RG&E **Integrated EV & Battery Storage** **Date (3Q2019)** **Active**

Project Start Date: 6/*08/2018* **Project End Date:** 12/31/2020

Budget: *$2,112,000* **Current Quarter Spend:** *$0* **Cumulative Spend:** *$2,118,714*

Project Summary: The Integrated EV & Battery Storage Project is demonstrating how battery storage can improve the economics of EV adoption and minimize its impact to the electric grid. The project is demonstrating how battery storage can be integrated with DC fast and level 2 EV chargers in order to manage cost impacts while optimizing the value of the battery system. The system is located at the RG&E Operations Center at 1300 Scottsville Rd in Rochester, NY and consists of two DC fast chargers, five level 2 chargers, and a 150 kW / 600 kWh stationary battery.

Lessons learned:

- **The Customer**
  - No customer lessons learned at this time.
- **The Market**
  - Our experience through Q1 and Q2 of identifying and working to resolve technical issues with the battery system expanded our technical knowledge of this system and has led to a greater appreciation for the current state of maturity of large scale battery storage technology. We must remain diligent in monitoring, testing, and resolving any system anomalies. As a demonstration project, it is important to remain flexible and to use implementation learning to ensure future success of these and other battery storage projects.
- **Utility Operations**
  - Data gathering and reporting must be simple, easy to use, and in a consistent format

Application of lessons learned: The lessons learned will be taken into account for future battery storage projects.

Explanation for over budget:

Issues Identified: Noise generated by the inverter was impacting self-monitoring capabilities of the batter management system.

Solutions Identified: In order to resolve this issue the battery stacks has been replaced in Q2.

Recent Milestones/Targets Met:

- Phase 1 – Closeout: Commissioning and Turnover
- Phase 2 – Initiate: Review Metrics and Information Gathering
- Phase 2 – Plan: Develop Test Plan and Determine Roles & Responsibility

Upcoming Milestones/Targets:

- Phase 2 – Execute: Hypothesis Validation and Data Collection
  - Continued development and refinement of the use case process and procedures
  - Continuation of data collection on the battery and system performance at the site
  - Continued validation of use cases with the collected test data
  - Work to resolve the battery storage capacity discharge issue
  - Work with internal resources to increase the use of the Level II and DC fast charge

Reforming the Energy Vision

Demonstration Project Q3 2019 Report

Integrated Electric Vehicle Charging & Battery Storage System

RG&E

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1.0 Executive Summary

Rochester Gas and Electric Corporation (RG&E or the Company) submits this quarterly report on the progress of the Integrated Electric Vehicle (EV) Charging and Battery Storage System Demonstration Project (Integrated EV & BSS Project). The Integrated EV & BSS Project is demonstrating how battery storage can improve the economics of EV adoption and minimize its impact to the electric grid. The Integrated EV & BSS Project is demonstrating how battery storage can be integrated with DC fast and level 2 EV chargers in order to manage cost impacts while optimizing the value of the battery system. The system is located at the RG&E Operations Center at 1300 Scottsville Road in Rochester, New York. The system consists of two DC fast chargers, five level 2 chargers, and a 150KW and 600kWh stationary battery with a Battery Management System (BMS) to optimize all resources, including building demand.

The Integrated EV & BSS Project consists of two phases, including: Integrated System Installation (Phase I), and Hypothesis Validation and Reporting (Phase II). The entire project is anticipated to take approximately thirty-two months, which includes site preparation, construction, and commissioning of the EV chargers and battery system as well as the validation and testing of the hypothesis, use case functionality and final analysis.

During Q3 2019, with the completion of installation and commissioning in Q2 2019, the project focus has been shifted to the hypothesis validation by implementing the use cases process and procedures, continued data collection on the battery and system performance at the site.

Anticipated plans for Q4 2019 include:

- Continued development and refinement of the use case process and procedures
- Continued data collection on the battery and system performance at the site
- Continued validation of use cases with the collected test data

The following report provides a progress update on the tasks, milestones, checkpoints, and lessons learned to date.

2.0 Demonstration Highlights since the Previous Quarter

2.1 Activity Overview

Activity completed and results for Q3, 2019 included:

- Upgrading of the battery storage cell technology
- Implementing the use cases process and procedures
- Continued of data collection on the battery and system performance at the site

2.1.1 Upgrading of the Battery Storage Cell Technology

The battery system and cells experienced high voltage hysteresis and frequent disconnection over the second quarter of 2019. This has been resolved with the installation and testing of the 2nd generation battery stacks during August, 2019. The battery system has experienced better operational performance since the upgrade.

2.1.2 Development of use case process and procedures

The project team has continued developing procedures for the collection of use case data and a process for reviewing use case performance and effectiveness on a regular basis. Activity in the third quarter included refining metrics to track use cases including peak reduction, building loading factor improvement and demand response participation.

2.1.3 Data collection on the battery and system performance at the site

Collection of battery performance data and system performance monitoring has been consistent since the cell technology upgrade. Detailed metrics highlighting use case performance can be found in section 2.2 below.

2.2 Metrics and Checkpoints

The demonstration project team has completed all the milestones up to “Phase 1 – Execute” and milestones “Phase 2- Initiate” and “Phase 2 – Plan” portion of the project as defined in the Implementation Plan. Since early August, the project team has spent most of its time on data collection and hypothesis validation.

2.1.1 Reducing Circuit Peak Demand

The “Reducing Circuit Peak Demand” use case has been identified as one of the metrics that can measure the impact of battery storage on reducing the peak demand on distribution circuits. Figure 1 shows the maximum daily load of the circuit with and without the presence of battery storage. As it can be seen, the battery storage has significantly reduced the peak demand during the month of September. The average value for the blue and red bars is 204kW and 266kW, respectively.

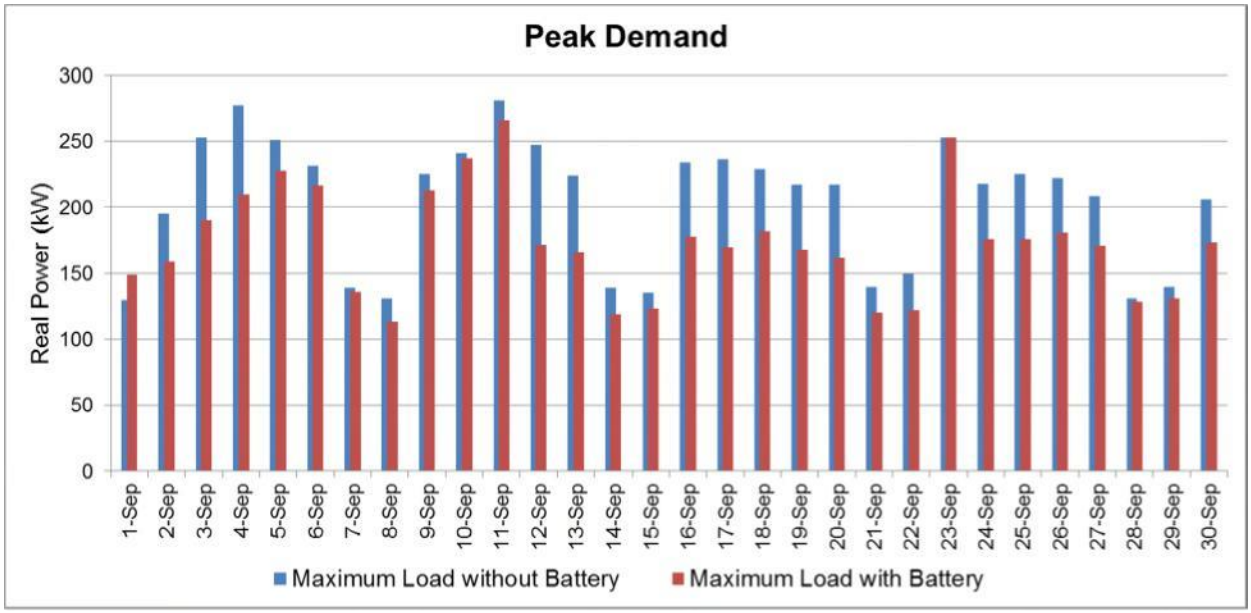

Figure 1. Daily circuit peak demand w and w/o presence of battery storage

Figure 2 shows the average hourly load of the circuit with and without the presence of battery storage during month of September. As it can be seen, the battery storage had a decent performance shifting peak load to off-peak hours by discharging during peak hours (5AM-5PM), and charging during off-peak hours (5PM-5AM).

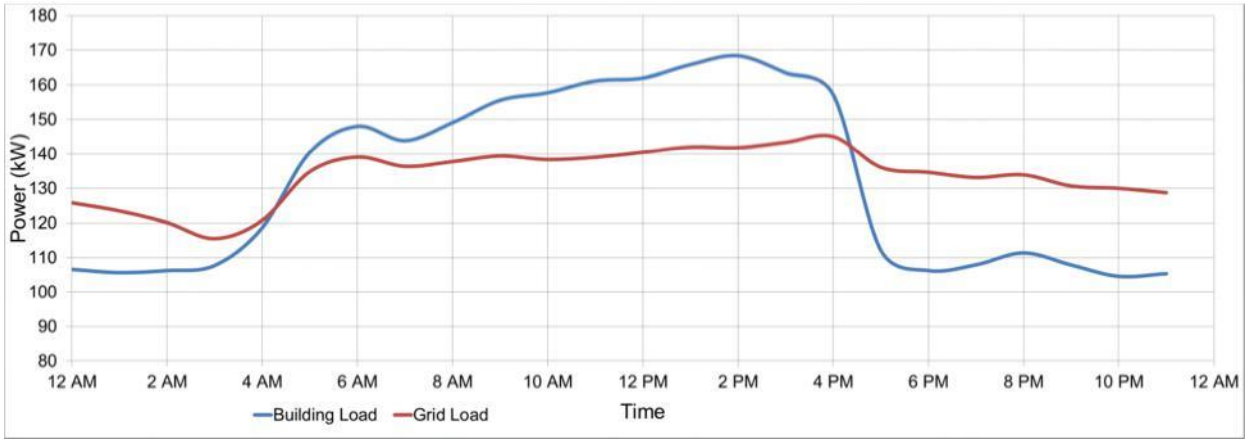

Figure 2. Average hourly circuit peak demand w and w/o presence of battery storage

2.1.2 Building Load Factor

Another metric defined to track the performance of the battery is “Building Load Factor” use case. The load factor is defined as the average load divided by maximum load. Using this definition and data collected during month of September, we tracked building’s load factor on a daily basis. As shown in Figure 3, the battery storage has significantly improved the load factor during the month of September. The average value for the blue and red bars is 65.9% and 78.5%, respectively.

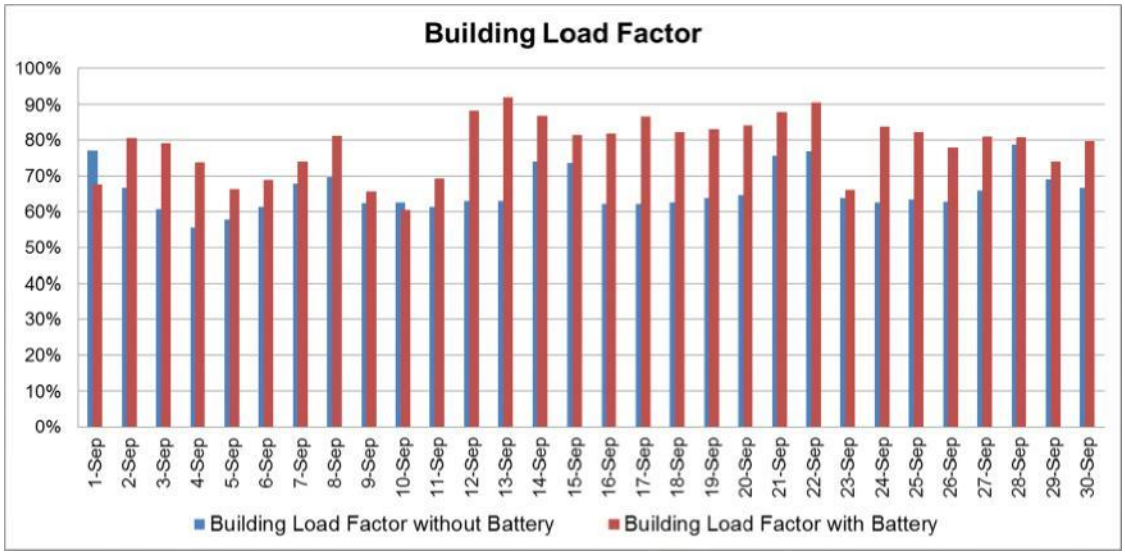

Figure 3. Building load factor w and w/o presence of battery storage

2.1.3 Demand Response

One of the hypotheses identified by the project team was the possibility of leveraging battery storage for demand response. While the deadline for official enrolment in RG&E demand response was passed, the team decided to unofficially participate and record the performance and potential saving that could have been achieved if officially enrolled. Table 1 shows the details of 6 RG&E demand response events during month of July, 2019. The project team managed to participate in 4 out of 6 events. The potential saving from the official participation could have been $1,130.

Table 1: Demand Response Events Participated in July 2019

		Event Date	Time Period	Baseline (kW)	Actual Load (kW)	Actual Reduction (kW)
July 10, 2019 14:00-18:00		7/10/2019	3:00 PM	245.14	155.35	89.8
Performance Factor	**0.82**	7/10/2019	4:00 PM	230.4	154.81	75.59
Total kW	**330.69**	7/10/2019	5:00 PM	228.26	146.3	81.97
Perfomance Payment	**$165.35**	7/10/2019	6:00 PM	159.07	75.74	83.33
July 11, 2019 14:00-18:00		7/11/2019	3:00 PM	227.02	218.18	8.84
Performance Factor	**0**	7/11/2019	4:00 PM	213.36	217.03	-3.67
Total kW	**0.00**	7/11/2019	5:00 PM	211.38	213.21	-1.83
Perfomance Payment	**$0.00**	7/11/2019	6:00 PM	147.31	172.01	-24.7
July 16, 2019 14:00-18:00		7/16/2019	3:00 PM	241.84	265.13	-23.29
Performance Factor	**0**	7/16/2019	4:00 PM	221.44	254.42	-32.98
Total kW	**0.00**	7/16/2019	5:00 PM	212.89	240.73	-27.84
Perfomance Payment	**$0.00**	7/16/2019	6:00 PM	151.67	154.61	-2.94
July 18, 2019 14:00-18:00		7/18/2019	3:00 PM	273.22	160.62	112.6
Performance Factor	**1**	7/18/2019	4:00 PM	252.4	155.72	96.68
Total kW	**404.28**	7/18/2019	5:00 PM	241.81	144.35	97.46
Perfomance Payment	**$202.14**	7/18/2019	6:00 PM	173.49	75.95	97.54
July 19, 2019 14:00-18:00		7/19/2019	3:00 PM	273.22	168.63	104.59
Performance Factor	**0.96**	7/19/2019	4:00 PM	252.4	143.39	109.02
Total kW	**385.44**	7/19/2019	5:00 PM	241.81	138.08	103.73
Perfomance Payment	**$192.72**	7/19/2019	6:00 PM	173.49	105.39	68.1
July 29, 2019 14:00-18:00		7/29/2019	3:00 PM	272.28	103.71	168.57
Performance Factor	**1**	7/29/2019	4:00 PM	259.91	101.05	158.86
Total kW	**571.41**	7/29/2019	5:00 PM	253.71	98.66	155.06
Perfomance Payment	**$285.71**	7/29/2019	6:00 PM	207.16	118.25	88.92

	Enrolled Load Reduction (kW) (July)	July Performance Factor	July Reservation Payment	July Performance Payment	July Total Payment
CSRP-Reservation and Performance	100	0.63	$ 283.50	$ 845.91	$ 1,129.41

2.3 Issues

Upon installation of 2nd generation Powin battery in Q2 2019, the team started operating battery and collecting data. The analysis of data showed that out of total battery capacity of 700kWh, only 520kWh could be used. The issue has been communicated with the manufacture and Powin claimed that once the upgraded battery software is available, it will increase the available capacity. The team will address the progress in resolving this issue in Q4 2019 report.

Upon collection of data in Q3 2019, the team has noticed that EV chargers are rarely used. The team has identified this issue and is working with internal communication channels in the company to encourage employees and fleet management to use the chargers. Due to this limited use of EV chargers, the team was unable to track some of the metrics and use cases related to combinational usage of EV and Energy Storage. The team will address the progress in resolving this issue in Q4 2019 report.

3.0 Work Plan

3.1 Budget Review

3.2 Updated Work Plan

Milestone	Description	Date
Phase 1 - Initiate	Vendors Selected and Kick Off Meeting	Complete
Phase 1 - Plan	Engineering and Procuring Equipment	Complete
Phase 1 - Execute	Construction and Testing	Complete
Phase 1 - Closeout	Commissioning and Turnover	Complete
Phase 2 - Initiate	Review Metrics and Information Gathering	Complete
Phase 2 - Plan	Develop Test Plan and Determine Roles & Responsibility	Complete
Phase 2 - Execute	Hypothesis Validation and Data Collection	January 2019 – December 2020
Phase 2 -Closeout	Results and Report Creation, Scalability Analysis, Demonstration Project Completion	October 2020 - December 2020

The work plan shown above as developed as part of the Implementation Plan has no changes to the current milestones. Milestones “Phase 1 – Initiate, Plan, and Execute” as well as “Phase 2 – Initiate and Plan” are all complete. The project is currently focusing on the “Phase 2 – Execute” milestone.

3.3 Next Quarter Planned Activities

In Q4, 2019 the project team aims to continue the following tasks:

Phase 2 - Execute

- Continued development and refinement of the use case process and procedures
- Continuation of data collection on the battery and system performance at the site
- Continued validation of use cases with the collected test data
- Work to resolve the battery storage capacity discharge issue
- Work with internal resources to increase the use of the Level II and DC fast charges

4.0 Conclusion / Lessons Learned

Our experience through Q1, Q2 and Q3 of identifying and working to resolve technical issues with the battery system has expanded our technical knowledge of this system and has led to a greater appreciation for the current state of maturity of battery storage technology. We must remain diligent in monitoring, testing, and resolving any system anomalies. As a demonstration project, it is important to remain flexible and to use implementation learning to ensure future success of these and other battery storage projects.