



# Measurement & Verification Report

## 1<sup>st</sup> Quarterly Reporting Period



## Cogeneration

## System

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**Project ID:** Toronto-PROJECT-601923  
August 11, 2022  
Revision 0

**Prepared for:**  
Toronto Hydro-Electric System Limited



**Prepared by:**  
CLEAResult (the Technical Reviewer)  
393 University Avenue, Suite 1622, Toronto, ON M5G 1E6  
(416) 504-3400

Prepared per Program Rules version "saveONenergy Process & Systems Upgrades Program, FINAL v2.0  
April 6, 2018"

## Approvals

	Written by Technical Reviewer	Reviewed by Technical Reviewer
Name:	[REDACTED]	[REDACTED]
Date:	August 3, 2022	August 10, 2022
Signature:	[REDACTED]	

## Revision History

Date	Description	Revision	Technical Reviewer
August 11, 2022	First M&V Report issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Quarterly Reporting Period of December 23, 2021, to March 22, 2022, are 275 MWh, which represents 94% of the Anticipated Electricity Savings.

The Incentive payable to the Participant for this Reporting Period is \$110,155. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Dec 23, 2021 to Mar 22, 2022	275	94%	\$36,025
1 <sup>st</sup> Annual	Dec 23, 2021 to Dec 22, 2022	N/A	N/A	N/A

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date was set to December 23, 2021, on February 2, 2022, by the Technical Reviewer.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$131/MWh obtained from the Project Approval Letter.

## Metered Data Analysis

[REDACTED] the LDC representative, provided the M&V data on May 3, 2022, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	December 23, 2021, 0:00		Start date of the Reporting Period.
Reporting Period End	March 22, 2022, 23:59		End date of the Reporting Period.
Reporting Period Duration	2,160	hours	End date minus start date.
Available Data	2,160	hours	
Missing Data	0	hours	0% of the Reporting Period Duration.
Hours of Operation	2,156	hours	99.8% of the Reporting Period Duration.

## Performance of the Measure

The electrical performance of the Project is based on the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the generation Baseline Energy is 0 MWh/year.



## Reporting Period Energy

The electricity generation of the CHP System for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	281	MWh	
Auxiliary Loads Energy	5.7	MWh	2% of the CHP Gross Electrical Output. See details below Table 3.
Reporting Period Energy	275	MWh	Gross Electrical Energy – Auxiliary Load Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	%	The Uncertainty is the accuracy of the electrical meter.
Average Generation	127	kW	Reporting Period Energy ÷ Reporting Period Duration
Summer Peak Demand Generation	N/A	kW	Summer peak demand period is defined as Monday to Friday, 1:00 pm - 7:00 pm, June 1 to August 31.

The Participant's consultant, [REDACTED], has indicated that the electrical output readings included in the M&V dataset, are net of internal auxiliary loads, which includes the coolant pumps and heat rejection fans. These loads draw their power directly from the internal combustion engines (ICEs). However, there are system pumps that are powered externally and whose power draw was spot metered<sup>3</sup> to be 2.62 kW. The Gross Electrical Energy of 281 MWh is net of the internal auxiliary loads. The 5.7 MWh Auxiliary Loads Energy was calculated based on the 2.62 kW external auxiliary load and 2,156 operating hours.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	275	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	275	MWh	
Uncertainty of the Electricity Savings	± 2.5%		The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	294	MWh	Based on the anticipated annual electricity savings, pro-rated for this Reporting Period according to Table 5 of the M&V Plan.

<sup>3</sup> The spot metering of the pumps was done at another Facility operated by Toronto Community Housing Corporation (TCHC) and where a similar type of CHP system, involving Yanmar CP35D1 engines and a similar hot water heat recovery system.

Electricity Savings as a Percentage of Anticipated Electricity Savings	94%		
Average Demand Savings	127	kW	Equal to Average Generation from Table 3
Summer Peak Demand Savings	N/A	kW	Equal to Summer Peak Demand Generation from Table 3.
Projected Annual Electricity Savings	1,102	MWh/year	For Incentive evaluation purposes only. Assumes the same performance (i.e., 94%) is applicable to the entire 1 <sup>st</sup> Annual Reporting Period.

The 1<sup>st</sup> Quarterly Electricity Savings are 275 MWh, which represents 94% of the Anticipated Electricity Savings. The slight underperformance is likely due to a lower than anticipated uptime of one CHP system.

### Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$\text{Eq. 1 } TSE (\%) = [\text{CHP Gross Energy (MWh)} + \text{CHP Utilized Thermal Output (MWh)}] / \text{CHP Fuel Energy Input (MWh)}$$

**Table 5. Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	281	MWh	From Table 3.
Utilized Thermal Output	434	MWh	
Natural Gas Higher Heating Value (HHV)	10.75	kWh/m <sup>3</sup>	As per the M&V Plan.
CHP Fuel Energy Input (HHV)	940	MWh	Calculated using the Reporting Period metered total natural gas volumetric flowrate and the natural gas HHV.
Total System Efficiency	75.95	%	

The CHP Gross Electrical Energy of 281 MWh is net of internal auxiliary loads. Thus, the actual Gross Electrical Energy is expected to be slightly higher than 281 MWh. Due to lack of data on the internal auxiliary loads, the Technical Reviewer did not account for the internal auxiliary loads to calculate the Gross Electrical Energy. Additionally, the calculated value of TSE 76% is a conservative value given that the actual Gross Electricity is higher than 281 MWh.

The TSE of 76% exceeds the minimum 65% Program Requirement. Note that this TSE value is for information purposes only as the TSE value from the 1<sup>st</sup> Annual Reporting Period will be used to assess whether the Project has met the minimum 65% Program Requirement and whether an Incentive penalty needs to be applied.

## Next Reporting Period

The Participant will need to provide the metered data for the next Reporting Period in the same format as previously provided. The review of the next M&V Report (1<sup>st</sup> Annual Report) will include the analysis of the Electricity Savings and calculation of the Incentive for the 1<sup>st</sup> Annual Reporting Period.

## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Quarterly M&V Reporting Period, the Incentive payable to the Participant is \$110,155, subject to review of Eligible Costs.<sup>4</sup> The Master Payment Requisition will be issued once the Participant has provided the required supporting information, including information required to review the Eligible Costs.

Table 6 outlines the Incentive payment calculation using the latest available information. The Projected Annual Electricity Savings of 1,102 MWh results in an Incentive of \$220,310, which is based on the \$200/MWh of Electricity Savings limiter (capped at 120% of the Approved Amount in the Project Approval Letter), as per the Program Rules. The Incentive payable for the 1<sup>st</sup> Quarterly Reporting Period is \$110,155, which is 50% of \$220,310. Note that the Eligible Costs used in the Incentive calculation are from the Project Approval Letter. The actual Eligible Costs will be reviewed as part of the Payment Recommendation process.

**Table 6. Incentive Calculation**

Description	Value	Comment
Projected Electricity Savings (MWh)	1,102	Projected Annual Electricity Savings, based on applying the 1 <sup>st</sup> Quarterly Reporting Period Performance Ratio of 94% to the Annual Anticipated Electricity Savings of 1,176 MWh.
Estimated Eligible Costs	\$1,983,299	As per the Project Approval Letter
Electricity Billed Savings	\$144,303	Based on the Project Approval Letter Electricity Billing Rate of \$131/MWh
Other Benefits	\$66,869	From the Project Approval Letter
Other Costs	\$184,129	From the Project Approval Letter
Net Project Benefits	\$27,043	Electricity Billed Savings +Other Benefits – Other Costs
<b>Approved Incentive Amount</b>	<b>\$235,200</b>	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$220,310	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Eligible Costs	\$793,320	40% of the minimum of Actual and Estimated Eligible costs.
Limited 3 – Project Payback	\$1,956,256	Eligible costs minus Net Project Benefits
<b>Project Incentive</b>	<b>\$220,310</b>	Minimum of the three limiters.
<b>Incentive payable for 1<sup>st</sup> Quarterly Reporting Period</b>	<b>\$110,155</b>	50% of the Project Incentive

Table 7 provides the Incentive payment schedule.

<sup>4</sup> Note the incentive could be impacted if the actual Eligible Costs are lower than the amount in the Project Approval Letter.

**Table 7. Incentive Payment Schedule**

<b>Deferred Payment Schedule</b>	<b>Projected Date</b>	<b>% of Approved Amount</b>
<b>Payment 1</b>	After issuance of the initial (Q1) M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the initial M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the final (Year 1) M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the final M&V Report, and the total payments made to date.

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CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES

# Measurement & Verification Report

## 1<sup>st</sup> Annual Reporting Period



## Cogeneration System

**Project ID:** Toronto-PROJECT-601924

June 22, 2023

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited (THES)



**Prepared by:**

Aladaco Consulting Inc.

**Prepared in accordance with:**

Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018



## Approvals

	Written by	Reviewed by
Name:	[REDACTED]	[REDACTED]
Date:	June 22 <sup>nd</sup> , 2023	June 22 <sup>nd</sup> , 2023
Signature:	[REDACTED]	

## Revision History

Date	Description	Revision	Technical Reviewer
June 22, 2023	M&V Report first issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of December 23, 2021 to December 22, 2022, are 1,091 MWh, which represents 73% of the Anticipated Electricity Savings.

The Incentive payable to the Participant for this Reporting Period is \$109,829.50, calculated in accordance to Program Rules. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings and Incentive payments to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Dec 23, 2021, to Mar 22, 2022	281	73%	\$37,092
1 <sup>st</sup> Annual	Dec 23, 2021, to Dec 22, 2022	1,091	73%	\$144,012

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Adjusted Baseline Energy and the Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of the Project is December 23, 2021, which was established on February 23, 2022.

1<sup>st</sup> Quarterly Report was issued on September 14, 2022.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on the Application Review Electricity Billing Rate of \$132/MWh. Note, the Electricity Billing Rate in the Project Letter of Approval (\$71.49/MWh) appears incorrect.

## Metered Data Analysis

[REDACTED] representative of THES, provided the M&V data on May 10, 2023 to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Dec 23, 2021 00:00		Start date of the Reporting Period.
Reporting Period End	Dec 22, 2022 23:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date.
Available Data	8,525	hours	
Missing Data	235	hours	2.7% of the Reporting Period Duration. See comments below table.
Hours of Operation	8,673	hours	99.01% of the Reporting Period Duration

There was a total of 235 hours missing from the data set; however, 149 of those hours show only natural gas consumption data missing. This missing data is discussed in more detail in the Total System Efficiency section found further in this report.

## Performance of the Measures

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the Baseline Energy is 0 MWh/year.

### Reporting Period Energy

The Reporting Period Energy is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,113	MWh	CHP System Gross Electrical Output (See comment below table)
Auxiliary Loads Energy	23	MWh	Equal to 2.0% of the Gross Electrical Energy (See comment below table).
Reporting Period Energy	1,091	MWh	Gross Electrical Energy – Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	125	kW	Reporting Period Energy divided by Reporting Period Duration.
Summer Peak Generation	113	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

The Participant's consultant, ██████████, has indicated that the electrical output readings included in the M&V dataset are net of internal auxiliary loads, which includes the coolant pumps and heat rejection fans. However, there are system pumps that are powered externally and whose power draw was spot metered<sup>3</sup> to be 2.62 kW. Therefore, the Technical Reviewer used the hourly external auxiliary load of 2.62 kW per CHP operating hour to calculate the total auxiliary load energy.

### Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	1,091	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,091	MWh	Equal to the Reporting Period Energy
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	1,490	MWh	Obtained from Table 5 of the M&V Plan
Electricity Savings as a Percentage of Anticipated Electricity Savings	73%	-	
Average Demand Savings	125	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	113	kW	Equal to Summer Peak Generation from Table 3.

<sup>3</sup> The spot metering of the pumps was done at another Facility operated by ██████████ and where a similar type of CHP system, involving Yanmar CP35D1 engines and a similar hot water heat recovery system.

The 1<sup>st</sup> Annual Electricity Savings are 1,091 MWh and represent 73% of the Anticipated Electricity Savings.

The Project was originally planned for a total nominal capacity of 195 kW, consisting of two 125 kW internal combustion engines (ICEs), one of which to be permanently derated to 70 kW. In the completed Project, four 35 kW ICEs were installed with a nominal capacity of 140 kW. The under-performance resulted from this re-design which resulted in lower than anticipated average electrical output of the CHP System. The average electrical power generated during the Reporting Period (125 kW) is approximately 27% lower than the anticipated average output in the Application Review (170 kW) which reflects the 28% decrease in system capacity.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$TSE (\%) = [Gross\ Electrical\ Energy + CHP\ Thermal\ Output\ Utilized] / CHP\ Energy\ Input$$

**Table 5. Calculations of Total System Efficiency**

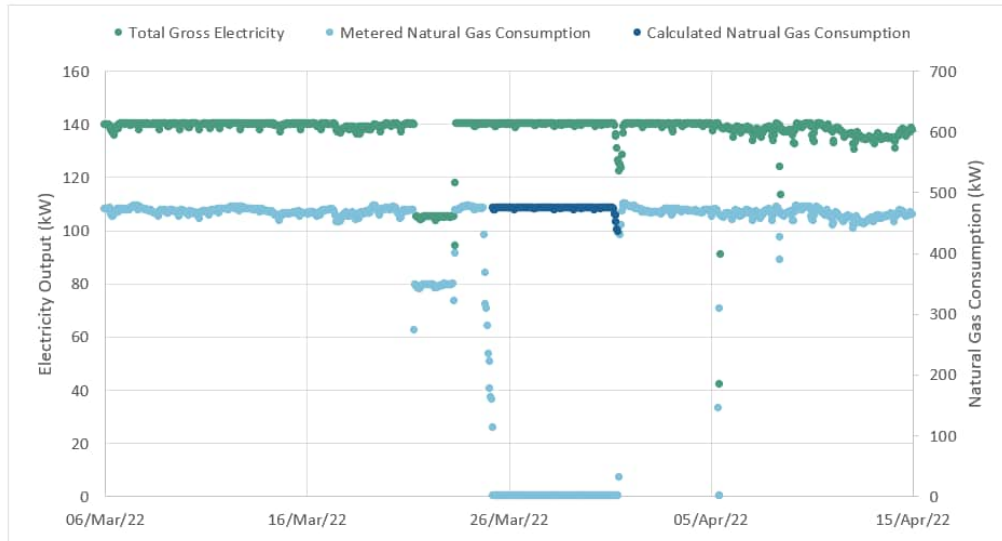
Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,113	MWh	See the comment below.
CHP Thermal Output Utilized	1,476	MWh	
CHP Energy Input	3,754	MWh	See comment below table.
Total System Efficiency	69.0%	-	

The system achieved a TSE of 69.0%, which exceeds the Program Rules minimum requirement of 65%.

The CHP energy input was calculated in two ways:

- From March 25, 2022 at 6:00 to March 31, 2022 at 10:59 the gross electrical output of each ICE along with part load data for the Yanmar CP31D1 model was used to calculate the natural gas consumption.
- The remainder of the Reporting Period was calculated using the metered volumetric flowrate of natural gas and Natural Gas Higher Heating Value (HHV) of 10.75 kWh/m<sup>3</sup>, which was obtained from the M&V Plan.

Figure 1 shows the CHP system operation for both methods detailed above and indicates that the calculated natural gas consumption aligns well with the metered consumption for a similar time period.



**Figure 1. CHP System's gross electrical output and natural gas consumption**

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period and review of the Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is \$109,829.50, pending issuance of the Master Payment Requisition.

The Incentive is based on the \$200/MWh of Electricity Savings limiter. Table 6 outlines the Incentive payment calculation.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	1,091	From Table 4
<b>Eligible Costs</b>	<b>\$776,359.06</b>	From the 1 <sup>st</sup> Master Payment Requisition.
Electricity Billed Savings	\$144,012.00	Based on the Application Review Electricity Billing Rate of \$132/MWh
Other Benefits	\$64,444.00	From the Project Approval Letter
Other Costs	\$170,996.00	From the Project Approval Letter
Net Project Benefits	\$37,460.00	Electricity Billed Savings + Other Benefits - Other Costs
<b>Approved Incentive Amount</b>	<b>\$298,000.00</b>	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$218,200.00	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Eligible Costs	\$310,543.62	40% of the minimum of Actual and Estimated Eligible costs.
Limited 3 - Project Payback	\$738,899.06	Eligible costs minus Net Project Benefits
Project Incentive	\$218,200.00	Minimum of the three limiters.
Incentives paid to date	\$108,370.50	From the 1 <sup>st</sup> Master Payment Requisition.
<b>Incentive payable (Balance Payment) (\$)</b>	<b>\$109,829.50</b>	Project Incentive - Incentives paid to date

The table below shows the payment schedule as defined in the contract and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.

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CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES

# Measurement & Verification Report

## 1<sup>st</sup> Annual Reporting Period



# [Redacted] Cogeneration System

**Project ID:** Toronto-PROJECT-601930

October 17, 2023

Revision 1

**Prepared for:**

Toronto Hydro-Electric System Limited (THES)



**Prepared by:**

Aladaco Consulting Inc.

**Prepared in accordance with:**

Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018

## Approvals

	Written by	Reviewed by
Name:	[REDACTED]	[REDACTED]
Date:	October 11 <sup>th</sup> , 2023	October 11 <sup>th</sup> , 2023
Signature:	[REDACTED]	

## Revision History

Date	Description	Revision	Technical Reviewer
October 11, 2023	M&V Report first issuance.	0	[REDACTED]
October 17, 2023	M&V Report second issuance – the Reporting Period End Date was amended to September 27, 2023, 23:59	1	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of September 28, 2022, to September 27, 2023, are 743 MWh, which represents 92% of the Anticipated Electricity Savings.

The Incentive payable to the Participant for this Reporting Period is \$72,500, calculated in accordance with Program Rules. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings and Incentive payments to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Sept 28 to Dec 27, 2022	194	94%	\$25,608
1 <sup>st</sup> Annual	Sept 28, 2022, to Sept 27, 2023	743	92%	\$98,076

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Adjusted Baseline Energy and the Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of July 15, 2022, was established on August 26, 2022. However, THES has approved a Reporting Period starting September 28, 2022.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$132/MWh obtained from the Project Application Review.

## Metered Data Analysis

[REDACTED] a representative of THES, provided the M&V data on October 10, 2023, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Sept 28, 2022, 00:00		Start date of the Reporting Period.
Reporting Period End	Sept 27, 2023, 23:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date.
Available Data	8,760	hours	
Missing Data	0	hours	0% of the Reporting Period Duration.
Hours of Operation	8,495	hours	96.97% of the Reporting Period Duration and 98.89% of the Estimated Hours of Operation.

## Performance of the Measures

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the Baseline Energy is 0 MWh/year.

### Reporting Period Energy

The Reporting Period Energy is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	765	MWh	CHP System Gross Electrical Output (See comment below table)
Auxiliary Loads Energy	22	MWh	Equal to 2.9% of the Gross Electrical Energy (See comment below table).
Reporting Period Energy	743	MWh	Gross Electrical Energy – Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	85	kW	Reporting Period Energy divided by Reporting Period Duration.
Summer Peak Generation	79	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31. The Reporting Period does not include the Summer Peak period.

The Participant's consultant, [REDACTED], has indicated that the electrical output readings included in the M&V dataset are net of internal auxiliary loads, which includes the coolant pumps and heat rejection fans. However, there are system pumps that are powered externally and whose power draw was spot metered<sup>3</sup> to be 2.62 kW. Therefore, the Technical Reviewer used the hourly external auxiliary load of 2.62 kW per CHP operating hour to calculate the total auxiliary load energy.

### Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

<sup>3</sup> The spot metering of the pumps was done at another Facility operated by [REDACTED] and [REDACTED] where a similar type of CHP system, involving Yanmar CP35D1 engines and a similar hot water heat recovery system.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	743	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	743	MWh	
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	807	MWh	Obtained from Table 5 of the M&V Plan
Electricity Savings as a Percentage of Anticipated Electricity Savings	92%	-	
Average Demand Savings	85	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	79	kW	Equal to Summer Peak Generation from Table 3.

The 1<sup>st</sup> Annual Electricity Savings are 743 MWh and represent 92% of the Anticipated Electricity Savings.

The underperformance of the Project can be primarily attributed to the lower than expected average generation value of the combined CHP system. The Application Review estimated an Average Generation value of 92 kW. The Reporting Period Analysis resulted in an Average Generation of 85 kW (92%). Additionally, Summer Peak Demand Savings were expected to achieve a 91 kW average reduction, where only a 79 kW (87%) reduction was observed.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$TSE (\%) = [Gross\ Electrical\ Energy + CHP\ Thermal\ Output\ Utilized] / CHP\ Energy\ Input$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	765	MWh	
CHP Thermal Output Utilized	1,123	MWh	
CHP Energy Input	2,750	MWh	Calculated using the metered volumetric flowrate of natural gas and Natural Gas Higher Heating Value (HHV) of 10.75 kWh/m <sup>3</sup> , obtained from the M&V Plan.
Total System Efficiency	68.7%	-	

The system achieved a TSE of 68.7%, which exceeds the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO



## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period and review of the Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is \$72,500, pending issuance of the Master Payment Requisition.

The Incentive is based on the \$200/MWh of Electricity Savings limiter. Table 6 outlines the Incentive payment calculation.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	743	From Table 4
<b>Eligible Costs</b>	<b>\$642,962</b>	From the 1 <sup>st</sup> Master Payment Requisition (Actual Eligible Costs are lower than Estimated Eligible Costs)
Electricity Billed Savings	\$98,076	Based on the Project Approval Letter Electricity Billing Rate of \$132/MWh
Other Benefits	\$37,398	From the Project Approval Letter
Other Costs	\$105,730	From the Project Approval Letter
Net Project Benefits	\$29,744	Electricity Billed Savings + Other Benefits – Other Costs
<b>Approved Incentive Amount</b>	<b>\$161,400</b>	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$148,600	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Eligible Costs	\$257,185	40% of the minimum of Actual and Estimated Eligible costs.
Limited 3 - Project Payback	\$613,218	Eligible costs minus Net Project Benefits
Project Incentive	\$148,600	Minimum of the three limiters.
Incentives paid to date	\$76,100	From the 1 <sup>st</sup> Master Payment Requisition.
<b>Incentive payable (Balance Payment) (\$)</b>	<b>\$72,500</b>	Project Incentive - Incentives paid to date

The table below shows the payment schedule as defined in the contract and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.

## Disclaimer and Limitations

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Capitalized terms used in this document have the meaning given to them either in the Save on Energy Process and Systems Upgrade Program Rules, or the IPMVP Core Concepts dated October 2016 and Uncertainty Assessment for IPMVP, dated April 2018, as applicable.

***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES

# Measurement & Verification Report

## 1<sup>st</sup> Annual Reporting Period



### Cogeneration System

**Project ID:** Toronto-PROJECT-601932

July 06, 2023

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited (THES)



**Prepared by:**

Aladaco Consulting Inc.

**Prepared in accordance with:**

Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018

## Approvals

	Written by	Reviewed by
Name:	[REDACTED]	[REDACTED]
Date:	July 6 <sup>th</sup> , 2023	July 5 <sup>th</sup> , 2023
Signature:	[REDACTED]	

## Revision History

Date	Description	Revision	Technical Reviewer
July 6 <sup>th</sup> , 2023	M&V Report first issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of December 23, 2021 to January 28, 2023, are 841 MWh, which represents 89% of the Anticipated Electricity Savings.

The original Reporting Period has been extended by 885 hours (approximately 37 days). Please refer to Table 2 for details.

The Incentive payable to the Participant for this Reporting Period is \$84,758, calculated in accordance to Program Rules. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings and Incentive payments to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Dec 23, 2021, to Mar 27, 2022	208	88%	\$28,080
1 <sup>st</sup> Annual	Dec 23, 2021, to Jan 28, 2023	841	89%	\$113,535

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Adjusted Baseline Energy and the Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of the Project is December 23, 2021, which was established on February 23, 2022.

The 1<sup>st</sup> Quarterly Report was issued on December 8, 2022.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$135/MWh obtained from the Project Letter of Approval.

## Metered Data Analysis

a representative of THES, provided the M&V data on May 10, 2023 to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Dec 23, 2021 00:00		Start date of the Reporting Period.
Reporting Period End	Jan 28, 2023 20:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date, excluding the shutdown periods noted below.
Available Data	8,537	hours	
Missing Data	223	hours	2.5% of the Reporting Period Duration.
Hours of Operation	8,534	hours	97.42% of the Reporting Period Duration

, the Participant's consultant, provided a summary of unscheduled shutdowns that occurred during the 1<sup>st</sup> Annual Reporting Period. All the dates the CHP was not operating normally or the system was shut off for repairs are provided below:

- January 14, 20:00 to January 19, 16:59, 2022 (117 hours) due to an unexpected transformer failure.
- July 18, 11:00 to August 19, 2022, 10:59 (768 hours) due to leak that shorted out the CHP control system and a pump seal failure.

The 1<sup>st</sup> Annual Reporting period was extended by 885 hours to account for these shutdown periods.

In addition to the dates noted above, there were 223 hours of missing data, or 2.5% of the Reporting Period with no explanation provided by . As this represents less than 10% of the total data for the Reporting Period, the available data was used for the analysis and the missing hours assumed to represent 0 MWh savings, per Section B.6.2. of the M&V Plan.

## Performance of the Measures

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

## Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The Reporting Period Energy is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	863	MWh	CHP System Gross Electrical Output (See comment below table)
Auxiliary Loads Energy	22	MWh	Equal to 2.6% of the Gross Electrical Energy (See comment below table).
Reporting Period Energy	841	MWh	Gross Electrical Energy – Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	96	kW	Reporting Period Energy divided by Reporting Period Duration.
Summer Peak Generation	98	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

[REDACTED] has indicated that the electrical output readings included in the M&V dataset are net of internal auxiliary loads, which includes the coolant pumps and heat rejection fans. However, there are system pumps that are powered externally and whose power draw was spot metered<sup>3</sup> to be 2.62 kW. Therefore, the Technical Reviewer used the hourly external auxiliary load of 2.62 kW per CHP operating hour to calculate the total auxiliary load energy.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

<sup>3</sup> The spot metering of the pumps was done at another Facility operated by [REDACTED] and [REDACTED] where a similar type of CHP system, involving Yanmar CP35D1 engines and a similar hot water heat recovery system.



**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	841	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	841	MWh	
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	946	MWh	Obtained from Table 5 of the M&V Plan
Electricity Savings as a Percentage of Anticipated Electricity Savings	89%	-	
Average Demand Savings	96	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	98	kW	Equal to Summer Peak Generation from Table 3.

The 1<sup>st</sup> Annual Electricity Savings are 841 MWh and represent 89% of the Anticipated Electricity Savings.

The Project was originally planned for a total nominal capacity of 125 kW, consisting of a single 125 kW internal combustion engine (ICE). In the completed Project, three 35 kW ICEs were installed with a nominal capacity of 105 kW. The under-performance is due to this re-design which resulted in lower than anticipated average electrical output of the CHP System. The average electrical power generated during the Reporting Period (96 kW) is approximately 11% lower than the anticipated average output in the Application Review (108 kW) which reflects the 16% decrease in system capacity.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$TSE (\%) = [Gross\ Electrical\ Energy + CHP\ Thermal\ Output\ Utilized] / CHP\ Energy\ Input$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	863	MWh	See the comment below.
CHP Thermal Output Utilized	1,210	MWh	
CHP Energy Input	2,970	MWh	Calculated using the metered volumetric flowrate of natural gas and Natural Gas Higher Heating Value (HHV) of 10.75 kWh/m <sup>3</sup> , obtained from the M&V Plan.
Total System Efficiency	69.8%	-	

The system achieved a TSE of 69.8%, which exceeds the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period and review of the Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is \$84,758, pending issuance of the Master Payment Requisition.

The Incentive is based on the \$200/MWh of Electricity Savings limiter. Table 6 outlines the Incentive payment calculation.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	841	From Table 4
<b>Eligible Costs</b>	<b>\$702,516</b>	From the 1 <sup>st</sup> Master Payment Requisition.
Electricity Billed Savings	\$113,535	Based on the Project Approval Letter Electricity Billing Rate of \$135/MWh
Other Benefits	\$42,824	From the Project Approval Letter
Other Costs	\$133,514	From the Project Approval Letter
Net Project Benefits	\$22,845	Electricity Billed Savings + Other Benefits - Other Costs
<b>Approved Incentive Amount</b>	<b>\$189,200</b>	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$168,200	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Eligible Costs	\$281,006	40% of the minimum of Actual and Estimated Eligible costs.
Limited 3 - Project Payback	\$679,671	Eligible costs minus Net Project Benefits
Project Incentive	\$168,200	Minimum of the three limiters.
Incentives paid to date	<b>\$83,442</b>	From the 1 <sup>st</sup> Master Payment Requisition.
<b>Incentive payable (Balance Payment) (\$)</b>	<b>\$84,758</b>	Project Incentive - Incentives paid to date

The table below shows the payment schedule as defined in the contract and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.

## Disclaimer and Limitations

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***Please note:***

Capitalized terms used in this document have the meaning given to them either in the Save on Energy Process and Systems Upgrade Program Rules, or the IPMVP Core Concepts dated October 2016 and Uncertainty Assessment for IPMVP, dated April 2018, as applicable.

***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.



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14 Carlton Street  
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## **Third Party Evaluation Reports**

This document includes the following third party evaluation reports:

### **Process and Systems Upgrades Program:**

- #601936
- #601943
- #601950
- #601954
- #601973
- #601977



CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES

# Measurement & Verification Report

## 1<sup>st</sup> Annual Reporting Period



# Cogeneration System

**Project ID:** Toronto-PROJECT-601936

June 22, 2023

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited (THES)



**Prepared by:**

Aladaco Consulting Inc.

**Prepared in accordance with:**

Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018

## Approvals

	Written by	Reviewed by
Name:	[REDACTED]	[REDACTED]
Date:	June 22 <sup>nd</sup> , 2023	June 22 <sup>nd</sup> , 2023
Signature:	[REDACTED]	

## Revision History

Date	Description	Revision	Technical Reviewer
June 22, 2023	M&V Report first issuance.	0	[REDACTED]



## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of April 13, 2022 to April 12, 2023, are 1,088 MWh, which represents 71% of the Anticipated Electricity Savings.

Note the In-Service Date of the Project is December 29, 2021. However, the start of the Reporting Period was delayed to April 13, 2022 to allow the Participant to rectify issues with the combined heat and power (CHP) system's heat recovery system, which could have impacted the Project's ability to meet the Total System Efficiency (TSE) requirement.

The Incentive payable to the Participant for this Reporting Period is \$101,397.50, calculated in accordance to Program Rules. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings and Incentive payments to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Apr 13 to Jul 12, 2022	285	76%	\$35,521
1 <sup>st</sup> Annual	Apr 13, 2022, to Apr 12, 2023	1,088	71%	\$131,681

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Adjusted Baseline Energy and the Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of the Project is December 29, 2021, which was established on February 23, 2022.

1<sup>st</sup> Quarterly Report was issued on August 15, 2022.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on the Project Letter of Approval Electricity Billing Rate of \$121.03/MWh.

## Metered Data Analysis

[REDACTED] a representative of THES, provided the M&V data on May 10, 2023 to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Apr 13, 2022 00:00		Start date of the Reporting Period.
Reporting Period End	Apr 12, 2023 23:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date.
Available Data	8,483	hours	
Missing Data	277	hours	3.2% of the Reporting Period Duration.
Hours of Operation	8,483	hours	96.84% of the Reporting Period Duration

## Performance of the Measures

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the Baseline Energy is 0 MWh/year.

### Reporting Period Energy

The Reporting Period Energy is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,110	MWh	CHP System Gross Electrical Output (See comment below table)
Auxiliary Loads Energy	22	MWh	Equal to 2.0% of the Gross Electrical Energy (See comment below table).
Reporting Period Energy	1,088	MWh	Gross Electrical Energy – Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	124	kW	Reporting Period Energy divided by Reporting Period Duration.
Summer Peak Generation	130	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

The Participant's consultant, [REDACTED], has indicated that the electrical output readings included in the M&V dataset are net of internal auxiliary loads, which includes the coolant pumps and heat rejection fans. However, there are system pumps that are powered externally and whose power draw was spot metered<sup>3</sup> to be 2.62 kW. Therefore, the Technical Reviewer used the hourly external auxiliary load of 2.62 kW per CHP operating hour to calculate the total auxiliary load energy.

### Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	1,088	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,088	MWh	Equal to the Reporting Period Energy.
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	1,524	MWh	Obtained from Table 5 of the M&V Plan
Electricity Savings as a Percentage of Anticipated Electricity Savings	71%	-	
Average Demand Savings	124	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	130	kW	Equal to Summer Peak Generation from Table 3.

<sup>3</sup> The spot metering of the pumps was done at another Facility operated by [REDACTED] and where a similar type of CHP system, involving Yanmar CP35D1 engines and a similar hot water heat recovery system.

The 1<sup>st</sup> Annual Electricity Savings are 1,088 MWh and represent 71% of the Anticipated Electricity Savings.

The Project was originally planned for a total nominal capacity of 195 kW, consisting of two 125 kW internal combustion engines (ICEs), one of which to be permanently derated to 70 kW. In the completed Project, four 35 kW ICEs were installed with a nominal capacity of 140 kW. The under-performance resulted from this re-design which resulted in lower than anticipated average electrical output of the CHP System. The average electrical power generated during the Reporting Period (124 kW) is approximately 29% lower than the anticipated average output in the Application Review (174 kW) which reflects the 28% decrease in system capacity.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$TSE (\%) = [Gross\ Electrical\ Energy + CHP\ Thermal\ Output\ Utilized] / CHP\ Energy\ Input$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,110	MWh	See the comment below.
CHP Thermal Output Utilized	1,511	MWh	Calculated using the metered volumetric flowrate of natural gas and Natural Gas Higher Heating Value (HHV) of 10.75 kWh/m <sup>3</sup> , which was obtained from the M&V Plan.
CHP Energy Input	3,655	MWh	See comment below table.
Total System Efficiency	71.7%	-	

The system achieved a TSE of 71.7%, which exceeds the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period and review of the Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is \$101,397.50, pending issuance of the Master Payment Requisition.

The Incentive is based on the \$200/MWh of Electricity Savings limiter. Table 6 outlines the Incentive payment calculation.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	1,088	From Table 4
<b>Eligible Costs</b>	<b>\$786,635.01</b>	From the 1 <sup>st</sup> Master Payment Requisition.
Electricity Billed Savings	\$131,680.64	Based on the Project Approval Letter Electricity Billing Rate of \$121.03/MWh
Other Benefits	\$78,570.00	From the Project Approval Letter
Other Costs	\$198,346.00	From the Project Approval Letter
Net Project Benefits	\$11,904.64	Electricity Billed Savings + Other Benefits - Other Costs
<b>Approved Incentive Amount</b>	<b>\$304,800.00</b>	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$217,600.00	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Eligible Costs	\$314,654.00	40% of the minimum of Actual and Estimated Eligible costs.
Limited 3 - Project Payback	\$774,730.37	Eligible costs minus Net Project Benefits
Project Incentive	\$217,600.00	Minimum of the three limiters.
Incentives paid to date	\$116,202.50	From the 1 <sup>st</sup> Master Payment Requisition.
<b>Incentive payable (Balance Payment) (\$)</b>	<b>\$101,397.50</b>	Project Incentive - Incentives paid to date

The table below shows the payment schedule as defined in the contract and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.

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***Please note:***

Capitalized terms used in this document have the meaning given to them either in the Save on Energy Process and Systems Upgrade Program Rules, or the IPMVP Core Concepts dated October 2016 and Uncertainty Assessment for IPMVP, dated April 2018, as applicable.

***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES

# Measurement & Verification Report

## 1<sup>st</sup> Annual Reporting Period



# Cogeneration System

**Project ID:** Toronto-PROJECT-601943

August 30, 2023

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited (THES)



**Prepared by:**

Aladaco Consulting Inc.

**Prepared in accordance with:**

Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018



## Approvals

	Written by	Reviewed by
Name:	[REDACTED]	[REDACTED]
Date:	August 30, 2023	August 29, 2023
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
August 30, 2023	M&V Report first issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of April 20, 2022 to May 8, 2023, are 764 MWh, which represents 89% of the Anticipated Electricity Savings.

The In-Service Date of the Project is December 23, 2021. However, the start of the Reporting Period was delayed to April 20, 2022 due to [REDACTED] shutting off the CHP system while investigating an electrical issue at the facility.

The Incentive payable to the Participant for this Reporting Period is \$63,600, calculated in accordance to Program Rules. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings and Incentive payments to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	April 20 to August 7, 2022	201	104%	\$24,532
1 <sup>st</sup> Annual	April 20, 2022 to May 8, 2023	764	89%	\$93,246

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Adjusted Baseline Energy and the Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of December 23, 2021, was established on January 28, 2022.

The 1<sup>st</sup> Quarterly Report was issued on July 28, 2023.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$122.05/MWh obtained from the Project Application Review.

## Metered Data Analysis

a representative of THES, provided the M&V data on June 2, 2023, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	April 20, 2022 00:00		Start date of the Reporting Period.
Reporting Period End	May 8, 2023 19:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date, excluding the shutdown periods noted below.
Available Data	8,723	hours	
Missing Data	37	hours	0.4% of the Reporting Period Duration.
Hours of Operation	8,717	hours	99.51% of the Reporting Period Duration.

the Participant's consultant, provided a summary of unscheduled shutdowns that occurred during the 1<sup>st</sup> Annual Reporting Period. In June 2022, they discovered that the facility's domestic hot water thermostatic mixing valve (TMV) had failed, which negatively affected the CHP system's useful thermal output and, thus, its Total System Efficiency. Due to this failure, the CHP system was shut off for the following period:

- June 17, 13:00 to July 7, 8:59, 2022 (452 hours).

The 1<sup>st</sup> Annual Reporting period was extended by 452 hours to account for this unscheduled shutdown period.

## Performance of the Measures

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the Baseline Energy is 0 MWh/year.

## Reporting Period Energy

The Reporting Period Energy is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	787	MWh	CHP System Gross Electrical Output.
Auxiliary Loads Energy	23	MWh	Equal to 2.8% of the Gross Electrical Energy (See comment below table).
Reporting Period Energy	764	MWh	Gross Electrical Energy – Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	87	kW	Reporting Period Energy divided by Reporting Period Duration.
Summer Peak Generation	79	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

The Participant's consultant, ██████████, has indicated that the electrical output readings included in the M&V dataset are net of internal auxiliary loads, which includes the coolant pumps and heat rejection fans. However, there are system pumps that are powered externally and whose power draw was spot metered<sup>3</sup> to be 2.62 kW. Therefore, the Technical Reviewer used the hourly external auxiliary load of 2.62 kW per CHP operating hour to calculate the total auxiliary load energy.

## Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	764	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	764	MWh	
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	854	MWh	Obtained from Table 5 of the M&V Plan

<sup>3</sup> The spot metering of the pumps was done at another Facility operated by ██████████ and where a similar type of CHP system, involving Yanmar CP35D1 engines and a similar hot water heat recovery system.

Electricity Savings as a Percentage of Anticipated Electricity Savings	89%	-	
Average Demand Savings	87	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	79	kW	Equal to Summer Peak Generation from Table 3.

The 1<sup>st</sup> Annual Electricity Savings are 764 MWh and represent 89% of the Anticipated Electricity Savings.

The Project was originally planned for a total nominal capacity of 125 kW, consisting of two 125 kW internal combustion engines (ICEs), one of which was stand-by. In the completed Project, three 35 kW ICEs were installed with a nominal capacity of 105 kW. The under-performance is due to this re-design which resulted in lower than anticipated average electrical output of the CHP System. The average electrical power generated during the Reporting Period (87 kW) is approximately 11% lower than the anticipated average output in the Application Review (97 kW) which reflects the 16% decrease in system capacity.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$TSE (\%) = [Gross\ Electrical\ Energy + CHP\ Thermal\ Output\ Utilized] / CHP\ Energy\ Input$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	787	MWh	See the comment below.
CHP Thermal Output Utilized	991	MWh	
CHP Energy Input	2,649	MWh	Calculated using the metered volumetric flowrate of natural gas and Natural Gas Higher Heating Value (HHV) of 10.75 kWh/m <sup>3</sup> , obtained from the M&V Plan.
Total System Efficiency	67.1%	-	

The system achieved a TSE of 67.1%, which exceeds the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period and review of the Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is \$63,600, pending issuance of the Master Payment Requisition.

The Incentive is based on the \$200/MWh of Electricity Savings limiter. Table 6 outlines the Incentive payment calculation.

**Table 6. Incentive Calculation**

Description	Value	Comment
Annual Electricity Savings (MWh)	764	From Table 4
<b>Eligible Costs</b>	<b>\$523,490</b>	From the 1 <sup>st</sup> Master Payment Requisition.
Electricity Billed Savings	\$93,246	Based on the Project Approval Letter Electricity Billing Rate of \$122.05/MWh
Other Benefits	\$37,179	From the Project Approval Letter
Other Costs	\$114,646	From the Project Approval Letter
Net Project Benefits	\$15,779	Electricity Billed Savings + Other Benefits – Other Costs
<b>Approved Incentive Amount</b>	<b>\$170,800</b>	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$152,800	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Eligible Costs	\$209,396	40% of the minimum of Actual and Estimated Eligible costs.
Limited 3 - Project Payback	\$507,710	Eligible costs minus Net Project Benefits
Project Incentive	\$152,800	Minimum of the three limiters.
Incentives paid to date	\$89,200	From the 1 <sup>st</sup> Master Payment Requisition.
<b>Incentive payable (Balance Payment) (\$)</b>	<b>\$63,600</b>	Project Incentive - Incentives paid to date

The table below shows the payment schedule as defined in the contract and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.

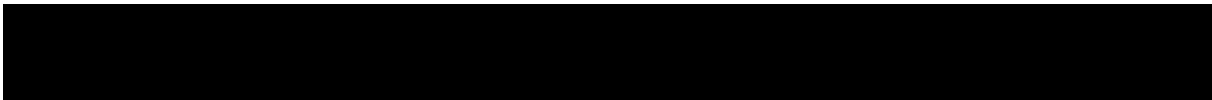






CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period



## Cogeneration System

July 7, 2023

Revision 0

**Project ID:** Toronto-PROJECT-601950

**Prepared for:**

Toronto Hydro-Electric System Limited (the LDC)



**Prepared by:**

Aladaco Consulting Inc. (the Technical Reviewer)

**Prepared in accordance with:**

*Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018*

## Approvals

	Written by	Reviewed by
Name:	██	██
Date:	July 6, 2023	July 7 <sup>th</sup> , 2023
Signature:	██	

## Revision History

Date	Description	Revision	Technical Reviewer
July 7, 2023	First M&V Report issuance.	0	██

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of December 24, 2021, to December 23, 2022, are 933 MWh, which represent 92% of the Anticipated Electricity Savings. The Incentive payable (balance payment) to the Participant for this Reporting Period is \$80,740, calculated in accordance with Program Rules. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Dec 24, 2021, to Mar 23, 2022	267	104%	\$35,713
1 <sup>st</sup> Annual	Dec 24, 2021, to Dec 23, 2022	933	92%	\$124,965

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan Rev.0, dated March 1, 2019, which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data for the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the Measure.
- The Incentive based on the performance of the Measure.

## In-Service Date Confirmation

The In-Service Date is December 24, 2021, which was established on January 28, 2022.

## Metered Data Analysis

[REDACTED] the LDC representative, provided the M&V data on June 2, 2023, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

<sup>1</sup> Percentage of the Anticipated Electricity Savings shown in the M&V Plan.

<sup>2</sup> Based on the Electricity Billing Rate of \$134/MWh shown in the Approval Letter.

## Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Dec 24, 2021, 00:00		Start date of the Reporting Period.
Reporting Period End	Dec 23, 2022, 23:59		End date of the Reporting Period.
Reporting Period Duration	8,760	hours	End date minus start date.
Available Data	8,541	hours	
Missing Data	219	hours	3% of the Reporting Period Duration. See note below.
Hours of Operation	8,538	hours	97% of the Reporting Period duration.

The raw data provided by the Participant included the following periods of missing generation data for the combined heat and power (CHP) System:

- 11 hours from May 17, 7:00 to May 17, 17:00, 2022.
- 166 hours from August 16, 13:00 to August 23, 10:00, 2022.
- 42 hours scattered during the period of October 6 to November 9, 2022.

The total missing data (219 hours) represents 3% of the Reporting Period duration. In an email dated June 2, 2023, Toronto Hydro explained the following reasons for the CHP System shutdown:

- May 17, 2022: Downtime on all CHP units due to electrical issue.
- August 16, to August 23, 2022: Downtime on all CHP units due to equipment issues.

For the periods of missing data, the CHP System was assumed to be not operational for conservativeness, i.e., no generation.

## Performance of the Measure

The Electricity Savings of this cogeneration Project is calculated based on the following equation:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Reporting Period Energy

The electricity generation of the CHP System for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comments
Gross Electrical Energy	955	MWh	Metered electrical output from the CHP System. see note below.
Auxiliary Loads Energy	22	MWh	Equal to 2.62 kW per operating hour. see note below.
Reporting Period Energy	933	MWh	CHP Net Electrical Output. = <i>Gross Electrical Energy</i> – <i>Auxiliary Loads Energy</i>
Uncertainty of the Reporting Period Energy	± 2.5%		The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	106	kW	= <i>Reporting Period Energy</i> ÷ <i>Reporting Period Duration</i>
Summer Peak Demand Generation	111	kW	Summer Peak Demand Period is defined as Monday to Friday, 1:00 pm - 7:00 pm, June 1 to August 31.

The Participant's consultant, [REDACTED], has indicated that the electrical output readings included in the M&V dataset, are net of internal auxiliary loads, which includes the coolant pumps and heat rejection fans. These loads draw their power directly from the internal combustion engines (ICEs). However, there are system pumps that are powered externally and whose power draw was spot metered<sup>3</sup> to be 2.62 kW. The Gross Electrical Energy of 955 MWh is net of the internal auxiliary loads. The 22 MWh Auxiliary Loads Energy was calculated based on the 2.62 kW external auxiliary load and 8,538 operating hours.

### Non-Routine Adjustments

The Technical Reviewer did not identify any Non-Routine Event; therefore, a Non-Routine Adjustment is not required.

### Electricity Savings

The Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comments
Reporting Period Energy	933	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	933	MWh	
Uncertainty of the Electricity Savings	± 2.5%		The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	1,019	MWh	From the Project Letter of Approval.
Electricity Savings as Percentage of Anticipated Electricity Savings	92%		
Average Demand Savings	106	kW	Equal to Average Generation, obtained from Table 3.
Summer Peak Demand Savings	111	kW	Equal to Summer Peak Demand Generation, obtained from Table 3.

<sup>3</sup> The spot metering of the pumps was done at another Facility operated by [REDACTED] and where a similar type of CHP system, involving Yanmar CP35D1 engines and a similar hot water heat recovery system.

The Electricity Savings of the 1<sup>st</sup> Annual Reporting Period are 933 MWh, which represent 92% of the Anticipated Electricity Savings. The underperformance is likely due to the lower than anticipated net electrical output and hours of operation of the CHP System.

The CHP System was anticipated to produce an average net electrical output of 116 kW, whereas the Reporting Period average net electrical output was 106 kW. This is likely due to a change in system configuration; the Project was originally planned for two 125 kW cogeneration systems (one operational standby). In the completed Project, four 35 kW ICEs were installed with a total capacity of 140 kW.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$TSE (\%) = [Gross\ Electrical\ Energy + Recovered\ Heat\ Utilized] / Fuel\ Energy\ Input$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comments
Gross Electrical Energy	955	MWh	Obtained from Table 3. See note below.
Recovered Heat Utilized	1,137	MWh	
Fuel Energy Input	3,080	MWh	Calculated from total volumetric natural gas consumption and a natural gas higher heating value (HHV) of 10.75 kWh/m <sup>3</sup> specified in the M&V Plan.
Total System Efficiency	68%		

The CHP Gross Electrical Energy of 955 MWh is net of internal auxiliary loads. Thus, the actual Gross Electrical Energy is expected to be slightly higher than 955 MWh. Due to lack of data on the internal auxiliary loads, the Technical Reviewer did not account for the internal auxiliary loads to calculate the Gross Electrical Energy. However, the internal auxiliary loads expected to be within the metering uncertainty shown in Table 4. Additionally, the calculated TSE of 68% is a conservative value given that the actual Gross Electrical Energy is higher than 955 MWh.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested.

## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, and review of the Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is \$80,740, pending issuance of the Master Payment Requisition. The Net Project Incentive Amount of \$186,515 was calculated in accordance with the Program Rules and is limited by the “\$200/MWh of Electricity Savings”, up to a maximum of 120% of the Approved Incentive Amount.

Table 6 outlines the Incentive payment calculation using the latest available information.

**Table 6. Incentive Calculation**

Description	Value	Comments
Electricity Savings (MWh)	933	Annual Electricity Savings, from Table 4.
Limiter 1 - Electricity Savings (\$)	186,515	\$200 per MWh of Electricity Savings, limited to 120% of the Approved Incentive Amount.
Actual Eligible Costs (\$)	800,944	Reviewed invoices provided by the Participant.
Estimated Eligible Costs (\$)	971,573	From the Project Letter of Approval.
Limiter 2 - Eligible Costs (\$)	320,378	40% of minimum Actual and Estimated Eligible Costs.
Project Net Benefits (\$)	41,556	= <i>Electricity Billed Savings + Other Benefits (from Letter of Approval) – Other Costs (from Letter of Approval)</i>
Limiter 3 – 1-year Project Payback (\$)	759,388	= <i>Actual Eligible Costs - Project Net Benefits</i>
Approved Incentive Amount (\$)	203,800	From the Project Letter of Approval.
<b>Net Project Incentive (\$)</b>	<b>186,515</b>	Minimum of the three limiters.
<b>Incentives paid to date (\$)</b>	<b>105,775</b>	Paid for the 1 <sup>st</sup> Quarterly Reporting Period.
<b>Incentive payable (Balance Payment) (\$)</b>	<b>80,740</b>	= <i>Net Project Incentive – Incentives paid to date</i>

The table below shows the payment schedule as defined in the contract and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.

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***Please note:***

Capitalized terms used in this document have the meaning given to them either in the Save on Energy Process and Systems Upgrade Program Rules, or the versions of IPMVP Core Concepts and Uncertainty Assessment for IPMVP, as applicable, available at the time of the M&V Plan Approval.

***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.



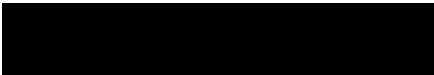




CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES

# Measurement & Verification Report

## 1<sup>st</sup> Annual Reporting Period



## Cogeneration System

**Project ID:** Toronto-PROJECT-601954

July 27, 2023

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited (THES)



**Prepared by:**

Aladaco Consulting Inc.

**Prepared in accordance with:**

Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018

## Approvals

	Written by	Reviewed by
Name:	[REDACTED]	[REDACTED]
Date:	July 27, 2023	July 27 <sup>th</sup> , 2023
Signature:	[REDACTED]	

## Revision History

Date	Description	Revision	Technical Reviewer
July 27, 2023	M&V Report first issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of December 22, 2021, to December 21, 2022, are 1,081 MWh, which represents 106% of the Anticipated Electricity Savings.

The Incentive payable to the Participant for this Reporting Period is \$108,122.50, calculated in accordance to Program Rules. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings and Incentive payments to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Dec 22, 2021, to Mar 21, 2022	272	106%	\$35,904
1 <sup>st</sup> Annual	Dec 22, 2021, to Dec 21, 2022	1,081	106%	\$142,692

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Adjusted Baseline Energy and the Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of the Project is December 22, 2021, which was established on January 28, 2022.

The 1<sup>st</sup> Quarterly Report was issued on July 5, 2022.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$132/MWh obtained from the Project Letter of Approval.

## Metered Data Analysis

██████████ a representative of THES, provided the M&V data on June 2, 2023 to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Dec 22, 2021 00:00		Start date of the Reporting Period.
Reporting Period End	Dec 21, 2022 23:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date, excluding the shutdown periods noted below.
Available Data	8,020	hours	
Shutdown Periods	627	hours	7.8% of the Available Data.
Missing Data	113	hours	1.4% of the Reporting Period Duration.
Hours of Operation	8,020	hours	98.61% of the Reporting Period Duration – Shutdown Periods

██████████ the Participant's consultant, provided a summary of unscheduled shutdowns that occurred during the 1<sup>st</sup> Annual Reporting Period. All the dates the CHP was not operating normally or the system was shut off for repairs are provided below:

- December 30, 4:00, 2021 to January 5, 10:59, 2022 (151 hours) due failure of Unit #4.
- February 19, 16:00 to March 7, 11:59, 2022 (380 hours) due failure of Unit #1.
- July 26, 6:00 to July 30, 5:59, 2022 (96 hours) due gas upgrades that resulted in Unit #1 being turned off.

The shutdown periods represent 627 hours total, which represents 7.8%, or less than 10%, of the total data for the Reporting Period. In addition to the dates noted above, there were 113 hours of missing data, or 1.4% of the Reporting Period, with no explanation provided by ██████████

Since the total unavailable data represents less than 10% of the total data for the Reporting Period, the analysis was completed per Section B.6.2. of the M&V Plan, in the following way:

- The remaining 90.8% of data was used to predict the CHP system operation during the unscheduled shutdowns using a linear extrapolation, and
- The missing hours are assumed to represent 0 MWh savings.

## Performance of the Measures

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the Baseline Energy is 0 MWh/year.

### Reporting Period Energy

The Reporting Period Energy is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,103	MWh	CHP System Gross Electrical Output (See comment below table)
Auxiliary Loads Energy	23	MWh	Equal to 2.1% of the Gross Electrical Energy (See comment below table).
Reporting Period Energy	1,081	MWh	Gross Electrical Energy – Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	123	kW	Reporting Period Energy divided by Reporting Period Duration.
Summer Peak Generation	110	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

[REDACTED] has indicated that the electrical output readings included in the M&V dataset are net of internal auxiliary loads, which includes the coolant pumps and heat rejection fans. However, there are system pumps that are powered externally and whose power draw was spot metered<sup>3</sup> to be 2.62 kW. Therefore, the Technical Reviewer used the hourly external auxiliary load of 2.62 kW per CHP operating hour to calculate the total auxiliary load energy.

### Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

<sup>3</sup> The spot metering of the pumps was done at another Facility operated by [REDACTED] and [REDACTED] where a similar type of CHP system, involving Yanmar CP35D1 engines and a similar hot water heat recovery system.

**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	1,081	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,081	MWh	
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	1,020	MWh	Obtained from Table 5 of the M&V Plan
Electricity Savings as a Percentage of Anticipated Electricity Savings	106%	-	
Average Demand Savings	123	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	110	kW	Equal to Summer Peak Generation from Table 3.

The 1<sup>st</sup> Annual Electricity Savings are 1,081 MWh and represent 106% of the Anticipated Electricity Savings.

The Project was originally planned for a total nominal capacity of 125 kW, consisting of two 125 kW internal combustion engines (ICEs), one operating as emergency backup only. In the completed Project, four 35 kW ICEs were installed with a nominal capacity of 140 kW. The over-performance is due to this re-design which resulted in a higher than anticipated average electrical output of the CHP System. The average electrical power generated during the Reporting Period (123 kW) is approximately 6% higher than the anticipated average output in the Application Review (116 kW) which reflects the 12% increase in system capacity.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$TSE (\%) = [Gross\ Electrical\ Energy + CHP\ Thermal\ Output\ Utilized] / CHP\ Energy\ Input$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,024	MWh	See comments below table.
CHP Thermal Output Utilized	1,283	MWh	See comments below table.
CHP Energy Input	3,404	MWh	Calculated using the metered volumetric flowrate of natural gas and Natural Gas Higher Heating Value (HHV) of 10.75 kWh/m <sup>3</sup> , obtained from the M&V Plan. See comments below table.
Total System Efficiency	67.8%	-	

The CHP energy input and outputs are the sums of the available data, they have not been extrapolated to account for the shutdown periods. The system achieved a TSE of 67.8%, which exceeds the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.



## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period and review of the Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is \$108,122.50, pending issuance of the Master Payment Requisition.

The Incentive is based on the \$200/MWh of Electricity Savings limiter. Table 6 outlines the Incentive payment calculation.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	1,081	From Table 4
<b>Eligible Costs</b>	<b>\$761,764</b>	From the 1 <sup>st</sup> Master Payment Requisition.
Electricity Billed Savings	\$142,692	Based on the Project Approval Letter Electricity Billing Rate of \$132/MWh
Other Benefits	\$43,541	From the Project Approval Letter
Other Costs	\$127,581	From the Project Approval Letter
Net Project Benefits	\$58,652	Electricity Billed Savings + Other Benefits - Other Costs
<b>Approved Incentive Amount</b>	<b>\$204,000</b>	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$216,200	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Eligible Costs	\$304,706	40% of the minimum of Actual and Estimated Eligible costs.
Limited 3 - Project Payback	\$703,112	Eligible costs minus Net Project Benefits
TSE Incentive Discount	\$0	5% discount for TSE $\geq$ 62.5% and $<$ 65.0%
<b>Project Incentive</b>	<b>\$216,200</b>	<b>Minimum of the three limiters – TSE Incentive Discount</b>
Incentives paid to date	\$108,077.50	From the 1 <sup>st</sup> Master Payment Requisition.
<b>Incentive payable (Balance Payment) (\$)</b>	<b>\$108,122.50</b>	Project Incentive - Incentives paid to date

The table below shows the payment schedule as defined in the contract and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES

# Measurement & Verification Report

## 1<sup>st</sup> Annual Reporting Period

[Redacted]

[Redacted] Cogeneration System

**Project ID:** Toronto-PROJECT-601973

July 25, 2023

Revision 0

**Prepared for:**

Toronto Hydro-Electric System Limited (THES)

[Redacted]

**Prepared by:**

Aladaco Consulting Inc.

**Prepared in accordance with:**

Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018

## Approvals

	Written by	Reviewed by
Name:	[REDACTED]	[REDACTED]
Date:	July 25 <sup>th</sup> , 2023	July 24 <sup>th</sup> , 2023
Signature:	[REDACTED]	[REDACTED]

## Revision History

Date	Description	Revision	Technical Reviewer
July 25 <sup>th</sup> , 2023	M&V Report first issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of December 22, 2021 to December 21, 2022, are 1,143 MWh, which represents 94% of the Anticipated Electricity Savings.

The Incentive payable to the Participant for this Reporting Period is \$119,138, calculated in accordance to Program Rules. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings and Incentive payments to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% of Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Dec 22, 2021, to Mar 21, 2022	274	90%	\$35,894
1 <sup>st</sup> Annual	Dec 22, 2021, to Dec 21, 2022	1,143	94%	\$149,733

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Adjusted Baseline Energy and the Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The In-Service Date of the Project is December 22, 2021, which was established on January 28, 2022.

The 1<sup>st</sup> Quarterly Report was issued on August 16, 2022.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$131/MWh obtained from the Project Letter of Approval.

## Metered Data Analysis

[REDACTED] a representative of THES, provided the M&V data on June 1, 2023 to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

### Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	Dec 22, 2021 00:00		Start date of the Reporting Period.
Reporting Period End	Dec 21, 2022 20:59		End date of the Reporting Period
Reporting Period Duration	8,760	Hours	End date minus start date, excluding the shutdown periods noted below.
Available Data	8,729	Hours	
Missing Data	31	Hours	0.4% of the Reporting Period Duration.
Hours of Operation	8,727	Hours	99.62% of the Reporting Period Duration

31 hours, or 2.5% of the Reporting Period, were missing. As this represents less than 10% of the total data for the Reporting Period, the available data was used for the analysis and the missing hours assumed to represent 0 MWh savings, per Section B.6.2. of the M&V Plan.

## Performance of the Measures

The electrical performance of the project is based on the adjusted baseline energy and the reporting period energy, as follows:

$$\text{Electricity Savings} = \text{Adjusted Baseline Energy} - \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Baseline Energy

This is an electricity generation Project with no existing generation. Therefore, the Baseline Energy is 0 MWh/year.

### Reporting Period Energy

The Reporting Period Energy is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comment
Gross Electrical Energy	1,166	MWh	CHP System Gross Electrical Output (See comment below table)
Auxiliary Loads Energy	23	MWh	Equal to 2.0% of the Gross Electrical Energy (See comment below table).
Reporting Period Energy	1,143	MWh	Gross Electrical Energy – Auxiliary Loads Energy.
Uncertainty of the Reporting Period Energy	± 2.5%	-	The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	130	kW	Reporting Period Energy divided by Reporting Period Duration.
Summer Peak Generation	130	kW	Summer peak demand period is defined as Monday to Fridays, 1:00 pm -7:00 pm, June 1 to August 31.

[REDACTED] has indicated that the electrical output readings included in the M&V dataset are net of internal auxiliary loads, which includes the coolant pumps and heat rejection fans. However, there are system pumps that are powered externally and whose power draw was spot metered<sup>3</sup> to be 2.62 kW. Therefore, the Technical Reviewer used the hourly external auxiliary load of 2.62 kW per CHP operating hour to calculate the total auxiliary load energy.

### Electricity Savings

The Baseline Energy, the Reporting Period Energy, and the Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

<sup>3</sup> The spot metering of the pumps was done at another Facility operated by [REDACTED] and [REDACTED] where a similar type of CHP system, involving Yanmar CP35D1 engines and a similar hot water heat recovery system.



**Table 4. Electricity Savings**

Description	Value	Unit	Comment
Baseline Energy	0	MWh	
Reporting Period Energy	1,143	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	1,143	MWh	
Uncertainty of the Electricity Savings	± 2.5%	-	The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	1,217	MWh	Obtained from Table 5 of the M&V Plan
Electricity Savings as a Percentage of Anticipated Electricity Savings	94%	-	
Average Demand Savings	130	kW	Equal to Average Generation from Table 3.
Summer Peak Demand Savings	130	kW	Equal to Summer Peak Generation from Table 3.

The 1<sup>st</sup> Annual Electricity Savings are 1,143 MWh and represent 94% of the Anticipated Electricity Savings.

The Project was originally planned for a total nominal capacity of 160 kW, consisting of a two 125 kW internal combustion engines (ICE), one permanently derated to 35 kW. In the completed Project, four 35 kW ICEs were installed with a nominal capacity of 140 kW. The under-performance is due to this re-design which resulted in lower than anticipated average electrical output of the CHP System. The average electrical power generated during the Reporting Period (130 kW) is approximately 6% lower than the anticipated average output in the Application Review (139 kW) which reflects the 13% decrease in system capacity.

## Total System Efficiency

The Total System Efficiency (TSE) is calculated according to the following equation:

$$TSE (\%) = [Gross\ Electrical\ Energy + CHP\ Thermal\ Output\ Utilized] / CHP\ Energy\ Input$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comment
CHP Gross Electrical Energy	1,166	MWh	See the comment below.
CHP Thermal Output Utilized	1,438	MWh	
CHP Energy Input	3,950	MWh	Calculated using the metered volumetric flowrate of natural gas and Natural Gas Higher Heating Value (HHV) of 10.75 kWh/m <sup>3</sup> , obtained from the M&V Plan.
Total System Efficiency	65.9%	-	

The system achieved a TSE of 65.9%, which exceeds the Program Rules minimum requirement of 65%.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested by the IESO.

## Appendix – Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period and review of the Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is \$119,138, pending issuance of the Master Payment Requisition.

The Incentive is based on the \$200/MWh of Electricity Savings limiter. Table 6 outlines the Incentive payment calculation.

**Table 6. Incentive Calculation**

Description	Value	Comment
Electricity Savings (MWh)	1,143	From Table 4
<b>Eligible Costs</b>	<b>\$749,206</b>	From the 1 <sup>st</sup> Master Payment Requisition.
Electricity Billed Savings	\$149,733	Based on the Project Approval Letter Electricity Billing Rate of \$131/MWh
Other Benefits	\$64,394	From the Project Approval Letter
Other Costs	\$163,417	From the Project Approval Letter
Net Project Benefits	\$50,710	Electricity Billed Savings + Other Benefits - Other Costs
<b>Approved Incentive Amount</b>	<b>\$243,400</b>	From the Project Approval Letter
Limiter 1 - Electricity Savings	\$228,600	\$200 per MWh of Electricity Savings, capped at 120% of Approved Incentive amount.
Limiter 2 - Eligible Costs	\$299,682	40% of the minimum of Actual and Estimated Eligible costs.
Limited 3 - Project Payback	\$698,496	Eligible costs minus Net Project Benefits
Project Incentive	\$228,600	Minimum of the three limiters.
Incentives paid to date	<b>\$109,462</b>	From the 1 <sup>st</sup> Master Payment Requisition.
<b>Incentive payable (Balance Payment) (\$)</b>	<b>\$119,138</b>	Project Incentive - Incentives paid to date

The table below shows the payment schedule as defined in the contract and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.

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***IPMVP defined terms:***

Adjusted Baseline Energy, Avoided Energy Use, Baseline Energy, Baseline Period, Confidence Level, Interactive Effects, M&V, Measurement Boundary, Non-Routine Adjustments, Precision, Reporting Period, Reporting Period Energy, Savings, Static Factors, Uncertainty.





CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

# Measurement & Verification Report 1<sup>st</sup> Annual Reporting Period

[Redacted]

[Redacted] Cogeneration System

June 14, 2023  
Revision 0

**Project ID:** Toronto-PROJECT-601977

**Prepared for:**  
Toronto Hydro-Electric System Limited (the LDC)  
[Redacted]

**Prepared by:**  
Aladaco Consulting Inc. (the Technical Reviewer)

**Prepared in accordance with:**  
*Save On Energy Process & Systems Upgrades Program, Program Requirements, FINAL v2.0 April 6, 2018*

## Approvals

	Written by	Reviewed by
Name:	[REDACTED]	[REDACTED]
Date:	June 14, 2023	June 14 <sup>th</sup> , 2023
Signature:	[REDACTED]	

## Revision History

Date	Description	Revision	Technical Reviewer
June 14, 2023	M&V Report first issuance.	0	[REDACTED]

## Summary

The Electricity Savings for the 1<sup>st</sup> Annual Reporting Period of December 23, 2021, to December 22, 2022, are 737 MWh, which represents 85% of the Anticipated Electricity Savings. The Incentive payable (balance payment) to the Participant for this Reporting Period is \$75,054, calculated in accordance with Program Rules. Refer to the Appendix for details.

The Electricity Savings for each Reporting Period to date are presented in Table 1.

**Table 1. Electricity Savings to Date**

Reporting Period	Start and End Dates	Electricity Savings (MWh)	% Anticipated Electricity Savings <sup>1</sup>	Electricity Cost Savings <sup>2</sup>
1 <sup>st</sup> Quarterly	Dec 23, 2021, to Mar 29, 2022	216	84%	\$28,711
1 <sup>st</sup> Annual	Dec 23, 2021, to Dec 22, 2022	737	85%	\$98,026

## Content Overview

This M&V Report presents the Electricity Savings based on the metered data provided by the Participant for the Project and the methodology described in the M&V Plan Rev.0, dated March 27, 2019, which should be reviewed prior to reading this report. The report assesses the following items:

- The metered data of the Reporting Period.
- The Reporting Period Energy.
- The electrical and thermal performance of the measure.
- The Incentive based on the performance of the measure.

## In-Service Date Confirmation

The Project's In-Service Date is December 23, 2021, which was established on February 23, 2022.

## Metered Data Analysis

[REDACTED] a representative of Toronto Hydro, provided the M&V data, on May 10, 2023, to the Technical Reviewer for analysis. The provided data is compliant with the M&V Plan requirements.

<sup>1</sup> Percent of Anticipated Electricity Savings defined in the M&V Plan.

<sup>2</sup> Based on \$133/MWh obtained from the Project Approval Letter.



## Reporting Period Metrics and System Hours of Operation

Table 2 presents an overview of the values related to the Reporting Period, available data, and hours of operation.

**Table 2. Reporting Period Metrics and System Hours of Operation**

Description	Value	Unit	Comments
Reporting Period Start	December 23, 2021, 00:00		Start date of the Reporting Period.
Reporting Period End	December 22, 2022, 23:59		End date of the Reporting Period
Reporting Period Duration	8,760	hours	End date minus start date.
Available Data	8,716	hours	See note below.
Missing Data	44	hours	0.5% of the Reporting Period Duration.
Hours of Operation	8,445	hours	96.4% of the Reporting Period Duration.

The generation data was not collected during the following periods:

- August 9, 2022, from 03:00 am to 24:00 am (22 hours).
- September 4, 2022, from 03:00 am to 24:00 am (22 hours).

The total missing data (44 hours) represents 0.5% of the Reporting Period duration. In an email dated May 10<sup>th</sup>, 2023, the Participant confirmed that the combined heat and power (CHP) System was operational during these periods and the missing data was replaced with representative data from the previous day.

## Performance of the Measure

The Electricity Savings of this cogeneration Project is calculated based on the following equation:

$$\text{Electricity Savings} = \text{Reporting Period Energy} \pm \text{Non-Routine Adjustments}$$

### Reporting Period Energy

The Reporting Period Energy of the System for this Reporting Period is presented in Table 3.

**Table 3. Reporting Period Energy**

Description	Value	Unit	Comments
Gross Electrical Energy	759	MWh	CHP System Gross Electrical Output (See note below).
Auxiliary Loads Energy	22	MWh	Equal to 2.9% of the Gross Electrical Energy (See note below).
Reporting Period Energy	737	MWh	CHP Net Electrical Output. = <i>Gross Electrical Energy</i> - <i>Auxiliary Loads Energy</i>
Uncertainty of the Reporting Period Energy	± 2.5%		The Uncertainty is mostly due to the accuracy of the meters.
Average Generation	84	kW	= <i>Reporting Period Energy</i> ÷ <i>Reporting Period Duration</i>
Summer Peak Generation	76	kW	Summer peak demand period is defined as June 1 to August 31, Monday to Friday, 1:00 pm -7:00 pm.

The Participant's consultant, [REDACTED], has indicated that the electrical output readings included in the M&V dataset, are net of internal auxiliary loads, which includes the coolant pumps and heat rejection fans. These loads draw their power directly from the internal combustion engines (ICEs). However, there are system pumps that are powered externally and whose power draw was spot metered<sup>3</sup> to be 2.62 kW. The Gross Electrical Energy of 759 MWh is net of the internal auxiliary loads. The 22 MWh Auxiliary Loads Energy was calculated based on the 2.62 kW external auxiliary load and 8,445 operating hours.

### Non-Routine Adjustments

The Technical Reviewer did not identify any Non-Routine Event; therefore, a Non-Routine Adjustment is not required.

### Electricity Savings

The Electricity Savings are presented in Table 4. This is an IPMVP Option B methodology of calculating the Electricity Savings.

**Table 4. Electricity Savings**

Description	Value	Unit	Comments
Reporting Period Energy	737	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	737	MWh	
Uncertainty of the Electricity Savings	± 2.5%		The Uncertainty is the accuracy of the electrical meter.
Anticipated Electricity Savings	865	MWh	Obtained from the M&V Plan.
Electricity Savings as a Percentage of Anticipated Electricity Savings	85%		
Average Demand Savings	84	kW	Equal to Average Generation, obtained from Table 3.
Summer Peak Demand Savings	76	kW	Equal to Summer Peak Demand Generation, obtained from Table 3.

The Electricity Savings of the 1<sup>st</sup> Annual Reporting Period are 737 MWh, which represent 85% of the Anticipated Electricity Savings.

The Project scope was originally based on installation of three 65 kW micro-turbines with a total nominal capacity of 195 kW. However, the installed system comprises of three 35 kW ICEs with a total nominal capacity of 105 kW. The underperformance is a result of the lower capacity of the installed CHP System. The average anticipated net operating electrical output was 119 kW, but the actual average net operating electrical output was 87 kW.

<sup>3</sup> The spot metering of the pumps was done at another Facility operated by [REDACTED] and [REDACTED] where a similar type of CHP system, involving Yanmar CP35D1 engines and a similar hot water heat recovery system.

## Total System Efficiency

The CHP System's Total System Efficiency (TSE) is calculated according to the following equation.

$$TSE (\%) = [Gross\ Electrical\ Energy + Recovered\ Heat\ Utilized] / Fuel\ Energy\ Input$$

**Table 5. Calculations of Total System Efficiency**

Description	Value	Unit	Comments
Gross Electrical Energy	759	MWh	Obtained from Table 3. (See comment below table).
Recovered Heat Utilized	1,198	MWh	
Fuel Energy Input	2,730	MWh	Calculated from total volumetric natural gas consumption and a natural gas higher heating value (HHV) of 10.75 kWh/m <sup>3</sup> , obtained from the M&V Plan.
Total System Efficiency	71.7%		Exceeds the minimum 65% required by the Program.

The CHP Gross Electrical Energy of 759 MWh is net of internal auxiliary loads. Thus, the actual Gross Electrical Energy is expected to be slightly higher than 759 MWh. Due to lack of data on the internal auxiliary loads, the Technical Reviewer did not account for the internal auxiliary loads to calculate the Gross Electrical Energy. Therefore, the calculated TSE of 71.7% is a conservative value given that the actual Gross Electrical Energy is higher than 759 MWh.

## Next Reporting Period

This is the final M&V Report, as the M&V Reporting Period is one year. No additional M&V data will be required, unless requested.

## Appendix - Incentive Payment

Based on the Electricity Savings achieved in the 1<sup>st</sup> Annual Reporting Period, and review of the Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is \$75,054, pending issuance of the Master Payment Requisition. The Net Project Incentive Amount of \$147,407 was calculated in accordance with the Program Rules and is limited by the “\$200/MWh of Electricity Savings”, up to a maximum of 120% of the Approved Incentive Amount.

Table 6 outlines the Incentive payment calculation using the latest available information.

**Table 6. Incentive Calculation**

Description	Value	Comments
Electricity Savings (MWh)	737	Annual Electricity Savings, from Table 4.
Limiter 1 - Electricity Savings (\$)	147,407	\$200 per MWh of Electricity Savings, limited to 120% of the Approved Incentive Amount.
Actual Eligible Costs (\$)	608,706	Reviewed invoices provided by the Participant.
Estimated Eligible Costs (\$)	886,931	From the Project Letter of Approval.
Limiter 2 - Eligible Costs (\$)	243,482	40% of minimum Actual and Estimated Eligible Costs.
Project Net Benefits (\$)	29,532	= <i>Electricity Billed Savings + Other Benefits (from Letter of Approval) – Other Costs (from Letter of Approval)</i>
Limiter 3 – 1-year Project Payback (\$)	579,174	= <i>Actual Eligible Costs - Project Net Benefits</i>
Approved Incentive Amount (\$)	173,000	From the Project Letter of Approval.
<b>Net Project Incentive (\$)</b>	<b>147,407</b>	Minimum of the three limiters.
<b>Incentives paid to date (\$)</b>	<b>72,353</b>	Paid for the 1 <sup>st</sup> Quarterly Reporting Period.
<b>Incentive payable (Balance Payment) (\$)</b>	<b>75,054</b>	= <i>Net Project Incentive – Incentives paid to date</i>

The table below shows the payment schedule as defined in the contract and Program Rules, for reference.

**Table 7. Incentive Payment Schedule**

Deferred Payment Schedule	Projected Date	Incentive Amount
<b>Initial Payment</b>	After issuance of the 1 <sup>st</sup> Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1 <sup>st</sup> Quarterly M&V Report.
<b>Final Payment (Holdback)</b>	After issuance of the 1 <sup>st</sup> Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1 <sup>st</sup> Annual M&V Report, and the total payments made to date.

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