SAVE ON ENERGY | DELIVERY PARTNER™

CONSERVATION FIRST FRAMEWORK: PROCESS & SYSTEMS UPGRADES PROGRAM

Measurement & Verification Report
1st Annual Reporting Period

Regional Municipality of Waterloo
Galt WWTP Digester Gas Cogeneration System

April 1, 2024

Revision 0

Project ID: Cambridge-SCP-601168

Prepared for:

GrandBridge Energy Inc., formerly known as Energy+ Inc. (the LDC)

Regional Municipality of Waterloo (the Participant)

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:	Behnam Haghjou, P.Eng., CEM, CMVP	Mary Steel, P.Eng., CEM, CMVP
Date:	April 1, 2024	April 3rd, 2024
Signature:		

Revision History

Date	Description	Revision	Technical Reviewer
April 1, 2024	First M&V Report issuance.	0	Behnam Haghjou, P.Eng., CEM, CMVP

Summary

The Electricity Savings for the 1st Annual Reporting Period of March 14, 2023, to March 13, 2024, are 4,258 MWh, which represents 91% of the Anticipated Electricity Savings. The Incentive payable (balance payment) to the Participant for this Reporting Period is $469,700, calculated in accordance with the Project Agreement. 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[1]	Electricity Cost Savings[2]
1st Quarterly	Mar 14, 2023, to Jun 13, 2023	1,025	87%	$146,614
1st Annual	Mar 14, 2023, to Mar 13, 2024	4,258	91%	$608,843

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 September 13, 2017, 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 original In-Service Date was November 17, 2021, which was established on February 4, 2022. However, the Reporting Period start date was delayed to March 14, 2023, due to Covid-19 pandemic implications and to allow the Participant to resolve thermal metering problems. The Technical Reviewer assumed the first day of the provided M&V data as the Project's start date which was agreed to by the Participant.

[1] Percentage of the Anticipated Electricity Savings shown in the M&V Plan.

[2] Based on the Electricity Billing Rate of $143/MWh obtained from the Project Application Review.

Metered Data Analysis

Tammy Bellamy, P.Eng., a representative of the Participant, provided the M&V data on March 19, 2024, 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 14, 2023, 0:00		Start date of the Reporting Period.
Reporting Period End	Mar 13, 2024, 23:59		End date of the Reporting Period.
Reporting Period Duration	8,784	hours	End date minus start date. 2024 is a leap year.
Available Data	8,782	hours	
Missing Data	2	hours	See below note 1.
Erroneous Data	39	hours	See below note 2.
Hours of Operation	8,638	hours	98% of the Reporting Period Duration.

1. Generation data was not recorded for two hours on March 10, 2024, 1:00 am and 2:00 am (daylight savings).

2. Generated power, auxiliary loads, digester gas, and natural gas consumption data was recorded erroneously for 39 hours scattered during the Reporting Period. The total erroneous data (39 hours) represents 0.4% of the Reporting Period Duration.

The Technical Reviewer assumed no generation during the periods of missing and erroneous data, for being conservative.

Performance of the Measure

The Electricity Savings of this cogeneration Project is calculated based on the following equation:

Electricity Savings = Reporting Period Energy ± Non-Routine Adjustments

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	Comments
Gross Electrical Energy	4,532	MWh	CHP System Gross Electrical Output.
Auxiliary Load Energy 1	136	MWh	Metered auxiliary loads of the CHP system.
Auxiliary Load Energy 2	138	MWh	Auxiliary loads of the gas conditioning and cooling system. See below note.
Auxiliary Loads Energy	274	MWh	Total of the Auxiliary Loads, which represents 6% of the Gross Electrical Energy.
Reporting Period Energy	4,258	MWh	CHP Net Electrical Output. = *Gross Electrical Energy - Auxiliary Loads Energy*
Uncertainty of the Reporting Period Energy	± 2.5%		The Uncertainty is mostly due to the accuracy of the electrical meters.
Average Generation	485	kW	= *Reporting Period Energy ÷ Reporting Period Duration*
Summer Peak Generation	482	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 of the gas conditioning and cooling system are calculated based on an average electrical power demand of 16 kW and 8,638 hours of operation. In an email dated May 10, 2022, the Participant confirmed that the power demand of 16 kW is based on spot metering of the gas cleaning skid (compressor & chiller) auxiliary loads.

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	4,258	MWh	Obtained from Table 3.
Non-Routine Adjustment	0	MWh	None.
Electricity Savings	4,258	MWh	
Uncertainty of the Electricity Savings	± 2.5%		The Uncertainty is mostly due to the accuracy of the electrical meters.
Anticipated Electricity Savings	4,697	MWh	Obtained from the M&V Plan.
Electricity Savings as a Percentage of Anticipated Electricity Savings	91%		
Average Demand Savings	485	kW	*= Electricity Savings ÷ Reporting Period Duration*
Summer Peak Demand Savings	482	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 1st Annual Reporting Period are 4,258 MWh and represent 91% of the Anticipated Electricity Savings.

The under-performance resulted from lower than anticipated average operating net electrical output of the CHP System. The CHP System was anticipated to produce an average net electrical output of 564 kW whereas the Reporting Period average operating net electrical output was 485 kW, i.e., 14% less. However, this reduction in power was slightly offset by an increase in the hours of operation. The uptime percentage for the CHP System during the Reporting Period (98%) was 4% more than anticipated (95%).

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	4,532	MWh	Obtained from Table 3.
Recovered Heat Utilized	3,395	MWh	
Digester Gas Consumption	898,407	m^3	
Digester Gas Meter Correction Factor	1.05		Provided by the Applicant.
Digester Gas HHV	6.861	kWh/m^3	Based on the analyses of the digester gas for HHV data.
Digester Gas Consumption (HHV)	6,472	MWh	55% of the Fuel Energy Input.
Natural Gas Consumption	371,687	m^3	
Natural Gas HHV	10.836	kWh/m^3	Based on the Enbridge natural gas composition and HHV data.
Natural Gas Meter Correction Factor	1.30		Provided by the Applicant.
Natural Gas Consumption (HHV)	5,236	MWh	45% of the Fuel Energy Input.
Fuel Energy Input	11,708	MWh	= *Digester Gas Consumption (HHV)* + *Natural Gas Consumption (HHV)*
Total System Efficiency	68%		Meets the minimum 65% required by the Program for a CCHP System.

In an email dated May 10, 2022, the Participant confirmed that the raw data from the gas flow meters for both Digester Gas and Natural Gas require correction factors to correct the readings to standard conditions. Analysis showed that without applying the correction factors to the raw data the calculated total Fuel Energy Input would be 88% of the expected values based on the CHP specifications. After applying the provided correction factors the Fuel Energy Input is 100% of the expected value.

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 1st Annual Reporting Period, and review of the Eligible Costs, the Incentive payable (balance payment) to the Participant for this Reporting Period is $469,700, pending the issuance of the Master Payment Requisition.

The Net Project Incentive Amount of $939,400 was calculated in accordance with the Project Agreement.

Table 6 outlines the Incentive payment calculations.

Table 6. Incentive Calculation

Description	Value	Comments
Electricity Savings (MWh)	4,258	Annual Electricity Savings, from Table 4.
Limiter 1 - Electricity Savings ($)	939,400	= *Contractual Incentive Amount* The electrical performance of the 1st Annual Reporting Period (91%) is greater than the Project Agreement threshold of 80%. Not requiring adjustment per the Project Agreement.
Estimated Eligible Costs ($)	5,350,073	From the Project Agreement.
Actual Eligible Costs ($)	8,851,497	Calculated by the Technical Reviewer based on the submitted supporting invoices.
Limiter 2 - Eligible Costs ($)	2,140,029	= *40% of the Estimated Eligible Costs* As per the Small Capital Project Agreement, Limiter 2 will not be adjusted based on Actual Eligible Costs when the Actual Eligible Costs are greater than the Estimated Eligible Costs.
Project Net Benefits ($)	208,051	= *Electricity Billed Savings + Other Benefits (from Application Review) – Other Costs (from Application Review)*
Limiter 3 – 1-year Project Payback ($)	5,142,022	= *Estimated Eligible Costs - Project Net Benefits*
Approved Incentive Amount ($)	939,400	From the Project Agreement.
Net Project Incentive ($)	**939,400**	Minimum of the three limiters.
Incentives paid to date ($)	**469,700**	Paid for the 1st Quarterly Reporting Period.
Incentive payable (Balance Payment)	**469,700**	= *Net Project Incentive – Incentives paid to date*

Table 7 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
Initial Payment	After issuance of the 1st Quarterly M&V Report.	50% of Participant Incentive. The first payment towards the Participant Incentive is calculated based on Electricity Savings in the 1st Quarterly M&V Report.
Final Payment (Holdback)	After issuance of the 1st Annual M&V Report.	The balance payment is the difference between the actual Participant Incentive, calculated based on the 1st 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