NYSEG RG&E

Mark O. Marini
Director - Regulatory

April 20, 2018

VIA EMAIL

Honorable Kathleen Burgess
Secretary, New York State Public Service Commission
Three Empire State Plaza
Albany, New York 12223

Re: Case 14-M-0101 – Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision (REV) – Demonstration Projects

Dear Secretary Burgess:

On behalf of New York State Electric & Gas Corporation and Rochester Gas and Electric Corporation (collectively, "the Companies"), enclosed for filing are the proposed Aggregated Behind the Meter Energy Storage Demonstration Project and Integrated Electric Vehicle Charging & Battery Storage System Demonstration Project. The Companies request confirmation from Staff that each of these storage projects as proposed would be considered as projects meeting the requirements under Ordering Clause 5 of the March 9, 2017 Order in Case 16-M-0411.

Please contact me if you have any questions regarding this matter.

Respectfully submitted,

Mark O. Marini

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Attachments

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AVANGRID

New York Energy Storage Initiative

REV Demonstration Project Outline

Aggregated Behind the Meter Energy Storage

1. Executive Summary

New York commercial and industrial ("C&I") customers are continually looking for a way to reduce their electricity costs. Opportunity exists in the emerging energy storage market and New York State Electric & Gas ("NYSEG") believes that Behind the Meter ("BTM") battery storage has great potential in reducing a customer's electric bill while simultaneously stacking additional value streams with left-over capacity such as providing overall system benefits. Recently, in states such as California and Hawaii, the behind-the-meter battery storage market has grown considerably. This growth has been driven by installations at C&I customer sites. A big reason for this growth is there is no need for customers to change or limit their operations to reduce load that is, by charging batteries off peak for use during on peak hours to reduce their demand charges while gaining revenue through participation in ISO or local utility programs that provide electric system benefits. Customer adoption of BTM battery storage is virtually non-existent today in NYSEG's territory due to high upfront installation costs and the limited ability of single customers to participate in the New York Independent System Operator ("NYISO") Demand Response or wholesale markets due to required size limitations.

NYSEG is proposing a partnership with a third-party market partner to install a mixture of small (~50 kW), medium (~150 kW), and large (~300 kW) battery installations for a range of C&I customers within the footprint of the Energy Smart Community ("ESC") located in Ithaca, NY. The advanced grid architecture in the ESC footprint allows NYSEG and its market partner to maximize the benefits that these advanced technologies offer. NYSEG aims to enroll and aggregate up to eight (8) customers in the battery storage offering, with a total capacity of approximately 1.060 MW and 4.2 MWh. Ideally, these customers will have a mix of peak loads on the system with enough variation in load profiles to enable effective aggregation. NYSEG will partner with a third-party to provide the software to aggregate and dispatch the batteries, while remaining the sole owner of these BTM battery storage systems throughout the proposed three-year demonstration period. Participating customers will enjoy the guaranteed bill-saving benefits of a battery storage system without the upfront cost of installation and in return pay a nominal fee to NYSEG and its partner for these benefits.

NYSEG will validate four hypotheses through several individual use cases, with other use cases being evaluated and added after the first year of operation. The first hypothesis to validate is that customers are interested in BTM battery storage and can realize bill savings through demand charge reduction, generation cost reduction and capacity tag reduction. The second hypothesis to be validated will verify that revenue can be generated from the NYSEG and New York Independent System Operator ("NYISO") demand response markets. The third hypothesis will validate whether system benefits can be gained from charging and discharging the battery for customer use when additional capacity is available after performing customer demand charge management and participating in demand response events. The final hypothesis will validate whether alternative rates can be utilized to

incentivize the use of BTM battery storage for some commercial and industrial customers. NYSEG and its market partner will also explore additional opportunities to provide electric system benefits and generate market revenue. In addition, NYSEG will gain valuable qualitative and quantitative insight into the performance and capability of BTM energy storage from this project aligning with NYSEG becoming a Distributed Service Provider ("DSP") according to its Distributed System Implementation Plan ("DSIP") that was filed in June, 2016.

This demonstration project directly addresses five Reforming the Energy Vision ("REV") Demonstration principles with its support of creative partnerships, stacked and shared value streams, time-of-use and standby rate support, distribution support, and most importantly through creative customer engagement efforts.

The experience and learnings gained from this demonstration project will help expand the program to accommodate future BTM battery ownership models as the market evolves. NYSEG's experience with third-party aggregation and dispatching utility-owned batteries will help to inform the integration of third-party aggregated DERs into the distribution system. The results of this demonstration project will inform what a scalable business model may look like for all parties and address key questions, including the most beneficial ownership model, and customer load profiles that yield the most benefit. This project will allow NYSEG to understand the market for BTM battery storage systems locally within the ESC, the potential market within the larger service territory, and the potential system benefits that BTM battery storage systems offer.

2. Business Model(s) Overview

a. Problem

Commercial and Industrial customers are continually looking for ways to reduce their maximum demand to help reduce their energy costs. Today, there are four typical methods C&I customers may employ to reduce their electric bills;

1. Energy Efficiency – Customers reduce total energy usage to lower energy supply costs. This approach requires investment in energy efficient equipment which customers typically delay until the relevant equipment requires replacement and therefore not always practical.

2. Behavioral Change – Customers can reduce their demand by changing energy usage patterns. This is typically not practical for most Commercial & Industrial customers who may not be able to change their operations without impact to revenues or they may not have access to valuable energy usage information to gain insights on drivers that most influence their demand charges.

3. Demand Response ("DR") – Customers can participate in demand response programs through NYSEG or NYISO. These programs may also contain barriers for commercial and industrial customers who cannot reduce their load sufficiently when called upon to participate. NYSEG customer participation in demand response programs has been limited as evidenced by Figure 1 below.

Sponsor	Program	Participants	Meters	MW
NYSEG	Commercial System Relief Program ("CSRP")	2	51	13
NYISO	Special Case Resource ("SCR")	3	5	44

Figure 1: NYSEG Customer Participation in Demand Response

4. Distributed Generation ("DG") – Customers install BTM generation that operates in parallel with the distribution system, such as a gas turbine or solar photovoltaic ("PV") panels. This approach is typically difficult to implement for the majority of small to mid-sized C&I customers because of the large initial investment.

The first three methods are more traditional solutions and have been common practice for many years throughout the electric industry. Changes in regulatory policy, the addition of net metering tariffs, and declining development costs for newer technological solutions such

as solar PV and battery storage have begun to reshape the electric industry from both a customer and distribution company perspective.

In other states such as California and Hawaii, battery storage technologies have proven to be an effective method for commercial customers to reduce their demand charge and therefore their energy costs. Battery storage solves a number of problems that plague the conventional methods for customers to reduce their demand charge by removing the need for customers to change or limit their operations to reduce load and customers may take advantage of reduced rates to charge batteries off peak for use during on peak hours. However, despite these benefits, high initial installation costs continue to present a barrier to adoption. Access to revenues generated from participation in NYISO Demand Response or wholesale markets are limited for single customers due to minimum size requirements. Even for a customer with a battery that meets the size requirements to participate directly in a NYISO market, the time required to manage the bids and dispatch the battery when called upon often inhibits participation.

Under NYSEG's current rate structure, demand customers are charged for their peak demand regardless of whether or not it aligns with local circuit or system peaks. Therefore, if a customer installed and used a battery for energy arbitrage and demand charge reduction, while the customer may see bill savings, their load shape may not provide the most optimum benefits to the local distribution circuit or the broader electric system. This presents a missed opportunity to harmonize customer and system benefits with the deployment of energy storage technology.

Additionally, NYSEG has no technical or operational experience with aggregated behind the meter battery storage systems. As the cost of battery storage declines customers will look to this type of Distributed Energy Resource ("DER") as a solution for various behind the meter issues. Experience with integrating aggregated BTM battery storage with advanced grid architecture such as telecommunications and an Advanced Distribution Management System ("ADMS") will become critical to understanding the impacts of BTM battery storage in the future.

b. Solution

A number of third-party companies have entered the energy storage market to insulate the customer from some of the added cost and complexity that comes with BTM battery storage solutions. These companies participate in utility and ISO markets on behalf of their customers, by aggregating multiple battery storage installations under their control that may not otherwise be able to participate in these markets on their own. They additionally support these dispatch efforts with extra capacity available after also reducing their customer's demand charges. While NYSEG has not seen a large volume of participation in these markets yet, we believe that as the cost of battery storage technologies falls, additional market opportunities develop, and aggregation software improves, there will be an increase

in participation. A partnership with a third-party to deploy and aggregate BTM battery storage systems will enable NYSEG to learn and prepare for the emergence of this new market.

This project aligns with NYSEG's plans to become a Distributed Service Provider ("DSP") according to its Distributed System Implementation Plan ("DSIP") that was filed in June, 2016. Communicating with a third-party aggregator of distributed resources is a critical component of how NYSEG will control the distribution system in the future.

NYSEG is proposing a partnership with a third-party market partner to install a mixture of small (~50 kW), medium (~150 kW), and large (~300 kW) battery installations for a range of commercial customers within the footprint of the Energy Smart Community ("ESC") located in Ithaca, NY. NYSEG aims to choose up to eight (8) customers to enroll in the battery storage offering, with a total capacity of approximately 1.06 MW and 4.2 MWh. Ideally, these customers will be a mix of small, medium, and large peak loads on the system with enough variation in load profiles to enable effective aggregation. Selection will be based on an analysis of the customer's load profile where available to determine the customer's potential bill savings if they were to install a battery system.

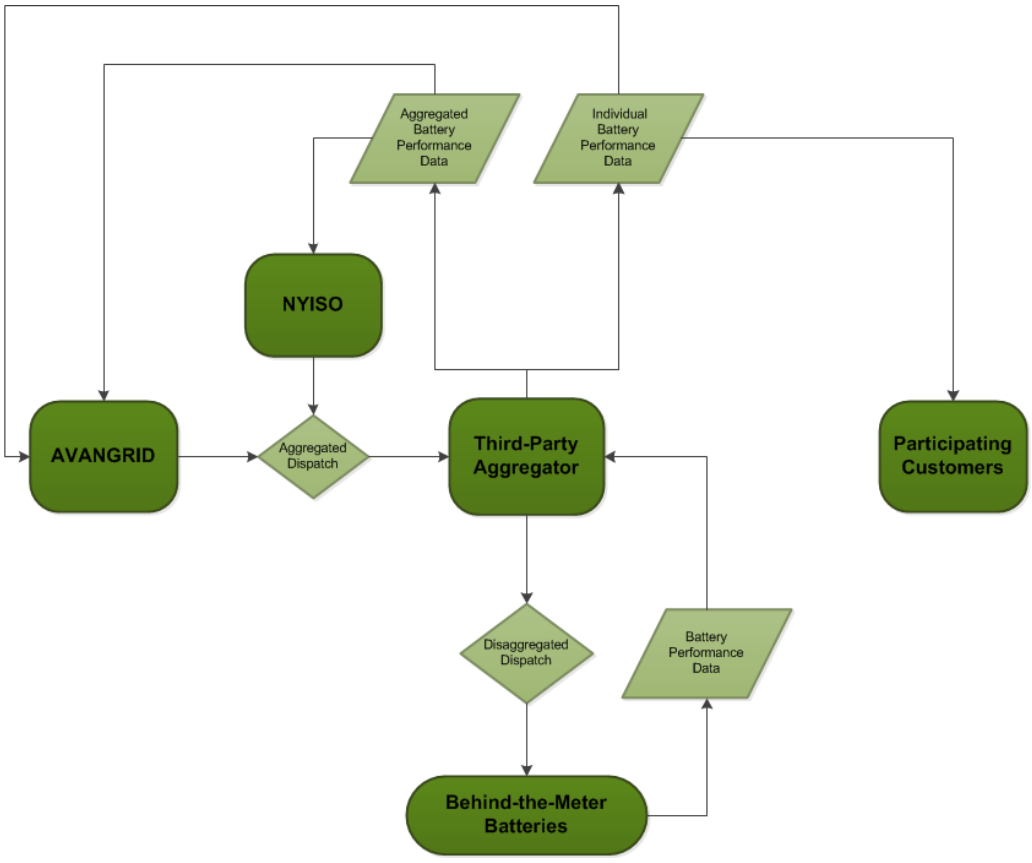

Figure 2 Information Flow Diagram for the BTM Demonstration Project

NYSEG will partner with a third-party to aggregate and dispatch the batteries, while remaining the sole owner of these BTM battery storage systems. As shown in Figure 2, the third-party will register as an aggregator with NYISO and NYSEG and manage the participation of the battery storage assets in NYISO and NYSEG DR markets. NYSEG will also have the ability to dispatch the batteries outside of demand response events via aggregated dispatch commands to the third-party who will translate the aggregated command into individualized dispatch instructions for each battery. Participating customers will enjoy certain guaranteed bill-saving benefits of a battery storage system without the upfront cost of installation and in return pay a nominal fee to NYSEG and its partner for these benefits. The third-party will provide NYSEG with a portal to view the performance data and customer usage forecasts for all the battery assets and customers in the portfolio. In addition, the third-party will provide each customer with a portal to view their usage and their individual battery's performance.

This business model aims to stack multiple value streams, including customer bill savings, to maximize both the customer and system benefits of BTM distributed battery storage systems. The BTM battery system will reduce the customer's peak demand and therefore reduce their demand charge, as well as decrease the customer's installed capacity tag, which will serve to reduce the associated supply charges.

In return for the benefits from these BTM energy storage systems, the customer will pay NYSEG a nominal fee. NYSEG's market partner will aggregate these BTM battery storage resources together to participate in Demand Response programs through both NYSEG and NYISO, to generate revenue. Any additional capacity left in the aggregation of batteries after serving both reducing the customer's demand charge and participation in demand response can be used to address circuit and system level issues and test future use cases. NYSEG is proposing to split the revenues from the demand response markets between NYSEG and the market partner, with the exact compensation structure to be determined once market partner selection is finalized.

NYSEG is proposing the following use cases that support four key hypotheses for this BTM battery storage demonstration project:

1. *Customer Energy Demand Management*

This use case will demonstrate a how behind the meter battery storage will decrease customer energy demand and smooth a customer load shape to reduce energy delivery costs.

2. *Aggregate Demand Response Capacity and Participation*

This use case will demonstrate how to aggregate customer behind the meter battery storage for participation in the NYISO Demand Response and NYSEG CSRP Demand Response programs to maximize value to all stakeholders.

3. Circuit and System Peak Reduction

This use case will demonstrate how to use individual and aggregated energy storage to reduce both circuit and system level peaks to provide circuit and system wide benefits.

4. Inform on BTM Rate Design

This use case will evaluate and inform alternative rate design for BTM battery storage to show the hypothetical impacts from these alternative rates.

Future use cases (i.e. increasing Hosting Capacity and participating in NYISO wholesale markets) will be explored after sufficient experience is gained from the initial use cases. NYSEG estimates that a six (6) month learning and implementation period will likely be required before additional uses cases can be introduced.

NYSEG will be responsible for identifying and soliciting commercial and industrial customers where a battery storage system would have the most impact on both the customer's bill and on the distribution system as a whole. Eligible participants are limited to commercial and industrial customers within the footprint of the ESC that is comprised of 15 feeders originating from four (4) substations and two (2) taps in the area of Ithaca, NY[1]. This area was chosen intentionally to leverage the installation of other advanced information and technologies available within the footprint, including: Tollgrade meters, Advanced Metering Infrastructure ("AMI"), full distribution line automation, and an ADMS that will allow the battery systems to be optimally utilized. Tollgrade meters were previously installed on all of the ESC's 15 circuits and four (4) substations to establish circuit level baselines and have been collecting data since July 2016. This data will be critical to quantifying the system efficiency benefits of this project. An ADMS will be implemented for the ESC footprint by the fourth quarter of 2018. The visibility and control provided by this technology is required to enable the system and circuit level efficiency use cases. This technology will also facilitate potential future use cases and ADMS functionality testing. AMI meters will be installed for all customers within the ESC, providing valuable data granularity needed to test and measure the success of the hypotheses and use cases. AMI data will also be used to optimize the sizing of the batteries installed at customer sites. Establishment of Time of Use ("TOU") rates may further increase the value realized by some participating customers in the ESC foot print. Analysis of those customers that benefit will provide valuable input to the TOU rate pilot scalability, as well the development of the other relevant rate structures, such as new battery-targeted standby rates. The integration of the different

[1] Customers in the ESC on the Cayuga Heights 602 feeder are excluded this demo project so as not to conflict with NYSEG's Distribution Circuit Deployed Battery Storage System demonstration project on that feeder.

customer platforms available in the ESC will provide a seamless experience to the customer and increase the value perceived. Furthermore, the ESC has an engaged market of early-adopters who are more likely to be receptive to a battery storage project like this one, as evidenced by the high penetration of DER technologies like solar PV in the Ithaca area.

c. Hypotheses Being Tested

NYSEG is testing four primary hypotheses in this demonstration project as shown in Figure 3 below.

Hypotheses	Primary Test
BTM Battery Storage can be used within the NYSEG service territory to provide customer savings.	Data will be collected on the amount of customer savings realized by the BTM batteries as well as the number of customers that participate in the program.
Aggregation of BTM storage as virtual power plants allows customers to maximize their participation in NYSEG and NYISO Demand Response Markets.	Comparison of both participation and revenue from NY-ISO DR programs and NYSEG CSRP program with participation and revenue if assets were not aggregated.
Distribution system issues can be addressed through the dispatch of aggregated BTM battery storage assets.	The percent of time during the year the BTM Battery Storage Systems are dispatched and the performance of the assets during these events will be tracked. NYSEG may also conduct a number of trial events in order to simulate dispatching assets to meet a system need.
Alternative rates can be utilized to incentivize the use of BTM battery storage for some commercial and industrial customers.	NYSEG will conduct a number of trial events over the course of this pilot to determine the potential for incremental savings from alternative rate designs. Both the number of trial events and the projected savings from these alternative rates will be tracked.

Figure 3: Hypotheses Being Tested

d. REV Demonstration Principles Being Addressed

This demonstration project addresses five REV Demonstration principles with its support of creative partnerships, stacked and shared value streams, time-of-use rate learnings, distribution support, and most importantly through creative customer engagement efforts. These principles are outlined in Figure 4 below.

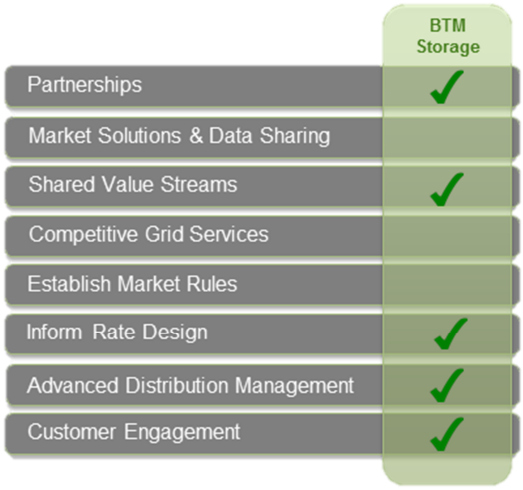

Figure 4: REV Principles Addressed with BTM Energy Storage[2]

Partnerships

NYSEG will procure the required battery storage assets as well as the engineering, construction and commissioning work for customer installation from a market partner. This will include the required O&M and warranties for the battery storage assets. NYSEG will also procure the software and operations of the battery storage assets required to meet the defined use cases for the three year demonstration period.

NYSEG will contract with customers to participate in the project, with guaranteed savings for the three year battery demonstration period. The customer will be charged a subscription fee, which will be based on a forecasted net savings from the demand charge management. If the customer savings do not meet the levels stipulated in the contract, NYSEG will make the customer whole. The percentage savings will be determined once the market partner is in place and detailed load analysis has been completed.

[2] https://nyrevconnect.com/rev-briefings/principles-rev-demonstrations/

The contract with both the market partner and the customer will be for the three year period of the demonstration project. There are currently four potential paths to continue to leverage the battery storage assets to create value for customers, as well as to continue to test additional use cases for network benefit after the demonstration period ends.

1. The participating customer chooses to purchase the battery storage asset, with an option to lease capacity to NYSEG for additional network benefit use cases.

2. The market partner chooses to purchase the battery storage asset, with an option to continue to provide customer with demand charge management services, and an option to lease capacity to NYSEG to continue to test additional use cases for network benefit.

3. NYSEG continues to own the battery asset, continues to provide the customer with demand charge savings, and continues to test additional use cases to support the various value stacks required to support a market based solution. The market partner contract for use case operations may be extended.

4. A different third party decides to purchase the battery storage assets, and provide the customer and NYSEG the above detailed use case operations.

The market partner and customers are welcome to propose additional ownership models after the three year demonstration period has ended.

Shared Value Streams

In this project NYSEG aims to demonstrate that the following economic value split is viable:

- The customer receives bill savings from demand charge reductions that are greater than its subscription costs[3]
- NYSEG receives a portion of the customer's bill savings, a portion of the demand response market revenue, and a contribution to its System Efficiency Earnings Adjustment Mechanism ("EAM"). NYSEG also receives additional potential circuit and system efficiency benefits.
- The third-party aggregation supplier receives payment for the installation of the BTM Battery Storage System, and a portion of the demand response market revenue as payment for managing the aggregation and bidding of the batteries into the NYISO and NYSEG demand response markets

[3] The exact payment and contract structure will depend on the market partner picked at the end of the competitive bid process. NYSEG's goal is to make the process as simple as possible for the participating customers.

Inform Rate Design

Customers participating in this battery storage project with load shapes that benefit from participating in the TOU rates will be encouraged to switch over to maximize their savings once these rates are launched within the ESC (planned for 2018). This supports NYSEG partnering with customers to assess the performance of commercial and industrial TOU rates with considerable load shifting capabilities in the form of a BTM battery. This will potentially allow the batteries to be utilized more efficiently by limiting the peak hours when they would need to operate.

NYSEG will also use this demonstration project to inform the development of new standby rates for battery storage. This project will provide NYSEG with real world data to use to validate and shape the future rates that are developed. NYSEG will also explore opportunities to test how these new rates might change the way the batteries are operated to provide savings to the customer.

Advanced Distribution Management

A significant component of this project is the software employed to aggregate the customer batteries together so that they may participate in demand response and be dispatched and aggregated as a whole. Third-party aggregators, similar to the one that we will be partnering with in this project, will communicate with our Distributed Energy Resource Management System ("DERMS") which will be part of our ADMS in the near future in order to manage our distribution system effectively. This project will allow NYSEG to trial the ADMS communication protocol with BTM assets we own and have a high-level of visibility into the operation of the assets.

Customer Engagement

This BTM demonstration project is targeting the batteries to be located at C&I customers in the footprint of the Energy Smart Community in Tompkins County. The intent of this project is to not only reduce the customer's impact on the grid by installing a battery, but also to increase their understanding of how they use energy and the affect this has on the distribution system. As part of this program, the participating customers will gain access to a portal that allows them to monitor their energy usage, both net and gross, in real-time. By allowing C&I customers to visualize their usage, NYSEG hopes to increase their awareness of how their behavior affects their energy usage. This project will be paired with other engagement programs, such as Energy Profiler Online, to increase the energy awareness of C&I customers in the ESC. At least one of the BTM batteries will be sited at a property owned by Cornell

University, and Cornell faculty will be engaged in the project, providing valuable feedback from the customer engagement point of view based on their expertise in behavioral economy and other social sciences. NYSEG plans to provide energy efficiency studies to all the participating customers to inform the customer's usage habits and maximize the effectiveness of the battery.

3. Market Attractiveness

a. Unique Value Proposition

Figure 5 represents the value exchange between the participating parties in this demonstration project.

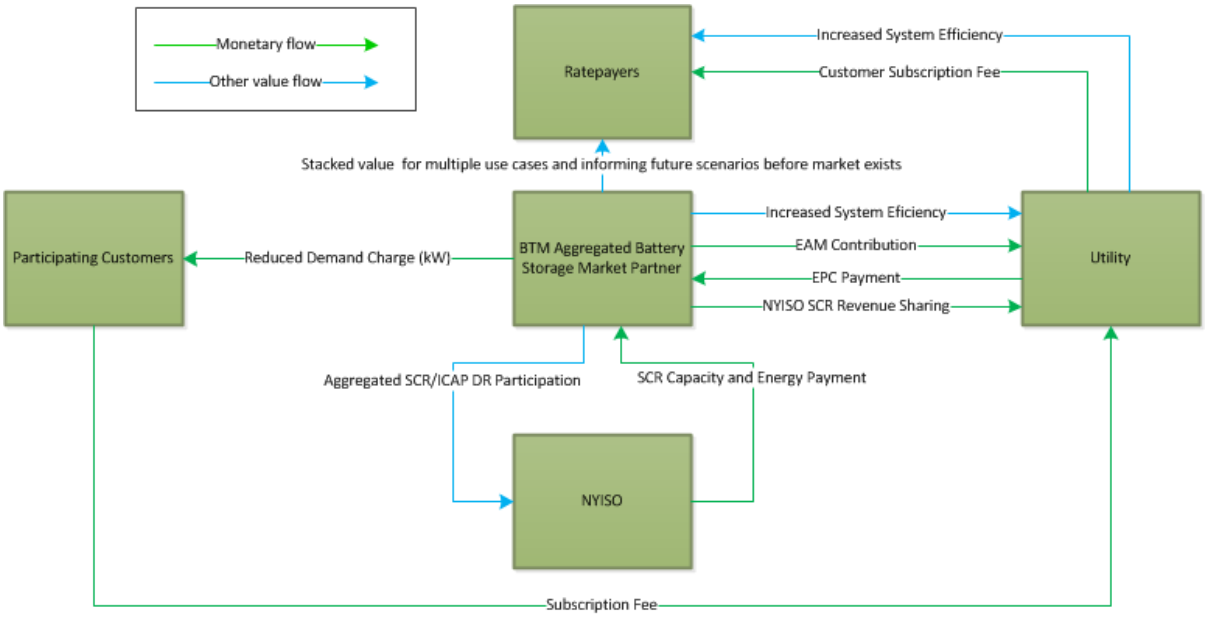

Figure 5: Value Exchange between Parties

i. Participating Customer

Customers who enroll in the BTM battery storage option offered by NYSEG will enjoy immediate energy savings resulting from a reduction in their demand. Additionally, they will not incur upfront installation costs or the associated management required to bid these resources into NYISO markets. The customer will pay a nominal subscription fee to participate in all of these benefits.

ii. Market Partner

The market partner benefits from this offering monetarily, earning payments from NYSEG for the design, installation, and operation of BTM battery storage systems to

meet the defined use cases. The market partner will also receive a small share of the NYISO demand response program payments earned in a cost-sharing structure determined by the competitive procurement currently underway. The third-party aggregator also gains entry into the developing BTM energy storage market in New York.

iii. Utility

NYSEG will earn revenue from customer fees collected, as well its share of the payments from the NYISO Demand Response program. NYSEG will also achieve system efficiency benefits through the reduction of peak loading on the circuits where the BTM battery storage systems are deployed. Finally, the learnings from this demonstration project will position NYSEG to understand BTM battery storage functionality and maximize the benefit to all customers through improved system efficiencies that may result from peak load reduction. The learnings from this demonstration pilot will also inform potential applications of aggregation and battery storage in other locations.

iv. NYISO

The battery aggregation will participate in at least one of the NYISO demand response markets. This program is presumed to be the SCR/ICAP program. The market partner will manage preparing the NYISO bids and receiving and responding to DR dispatch commands. As NYSEG plans for the batteries to participate in both NYISO and NYSEG demand response markets, NYSEG and the market partner will work with NYISO to ensure that this dual-participation does not lead to dual compensation for the same reduction.

v. System/Ratepayers

NYSEG anticipates several system benefits resulting from BTM battery storage systems. These benefits are primarily driven from decreased circuit peak loading and the potential for increased hosting capacity (future use case). In the future it will be possible to use these BTM battery storage assets to address system issues that may arise out of increased penetration of DERs. This project will also inform future use cases and business models that could be deployed for further system benefit.

b. Customer Segmentation and Demographics

Targeted customers for this demonstration project will meet the following criteria:

- The customer is served by one of the 15 feeders in the ESC
- The customer's feeder is not a participant in the Distribution Circuit Deployed Battery Storage System demonstration project
- The customer must receive service on a commercial or industrial tariff with a demand charge, and have a peak load of at least 50 kW but less than 1 MW.

NYSEG aims to have as diverse a mix of customer load profiles as possible in order to provide the most flexibility in responding to demand response events and providing grid services. Customers with certain load profiles may be excluded if they cannot provide enough value to the project in the form of potential bill savings, potential demand response market revenue, or potential value to additional use cases.

c. Channels

NYSEG will identify and solicit customers to participate in this project. NYSEG has developed a list of potentially eligible customers in the ESC based on the defined segmentation requirements, as well as details of their load characteristics, their potential for savings, and the feasibility of siting a battery at their location.

d. Ability to Scale

NYSEG believes that with a market partner, it can stack multiple value streams using aggregated BTM battery storage systems and allow customers to enter the battery storage and demand response markets that they may otherwise not have participated due to financial and institutional barriers. Furthermore, NYSEG intends to use this project to develop additional value streams that could be provided by battery storage and develop service rates to compensate battery storage appropriately for its value to the system. If NYSEG is able to demonstrate sufficient value to all stakeholders we expect customer adoption of BTM energy storage to significantly increase in New York much in the way it has in other markets such as Hawaii or California.

NYSEG expects the value generated from BTM battery storage systems to increase as time goes on, driven by aggregation software improvements, NYISO market evolution from increased DER penetration, and battery hardware cost reductions. If successful, NYSEG plans to expand the program and accommodate future BTM battery ownership models as the market evolves. NYSEG's experience with third-party aggregation and dispatching utility-owned batteries will inform integration of third-party owned and operated batteries into the distribution system.

4. Demonstration Plan

a. Metrics for Success

Figure 6 below outlines the metric and measure of success being assessed with BTM battery storage demonstration project.

Hypothesis	Metric	Measure of Success
BTM Battery Storage can be used within the NYSEG service territory to provide customer savings.	1. Customer Bill Savings	Average Customer Bill Savings ($/kWh of installed capacity) (Target: $1/kWh/month)
	2. Customer Acquisition	Number of Participating Customers (Target: 8)
Aggregation of BTM storage as virtual power plants allows customers to maximize their participation in NYSEG and NYISO Demand Response Markets.	1. Market Revenue	Demand Response revenue from NY-ISO is positive and measurable (Target: $15,000/yr)
	2. Total Demand Response Participation	Percent of NYISO and NYSEG Events Participated in each year (Target: 75%)
	3. Aggregated Demand Response Capacity Improvement	Total Capacity in the NY-ISO SCR and NYSEG CSRP is greater than if the customers had participated separately. (Target: TBD %)
	4. Aggregated Demand Response Participation Improvement	Total number of customers participating in NY-ISO and NYSEG DR markets is greater than if required to participate separately (Target: TBD %)
Distribution system issues can be addressed through the dispatch of aggregated BTM battery storage assets.	1. Overall Circuit and System Peak Reduction	Reduction of individual circuit peaks coincident with system level peaks (kW) (Detailed Circuit-level targets to be provided after customer list finalized)
Alternative rates can be utilized to incentivize the use of BTM battery storage for some commercial and industrial customers.	1. Inform Rate Design	Evaluate and inform alternative rate designs for BTM battery storage. (Target 4 rate trial periods[4]).

Figure 6: Project Metrics for Success

[4] Trials will be set up and conducted in a way that customer's demand charge under their current rate will be unaffected.

b. Timelines, Milestones and Data Collection

The demonstration project will cover a three year period that includes customer acquisition, site selection, construction, and commissioning of the battery systems. The installation of the eight battery systems is envisioned to take eleven months, half of which will be installed by the end of 2018 and the remaining systems will be installed by the middle of 2019. Once the systems have been installed a twenty-four month (2 year) timeframe will be used for hypothesis validation, additional use case development, and reporting of results. Milestones and projected completion dates are shown in Figure 7 below.

Milestone	Date(s)
Market Partner Selected	May 2018
Customer Acquisition and Site Selection	June – December 2018
Installation of Initial .5MW BTM Storage (~4 systems)	June - December 2018
Installation of Final .5MW BTM Storage (~4 systems)	January - May 2019
Hypothesis Validation and Data Collection	January 2019 – April 2021
Additional Use Case Development	January - June 2020
Results and Report Creation	January - March 2021
Scalability Analysis	March – April 2021
Demonstration Project Completion	April 2021

Figure 7: Project Milestones

Data Collection

NYSEG is in the process of installing AMI for commercial and industrial customers in the ESC that will provide the battery aggregation system a revenue-grade measurement of the customer's net load. If necessary, NYSEG and/or the market partner will install additional meters, current transformers, voltage transformers, or other measurement devices in order to track either the customer's gross load or the battery's output. All meters will comply with the Public Service Commission ("PSC") approved Meter List as prescribed in the PSC's Utility Metering Operating Manual. The battery and measurement systems will also comply with the NYISO requirements for participation in the chosen demand response markets. The measurement systems will communicate with a centralized data historian to store the required data to measure and prove out the identified hypothesis.

c. Participation

Customers

NYSEG and the chosen market partner will manage all aspects of the design, construction, testing and commissioning, and market participation of the battery assets. As a result the participation requirements for the customer are intended to be limited. Depending on the electrical configuration of the customer's site, installation of the battery system may require some operational interruption. NYSEG and their market partner will work with the customer to schedule the installation to limit any necessary interruption. The customer will also have to find space on their premises to safely site the battery and allow access for personnel from the market partner to perform maintenance on the batteries. Finally, any site specific landscaping requirements will need to be managed and paid for by the customer.

In order to make sure customers are fully aware of the requirements of this project, the customer agreement on this project will consist of two parts. The first part is a preliminary agreement similar to a letter of intent that outlines many of the general requirements of participation and is meant to demonstrate that the customer has a serious interest in participating. Following the customer's execution of the preliminary agreement, NYSEG will work with the chosen vendor to conduct a study of the customer's site and design a customized battery system for installation. Once the customer specific system design is complete and all of the customer specific requirements are identified, NYSEG will present the customer with Exhibit 1 of the preliminary agreement. Exhibit 1 will contain the customer's battery size, subscription fee, projected net savings, and guaranteed net savings percentage as well as a scope of work for NYSEG and the vendor for the battery installation. If at any point during the study process before Exhibit 1 is signed NYSEG or the customer decides not to continue, both parties shall be able to exit the preliminary agreement without any penalty.

Once the customer signs Exhibit 1, NYSEG and the vendor will begin the battery installation and the customer will be bound to participate in the project for the remainder of the pilot period until May 2021. If at any point the customer decides they would like to terminate the agreement they will be charged an early-termination fee in the amount of their projected net savings times the number of months remaining until the end of the demonstration project's term.

Market Partner

NYSEG has followed a RFP process in order to acquire a market partner to design, procure, construct the battery storage systems and operate the batteries to meet the prescribed use cases. In return for using their software to aggregate the batteries and bidding them into the NYISO markets and NYSEG demand response program, the partner will receive a portion of the demand response market revenues. The market partner will also receive payment for

purchasing, installing, testing and commissioning the BTM Battery Storage System from NYSEG and in exchange, NYSEG will retain ownership of the battery.

Utility

NYSEG has one project manager and one engineering coordinator working on this project that will be responsible for coordinating between the various parties involved to assure a successful project implementation. NYSEG will also be deploying a number of its members of the Smart Grids Innovation and Planning Team on this project to identify and interface with customers and establish detailed requirements for the project. During site installation, NYSEG will employ a construction supervisor and deploy other internal and/or external resources as needed.

d. Customer Outreach / Community Engagement

While this project does require customer participation in order to be successful, that participation is limited to approximately a total of eight commercial and industrial customers. NYSEG expects the above average positive opinion of renewable energy in the Ithaca area where the ESC is located to help with customer participation. Nevertheless, NYSEG will attempt to leverage the BTM batteries they install as part of this program to increase the engagement within the community. One method consists of providing customers who participate in the program more visibility of their energy usage and the potential for savings. This knowledge can be used to drive energy usage behavior changes that could lead to even greater savings compared to just installing the BTM battery alone. In addition, NYSEG will also address the participating customers' energy efficiency as part of this project. Finally, NYSEG intends to use this project to raise customer awareness of the benefits of battery storage and increase adoption in Tompkins County as well as throughout NYSEG's service territory.

e. Conditions / Barriers

Market Rules

NYISO's requirements to participate in the wholesale energy markets restrict aggregations from participating as Energy Limited Resources. NYISO also requires at least 1 MW of reduction in order to participate in the Demand-Side Ancillary Services Program (DSASP) which prevents us from being able to use our aggregation of batteries to derive additional revenues from these markets. NYSEG will monitor how NYISO market participation rules change in response to FERC Order 841 as well as any additional orders pertaining to DER aggregation that may arise in the near term and explore additional use cases as appropriate.

Customer Participation

Participation in this project carries with it a number of potential risks and challenges for the customer, including: increased bill complexity, fire safety, and potential operational interruptions. The combination of all these factors could affect the customer's willingness to participate. NYSEG has chosen to manage the installation of the battery system and guarantee a specific percent savings of between 2% and 10%[5] on the customer's monthly bill in order to offset some of these risks and increase customer willingness to participate.

Aggregation Shortcomings

If the battery aggregation software is unable to effectively balance the requirement to reduce the customer's monthly on-peak demand and the requirement to participate in demand response markets, the potential revenue generating capability of the aggregation will decrease significantly. For example, if NYSEG wants to have the batteries receive capacity payments as part of the NYISO SCR DR Program, the batteries will be required to perform during the event to meet the capacity commitment. If the batteries in aggregate fail to meet this commitment, the project would be subject to possible penalties from the NYISO, hurting our ability to generate revenue with demand response in the future.

Consumer Protection

In order to optimize the aggregation of BTM assets, we expect to need to provide the customer's load profile to the market partner to use this data to optimize their battery aggregation software. To protect the customer's privacy NYSEG will only share customer interval data with its market partner after having all the customers sign a release to allow NYSEG to share that information. NYSEG will not share individual customer interval data publically, but customer data may be presented in an anonymized or aggregated basis in reports issued to the New York Public Service Commission.

[5] These values are based on preliminary savings analysis. Due to variation in customer's bills and load profiles, the exact savings percentage will vary slightly from customer to customer in order to ensure each customer receives the same level of benefits from the project.

5. Financial Elements / Revenue Model

a. New Utility Revenue Streams

NYSEG estimates the following revenues over the course of the three year demonstration period of this project as shown Figure 8 below:

Revenue Stream	Projected Revenue[6]
Customer Subscription Fees	$82
NYISO ICAP	$26
NYISO SCR Energy Payment[7]	$3
NYSEG CSRP (Voluntary)[8]	$1
Total Revenue	*$112*

Figure 8: Estimate Total Revenue during the demonstration program period ($000)

NYSEG plans to test at least three (3) future revenue streams and sources of value on this project as follows:

1. **Customer Subscription Fees –** NYSEG will charge participating customers a lease fee on their bill to recover a share of the savings realized by the customer. The goal is for NYSEG and the customer to share the savings equally under this business model. In order to achieve an equal split of savings between the customer and NYSEG, NYSEG expects to charge customers an average of **$0.52/kWh** of installed capacity per month. The per kWh rate will likely be tailored to each customer based on projected savings to ensure as close to an even split as possible is achieved. NYSEG plans to guarantee the customer a fixed percentage of savings on their bill each month from the operation of the battery and will make additional credits to the customer's bill if this percentage savings is not achieved. The mechanism for sharing this savings is still in development as it may need to be modified based on customer response.

[6] Assuming total system size of 8 customers and 1.06 MW/4.2 MWh

[7] Assuming one 4-hour SCR event and two 1-hour tests (one each for the winter and summer ICAP periods) every year

[8] Assuming one 4-hour CSRP event every year (non-coincident with the NYISO event)

2. **NYISO SCR/ICAP DR Program –** The market partner will aggregate the participating customers and bid them into the NYISO ICAP market every month. The market partner will operate the batteries to meet their capacity commitments for each test event as well as for all NYISO SCR DR Events. In addition to the monthly payment from the ICAP market, NYSEG will also be entitled to performance payments of at least $500/MWh for the reductions in energy usage during NYISO events. As payment for providing aggregation and bidding services, the vendor will receive approximately 10% of the market revenues from DR generated by this project.

3. **NYSEG CSRP DR Program –** The market partner will also participate in the NYSEG CSRP program with any additional capacity available when a CSRP event is called. Due to higher compensation rates for capacity commitments in the ICAP market, all of the forecasted available capacity will be used to participate in the NYISO program. The demand reductions contributed into the CSRP program will consist of capacity that is available beyond that which has been committed to in the NYISO ICAP/SCR market. Therefore, the aggregation will only be able to collect energy based payments of $0.15/kWh for any load reduction provided during CSRP events. The vendor will also receive a 10% share of the CSRP revenues generated by this project.

The yearly revenue streams for the demonstration period are shown in Figure 9 below.

Revenue Stream	2019	2020	2021 (4 mo's)
Customer Subscription Fees	$31	$39	$12
NYISO DR ICAP	$12	$13	$2
NYISO DR SCR Energy	$1	$2	$0.2
NYSEG CSRP (Voluntary)	$0.5	$0.5	$0
Total Revenue	*$45.5*	*$53.5*	*$14*

Figure 9: Estimated demonstration period yearly revenue streams ($000)

b. Investments

NYSEG will own the individual battery assets. The estimated cost of installation of the anticipated eight (8) battery systems and overall execution of the project over the initial three year demonstration period is estimated at $7.09M. [redacted] It also contains all necessary overheads and internal labor required to manage the batteries during the pilot period. A breakdown of the costs by category can be found in Figure 10 below.

Cost Category	Cost
[redacted]	

Figure 10: Cost Categorization ($000)

The yearly cash flow for the duration of the demo project is depicted below in Figure 11.

	2017	2018	2019	2020	2021
Estimated Costs	$27	$6,240	$784	$32	$6

Figure 11: Estimate project cost ($000)

c. Returns

The returns NYSEG is able to realize from this project are very dependent on the ownership model taken after the three year pilot period. If NYSEG retains ownership of the batteries, then NYSEG expects it will to continue to receive the same pilot period revenue sources as well as any additional sources it is able to identify during that period. It is difficult to quantify the exact future revenue sources, so for the purpose of the following analysis, NYSEG has assumed that the same pilot period revenue streams are utilized with the value of those revenue streams increasing from both the customer subscription fees and NYISO DR ICAP due to projected increases in the value of demand. NYSEG also expects to see an approximate doubling in the value of the DR performance payments received by the end of the life of the batteries; this is due to an expected increased number of events called. NYSEG's simulations of expected battery operation patterns has shown that the batteries are expected to stay under the cycles limit in the manufacturer's warranty which would allow the warranty to be extended and additional five years beyond the typical ten year battery life. These additional years will allow the battery to generate more revenue and deliver more value to the customer before replacement is needed. In order to account for the loss of energy capacity over the life of the battery, the projected revenues are also adjusted based on the Minimum Energy Retention Percentage for the given year in the manufacturer's warranty. A summary of the project revenues can be seen below in Figure 12.

Revenue Streams[9]	2021-2033
Customer Subscription Fees[10]	$405
NYISO DR ICAP[11]	$108
NYISO DR SCR Energy[12]	$18
NYSEG CSRP (Voluntary)	$4
Total	$535

Figure 12: Total projected revenues for 13 years beyond the demonstration period. ($000)

If NYSEG is able to sell the batteries to the customers, the vendor, a third-party, or some combination of the three after the three year demonstration period, then NYSEG can expect to obtain one-time revenue equal to the value of the battery storage systems after two years of operation. To approximate what this value might be in 2021, NYSEG used the Minimum Energy Retention Percentage from the battery manufacturer's warranty to estimate how much capacity the batteries will have after two years of operation and the $/kWh of each of the batteries quoted to NYSEG by the vendor reduced by 10%[13] per year from 2018-2021. A breakdown of the total project resale value for each battery size can be found in Figure 13 below.

Customer Battery Size	Estimated Resale Value
[redacted]	

Figure 13: Summary of the projected resale values of the battery storage system sizes. ($000)

[9] All revenues are based on the calculated by NYSEG for year 1 and adjusted by the Minimum Energy Retention Percentage and a chosen year-over-year escalation percentage to represent expected revenue growth. The Minimum Energy Retention Percentage used can be found in the manufacturer's warranty.

[10] Revenue generated from customer subscription fees is escalated at a rate of 4% per year with the exception of 2024 (year 6) when it is increased by 10% to approximate a revenue increase from alternative rate design targeted at battery storage

[11] Revenue generated from NYISO DR ICAP payments is escalated at a rate of 1% a year to reflect increasing values of capacity and higher capacity bids from improvements in the aggregation software and forecasting engines

[12] Revenue generated from NYISO and NYSEG DR performance payments are escalated at a rate of 6% per year so that by year 15 the value of these performance payments has approximately doubled

[13] The CAGR of lithium-ion batteries as reported in *Lazard's Levelized Cost of Storage Analysis – Version 3.0* (2017)

d. Cost Effectiveness

In order to determine the cost effectiveness of this business model, NYSEG performed an analysis using the cash flows highlighted above for the two post-demonstration period scenarios, NYSEG ownership of the batteries and NYSEG sale of the batteries. The initial costs utilized in these analyses scenarios included the expected battery costs plus the necessary incremental costs to perform the required customer billing and monitor the battery performance. NYSEG also performed iterations of these cost-effectiveness analyses with the battery acquisition and installation costs reduced by 25, 35, 50, and 75 percent to simulate how much the cost of battery storage would need to drop to make this a viable business model. The result of that simple payback, Internal Rate of Return ("IRR") and Net Present Value ("NPV") analysis is shown in Figures 14 and 15 below.

Scenario	Estimated Battery Cost	Cost/kWh	Simple Payback (years)	IRR	NPV/kWh[14]
[redacted]					

Figure 14: Analysis of NYSEG maintaining ownership of the batteries for the 15 year life of the batteries

Scenario	Estimated Battery Cost	Cost/kWh	IRR	NPV/kWh
[redacted]				

Figure 15: Analysis of NYSEG selling the batteries after the demonstration period.

[14] Presuming a 3% cost of capital

[15] For this scenario the cash flow is too low for the IRR equation to register a real value

It is evident from this analysis that the costs in this project far outweigh the possible revenues. NYSEG is choosing to continue to pursue this project because NYSEG believes the additional values that do not have tangible revenue streams associated with them will lead to a net benefit in the long term. This project will allow NYSEG to thoroughly analyze the costs and benefits associated with implementing an aggregated BTM battery system at scale and identify the gaps where increased revenues or cost savings need to be found to make battery storage economically viable in New York State. Pursuant to this effort, NYSEG expects to be able to use this project to develop new use cases and value streams for behind-the-meter battery storage, such as ancillary services, and improving hosting capacity. NYSEG will also use this pilot to develop new rate structures aimed at more effectively compensating behind-the-meter battery storage for its value to the system. These two efforts combined with falling battery costs, can make energy storage more cost effective in the future.

6. Reporting

NYSEG will produce and submit quarterly reports to the Commission. The quarterly reports will include a description of progress toward project milestones, project cost performance (actual expenditures compared to budget), and the success metrics described in Section 4(a). In addition, quarterly reports will include lessons learned that will be applied during the remainder of the project. These lessons learned and final metrics will be summarized in a final evaluation report.

7. Conclusion

a. Post-Demonstration Benefits

i. Qualitative

From this project, NYSEG will gain valuable experience by working with a third-party demand response resource aggregator. This experience will be used to inform and improve how we interact with third-party aggregators as the customer asset aggregation market in New York evolves.

NYSEG will also gain a better understanding of customer appetite for BTM battery storage, informing future plans for battery storage and distributed energy resources and the feasibility of BTM battery storage as a tool to address system needs. In addition, NYSEG will gain experience in integrating advanced grid architecture such as an ADMS with a third-party aggregator to inform the development of a DERMS as outlined in its filed DSIP. Finally, results from this project will yield further information on additional rate structures and markets that could be leveraged by battery storage

ii. Quantitative

NYSEG will have quantifiable data on the true costs of and revenues from BTM battery storage systems. Costs will include installation costs, integration costs and operational costs, while revenues will include market participation earnings and customer payments. NYSEG will also have quantifiable data on the true capabilities of BTM battery storage and its potential for pursuing additional use cases that could allow the company to expand its application to address system issues.

b. Plans to Scale

Currently, the costs of behind-the-meter battery storage are still greater than the benefits for most C&I customers in NYSEG's service territory. However, battery costs continue to fall and the potential revenue streams that a BTM battery can leverage continue to grow to reflect the true value that battery storage has to the system. NYSEG plans to use this demonstration project to explore the value streams that can currently be leveraged by battery storage as well as leveraging any additional future value streams. These learnings will be used to inform new programs and rates that will ensure that battery storage is fairly compensated for its value. The results of this demonstration project will also inform on what a scalable business model may look like for all parties and address key questions, including the most beneficial ownership model, and customer load profiles that yield the most benefit from BTM storage. If this

demonstration project proves successful in identifying additional value streams, NYSEG will explore similar programs to facilitate customer adoption of BTM batteries outside the ESC. NYSEG will also take what it learns about working with a third-party DER aggregator from this project and apply it to developing its DERMS that will be a part of ADMS in the future.

c. Advantage

This project will allow NYSEG to understand the market for BTM battery storage systems locally within the ESC, the potential market within the larger service territory, and the potential system benefits of BTM battery storage systems. NYSEG will also gain experience using BTM battery storage systems to provide system benefits.

New York Energy Storage Initiative

REV Demonstration Project Outline

Integrated Electric Vehicle Charging & Battery Storage System

NYSEG RG&E

1. Executive Summary

Electric vehicles ("EVs") are forecasted to experience significant growth in the coming years and the availability of DC fast chargers to be able to quickly recharge vehicles will be critical to enabling increased EV adoption. EVs have limited range and typically have slow charge times. DC fast chargers provide an opportunity for EVs to be more effective for long range use. Although DC fast chargers are important for EV market development, there are several impediments to their use. For utilities, DC fast chargers present an inefficient load with high power and low energy. Uncoordinated fast charging will create system inefficiency and will contribute to increased peak demand. For charging station owners and operators, the high power requirements of DC fast chargers may create high installation costs if system reinforcements are needed, and will create high operating costs, driven by demand charges. Rochester Gas and Electric ("RG&E" or the "Company") is aware of the recent petition filed by NYPA and several other state entities, in which they request the New York State Public Service Commission ("Commission") to move fast charging stations from demand to non-demand meters. Should this request be adopted, it does not materially change the overall learnings available and other benefits attributed to this demonstration project.

In order to address these challenges, RG&E is proposing an Integrated EV Charging and Battery Storage System with the objective of improving the economics of EV adoption and minimizing its impact to the electric grid. The project will demonstrate 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 Integrated EV and Battery Storage System will be located at the RG&E Operations Center at 1300 Scottsville Road in Rochester, New York. The system will consist 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 RG&E Scottsville Road facility provides an ideal location for implementing this demonstration project. The facility has 25 active utility fleet Internal Combustion Engine ("ICE") passenger vehicles with an opportunity to convert some of these vehicles to EVs. DC fast chargers are needed in order to meet the travel requirements of RG&E fleet vehicles, including both daily planned and unplanned, as well as after-hours use. By having RG&E as the host site, it does not require a commercial customer to take on risks associated with demonstration project use case testing and any associated impact on operational performance. Additionally, the Scottsville Road facility provides an excellent location for shared public use as RG&E intends to allow the public access to one (1) of the two (2) DC fast chargers in order to maximize their utilization. The western New York region is currently void of DC fast chargers, and the facility is near the New York State Thruway (I90), is directly across the street from the Rochester regional airport, and is next door to a popular coffee shop.

RG&E will validate two hypotheses through several individual use cases. The first hypothesis to validate is how utilizing and dispatching a stationary battery with flexible charging load can help

meet customer and fleet transportation needs while minimizing cost and system impacts. The second hypothesis is to demonstrate how an integrated EV charging and battery storage system will provide valuable information for ratepayers, policy makers, and utilities. The project will also provide valuable information for considering how similar solutions could be scaled in the future. These hypotheses will be tested through multiple use cases including building and circuit demand reduction, load factor improvement, and energy arbitrage.

This demonstration project directly addresses six Reforming the Energy Vision ("REV") Demonstration principles with its support of market solutions and data sharing, shared value streams, competitive grid services, informed rate design, advanced distribution management, and customer engagement efforts.

This project provides an excellent opportunity for RG&E, as a fleet operator and commercial customer, to test the value of utilizing energy storage for demand reduction and to demonstrate how battery storage can be effectively integrated with EV chargers. Learnings from this project will encourage further development of the EV market in New York State and will inform future deployment of battery storage to meet the needs of high demand loads.

2. Business Model(s) Overview

a. Problem

Electric vehicles are continuing to increase their presence in the automotive industry. New York has adopted a zero-emission vehicle ("ZEV") mandate which targets nearly 1 million cumulative ZEV sales by 2025. As the electric vehicle market expands, more and more charging stations will be needed to meet drivers' needs. There are two predominant types of EV chargers in the market today, level 2 and DC fast chargers. Level 2 chargers are designed to charge vehicles over a long period of time (i.e. overnight) and are typically located at homes or in areas where cars may be parked for an extended period of time (i.e. parking lots). However, drivers of ICE vehicles are used to the convenience of a quick refueling that enables them to drive long distances without long wait periods for a refuel before arriving at their destination. Drivers of EVs want that same experience. DC fast chargers provide EV drivers with a similar "gas up and go" experience that they are accustomed to through their ability to recharge a vehicle up to approximately 80% of its full charge level in 30 minutes. The fast charger market is still in the development stage, and challenges associated with wide scale deployment of level 2 and fast chargers for fleet operators, customers, owners, utilities, and third party providers will need to be addressed for wide scale deployment.

For Drivers (fleet and non-fleet)

EVs have limited range and typically have slow charge times. For example, a 2018 Nissan Leaf has a range of 151 miles and a 2018 Chevy Bolt has a range of 238 miles and both typically take up to nine (9) hours to recharge. These stated ranges are reduced by 30% to 35% when running the vehicle heater in cold climates. This limited range and slow charging is a barrier in using EVs for long distance travel. To overcome some of those barriers a DC fast charger can be used.

For Charging Station Owners

DC Fast chargers have a high installation and equipment cost, which are primary factors in their lack of wide scale deployment. DC fast chargers are also expensive to operate because they create a load that has relatively high power requirements regardless of the number of vehicles that utilize the chargers. For example, one vehicle charging for thirty minutes at 50 KW with a demand rate of $15/KW will create a demand charge of $750. Consumers expect to pay no more than the equivalent cost of gasoline which will limit charges to somewhere around $10 for a 30 minute charge session. In this example, a charger would require seventy-five 30-minute sessions in order to simply cover the demand charges in one month. Significantly more sessions would be required to cover the equipment and installation cost. As noted earlier, there is a new petition to the Commission which requests an alternate, non-demand metered approach for fast charging stations.

For Utilities

DC fast chargers have high power and low energy requirements, making them a very inefficient load. Uncoordinated fast charging will create system inefficiency and will contribute to increased peak demand along with the potential for significant infrastructure build out to support that increased peak demand.

b. Solution

RG&E is proposing to pair battery storage with EV level 2 and DC fast chargers to develop an integrated EV charging and battery storage system. The integrated EV charging and battery storage system will demonstrate how battery storage can be integrated with DC fast and level 2 EV chargers and commercial building demand in order to manage costs while optimizing the value of the battery system. This demonstration project will provide the operational experience and requirements to determine how this solution, or parts of the solution, can be cost effective for the EV market and be replicated for other commercial DC fast and level 2 charger installations.

In order to determine the approximate size of the battery, RG&E performed analysis scenarios based on the addition of two (2) DC fast chargers with a minimum of 50 KW and maximum of 75KW capacity each along with five (5) level 2 chargers with a capacity of 7.2 KW each. These chargers were selected based on RG&E plans to incorporate five (5) EVs into its current twenty-five vehicle ICE passenger vehicle fleet located at the Scottsville Road facility in Rochester New York. Utility fleet vehicles often have high mileage driving needs throughout the day and, due to the nature of the utility business, may have unpredictable usage requirements when responding to storms and emergencies. Due to the limited range and the slow recharging time of EVs with level 2 chargers, it has been determined that DC fast charging is required for EVs to be a viable alternative to ICE vehicles. In order to incent high utilization of the DC fast chargers during non-critical use, RG&E intends to allow the public access to one of the two DC fast chargers as there are currently no available fast DC charging stations available within a 75 mile radius of the Scottsville Road facility. The level 2 chargers will only be used by RG&E fleet vehicles.

Scenarios for Sizing the Battery Storage

The figures below show five (5) potential EV charging scenarios and the expected impact on the existing Scottsville Road facility peak demand if RG&E added five (5) fleet EVs. The first three (3) scenarios shown build upon the previous scenario to determine the overall integrated building and proposed charger demand. Scenario 4 depicts the expected impact of opening the DC fast charger up for public use and scenario 5 shows the overall EV

charging and building demand when all scenarios are combined. The scenarios assume EV charging taking place in the month of July (based on data from 2017). July is typically a peak demand month at the facility.

Scenario 1: This scenario shows the expected demand increase if RG&E recharged 5 EVs using only level 2 chargers. Please note that in this scenario the lack of a DC fast charger would limit the utilization of the EVs due to slow charging limiting EV range. The expected facility demand increase from the level 2 EV charging is 32KW, or 14%.

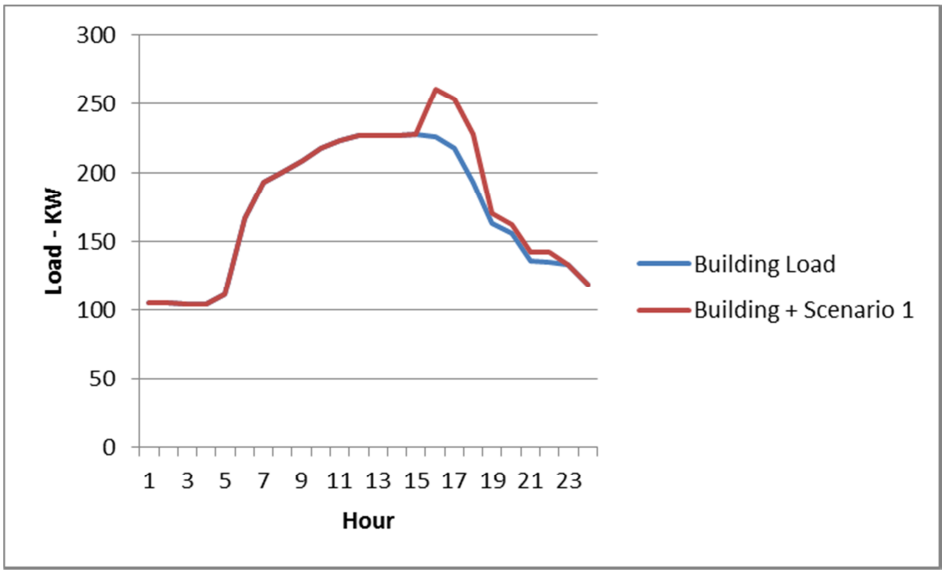

Figure 1: Charging scenario of 5 EVs with level 2 chargers only

Scenario 2: This scenario shows the expected demand increase from Scenario 1 with one of those EVs charged with a DC fast charger in the middle of the work day due to high mileage usage. The expected facility demand increase from the shown level 2 and DC fast charging is 73KW, or 32%. This scenario is the anticipated daily normal RG&E use of the EV chargers.

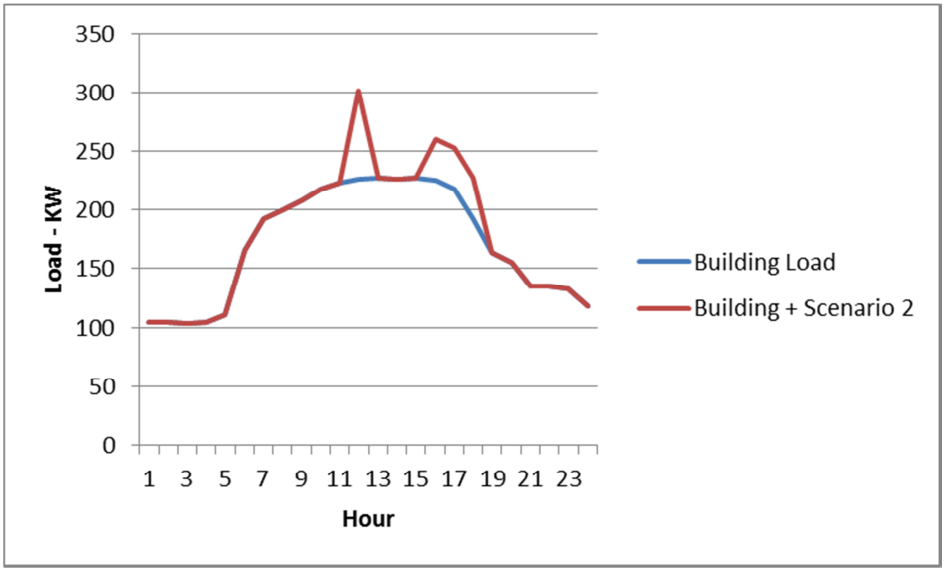

Figure 2: Normal anticipated EV charging scenario

Scenario 3: This scenario shows the expected demand increase from Scenario 2 with the recharging of two additional EVs simultaneously with a DC fast charger in the mid-afternoon in order to have the vehicles ready to drive in preparation of an afternoon storm. The expected facility demand increase from the level 2 and DC fast charging the EVs is 150KW, or 65%. RG&E anticipates this type of scenario to occur approximately 25 days a year based on past storm and emergency preparedness occurrences.

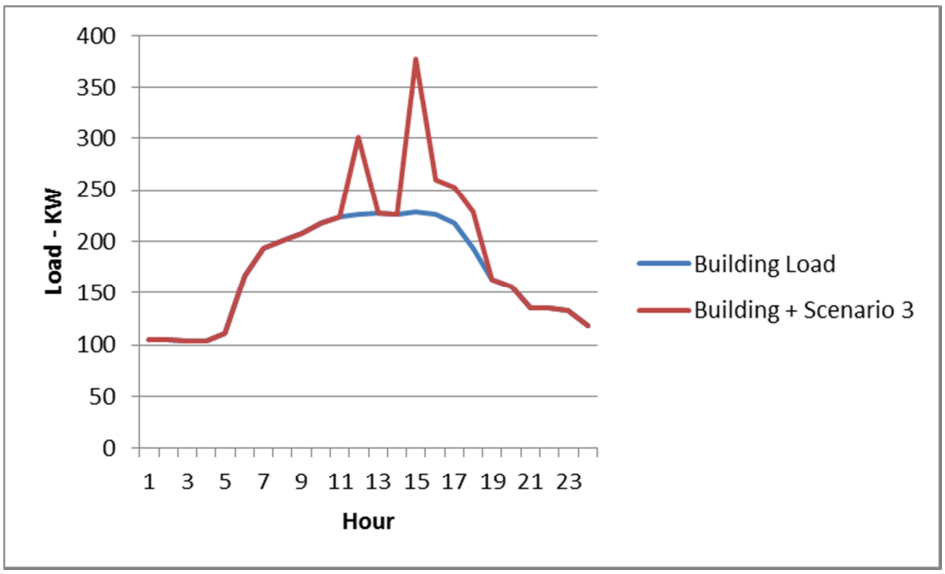

Figure 3: Charging scenario of EV's for both normal and storm use

Scenario 4: This scenario shows the expected demand increase based on hypothetical public use of RG&E's DC fast charger scattered throughout the day. The expected facility demand increase from EV charging is 74KW, or 32%.

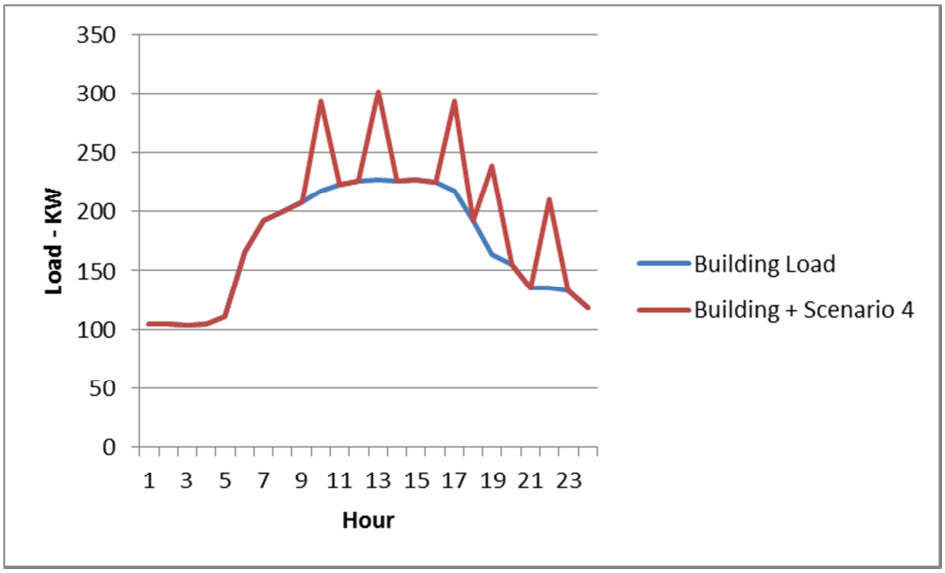

Figure 4: DC fast charging scenario for public vehicles

Scenario 5: This scenario shows the expected demand increase based on the demand created by combining Scenarios 3 and 4 (normal, storm preparation, and public charger use). The expected facility demand increase from EV charging is 150KW, or 65%.

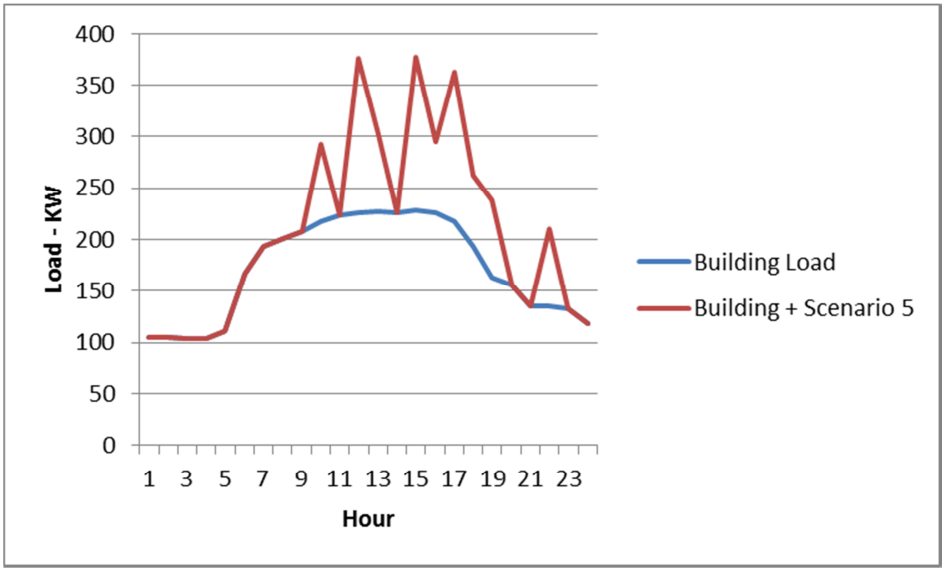

Figure 5: Combined charging scenario for normal, storm, and public use of chargers

As shown in Scenario 5 the EV level 2 and DC fast charging load creates a significant increase in overall site demand which will increase the facilities energy costs, create volatility in the facility load factor, and may cause the need for distribution system upgrades. The analysis shows that with the addition of the five (5) level 2 chargers, two (2) DC fast chargers to the existing building demand in the month of July an approximate battery size of 150 kW and 600 kWh would be required to meet the increased demand of the most robust of the charging scenarios.

In order to determine if the initial battery size is feasible, a hypothetical battery charging and discharging scenario for the 150 kW and 600 kWh was developed. The blue line show the total facility load including the building load and the EV charging load in scenario 5. The red line show the charging and discharging of the battery. Where the red line is above "0" the battery is charging and where the red line is below "0" the battery is discharging. The combined result of the building load, EV charging load, and battery charging and discharging is represented with the green line. In this hypothetical scenario the building peak demand is reduced by 138 KW, or more than 90% of the increased demand from EV Level 2 and DC fast charger load indicated in Scenario 5 above.

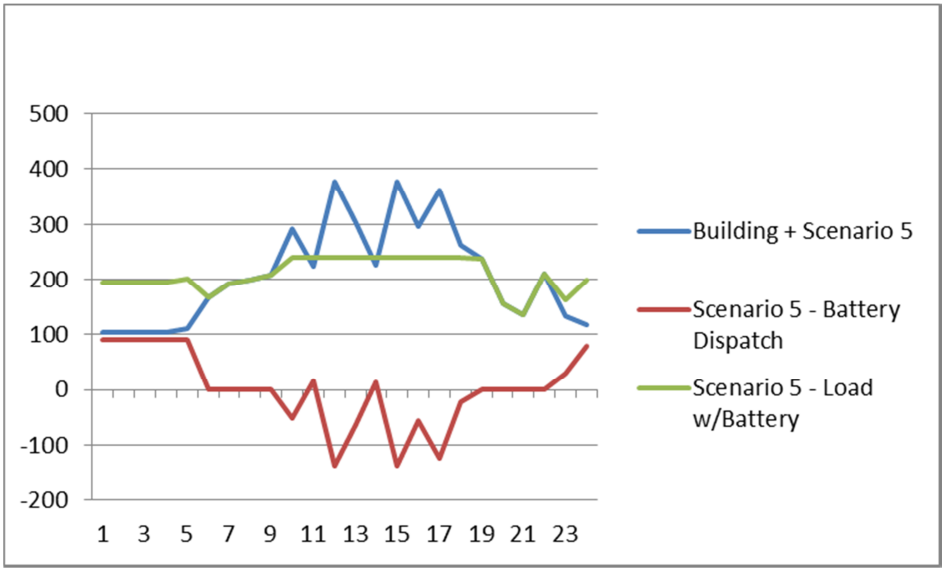

Figure 6: Battery storage hypothetical charging and discharging scenarios to meet increased charging demand

Based on the results of above analysis and hypothetical battery charging and discharging scenarios it was determined that the integrated EV charging and battery storage system would be comprised of the following:

1. **Battery and Battery Management System** – A 150 KW and 600 kWh battery will be utilized to strategically supply the EV chargers and the building's daily, monthly, and annual peak demand. The Battery Management System will manage battery charging and dispatch algorithms such that the load from the EV charging station does not coincide with the peak of the building loads, therefore avoiding paying excess demand charges or adding additional peak loads to the building.

2. **Flexible Level 2 EV Chargers** – The five (5) level 2 chargers (7.2 KW in size) will have the ability to receive commands to reduce their available capacity to any commanded set point and for any scheduled period of time.

3. **DC Fast EV Chargers** – The two (2) DC fast chargers (approximately 50 kw – 75 kw in size) will have the ability to recharge a vehicle up to approximately 80% of its full charge level in 30 minutes.

4. **Building Energy Management System** – The building will be able to adjust its energy usage by increasing building temperature in order to contribute to load reduction at peak times.

This integrated system will test the integration of battery storage with EV charging, provide new electric vehicle charging infrastructure, manage the facility's peak demand, and demonstrate a solution that can be replicated at other commercial locations. RG&E is proposing the following use cases that support two key hypotheses for this Integrated EV Charging and Battery Storage project:

1. *Building and Circuit demand reduction*

This use case will demonstrate how a battery storage system can reduce building and circuit peak demand and the associated cost for the facility.

2. *Building Load Factor Improvement*

This use case will demonstrate how a battery storage system will improve the existing building load factor.

3. *Energy Arbitrage*

This use case will demonstrate how a battery storage system can charge during off peak times and discharge during peak times to create additional monetary value.

4. *Demand Response Performance*

This use case will demonstrate how a commercial facility with flexible EV charging and a battery storage system can reliably participate in demand response programs. Program participation will include the New York Independent System Operator ("NYISO") Special Case Resource Program and the RG&E Commercial System Relief Program.

5. *Inform Infrastructure Impact and Rate Design*

This use case will be used to inform how a battery storage system can be used in lieu of (or supplemented with) system infrastructure upgrades for future DC fast charger deployments. This use case will also provide data and insight on how a facility with highly flexible load might benefit from potential future rate designs

The battery and EV charging will be coordinated in order to test the value of battery storage as a solution for minimizing the demand impact from EV charging. The project will provide new electric vehicle charging infrastructure, manage the facility's peak demand, and demonstrate a solution that can be replicated at other commercial locations. The daily load prediction and system optimization will be informed by a user vehicle scheduling application where the user will identify when they need to vehicle fully charged for readiness.

c. Hypotheses Being Tested

RG&E is testing two primary hypotheses in this demonstration project as shown below in Figure 7.

Hypothesis	Primary Test
Utilizing and dispatching a stationary battery with flexible charging load can help meet customer and fleet transportation needs while minimizing cost and system impacts.	Data will be collected on the amount of customer savings realized by the battery, building and circuit demand reduction, and an analysis will be performed on the efficiency of an integrated EV charging and battery storage system.
An integrated EV charging and battery storage system will provide valuable information for ratepayers, policy makers, and utilities.	Analyze and publish data collected relevant to the reduction of distribution infrastructure reinforcement resulting from the EV charging demand increase as well as inform on alternative rate designs for DC fast chargers paired with storage.

Figure7: Hypotheses Being Tested

d. REV Demonstration Principles Being Addressed

This demonstration project addresses six (6) of the REV Demonstration Project Principles that were established in the December 2014 Memorandum on Demonstration Projects as shown in Figure 8.

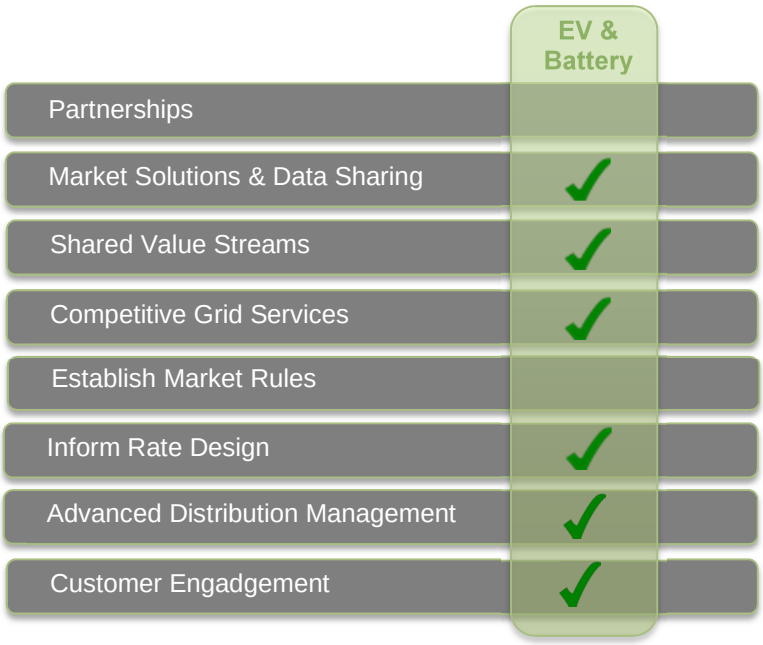

Figure 8: REV principles addressed with the integrated EV charger and battery storage system[1]

Market Solutions & Data Sharing

Potential solutions have been sourced through a competitive request for proposals. The battery storage solution and the EV charging will be designed and provided by the winning proposer and their partners. This project will demonstrate how the integrated system can solve real EV market problems by utilizing the system at a facility where the operational availability of its fleet is critical to operations. The data collected through this demonstration project will be used to inform on the site infrastructure impact of the increased EV load as well as inform on future EV and battery storage rate design.

[1] https://nyrevconnect.com/rev-briefings/principles-rev-demonstrations/

Shared Value Streams

The EV charging equipment provider will receive value through an up-front purchase agreement and ongoing operational maintenance payments. The battery provider will receive value through an up-front purchase agreement. RG&E as the facility owner and EV charger site host will be the recipient of the value of the facility demand reduction and will gain valuable experience incorporating EVs and battery storage into its operations. RG&E as the charger site host will also receive the value of the public EV user charging payments. RG&E as the utility will receive value through reduced system demand.

Competitive Grid Services

The market for grid services should be competitive and as such RG&E has competitively sourced potential solutions for this project. RG&E's request for proposals helps to assure competitive pricing and a robust innovative solution. The learning from this project will inform future development of the energy storage market by demonstrating the value of energy storage to meet the energy needs of EV charging. This project will also provide valuable information for the development of the EV charging market.

Inform Rate Design

RG&E will use this demonstration project to inform future rate design for EV loads paired with battery storage. This project will provide RG&E with real world data to use to develop and validate future EV charging and battery storage rates. RG&E will also explore opportunities to test how these new rates might change the way the batteries are operated to provide savings to customers contemplating the addition of DC fast and level 2 chargers.

Advanced Distribution Management

The BMS included with this project will continuously monitor and evaluate the utilization of the EV chargers and will optimize the charging and discharging of the battery in order to maximize the benefit of the system. The learnings gained on the operation of the BMS will be used to help RG&E understand the monitoring and control requirements for future commercial integrated EV charging and battery storage systems.

Customer Engagement

This project will treat the RG&E Scottsville Road facility as a commercial customer, will engage both internal and public EV drivers as well as other local commercial EV fleets as

potential users of the DC fast chargers. RG&E will also engage customers by leveraging various Rochester area EV community outreach programs to promote the benefits of EV's and the use of the available DC fast charger.

In addition to the Demonstration Project Principles listed above, this project will also support the following REV goals:

- *Make energy more affordable* – by reducing demand charges and operating the storage system to minimize cost.

- *Support the growth of clean energy innovation* – by demonstrating an integrated EV and Battery Storage System that promotes EV's, and energy storage.

- *Cut greenhouse gas emissions by 80% by 2050* – by supporting electrification of transportation and minimizing peak demand.

- *Improve NY's existing energy infrastructure* – by improving distribution system efficiency.

- *Protect NY's natural resources* – by utilizing electric transportation and reducing peak demand requirements.

- *Support cleaner transportation* – by promoting the use of electric vehicles, and demonstrating integration of DC fast charging with energy storage.

3. Market Attractiveness

a. Unique Value Proposition

As a distribution utility RG&E is uniquely positioned to execute and extract value from this demonstration project. We will bring together multiple interested parties, stakeholders, and customers while analyzing and sharing results to inform future EV policy, tariffs, market development, and investments.

The RG&E Scottsville Road facility provides an excellent location to test fleet utilization of EVs and associated charging needs and impacts as well as public utilization of DC fast chargers. The Scottsville Road facility currently has twenty five active fleet passenger vehicles with an opportunity to convert some to EVs. A key benefit to having RG&E as the EV charger host site is that it eliminates the need for another commercial customer to take on the financial and operational risk associated with demonstrating project use cases.

The RG&E Scottsville Road facility provides an excellent location for public utilization of the DC fast chargers as it is located in a region of New York State that is currently void of DC fast chargers. The nearest fast charger to the west is 78 miles (in Ontario, Canada). The nearest fast charger to the east is 132 miles (in Rome, New York). The Scottsville Road location is near the New York State Thruway (I90) and is directly across the street from the Rochester regional airport. One additional added benefit is that this facility is adjacent to a popular coffee shop, which will provide EV drivers with a place to go while their vehicle recharges.

Figure 9 below represents the value exchange between the participating parties identified in this demonstration project.

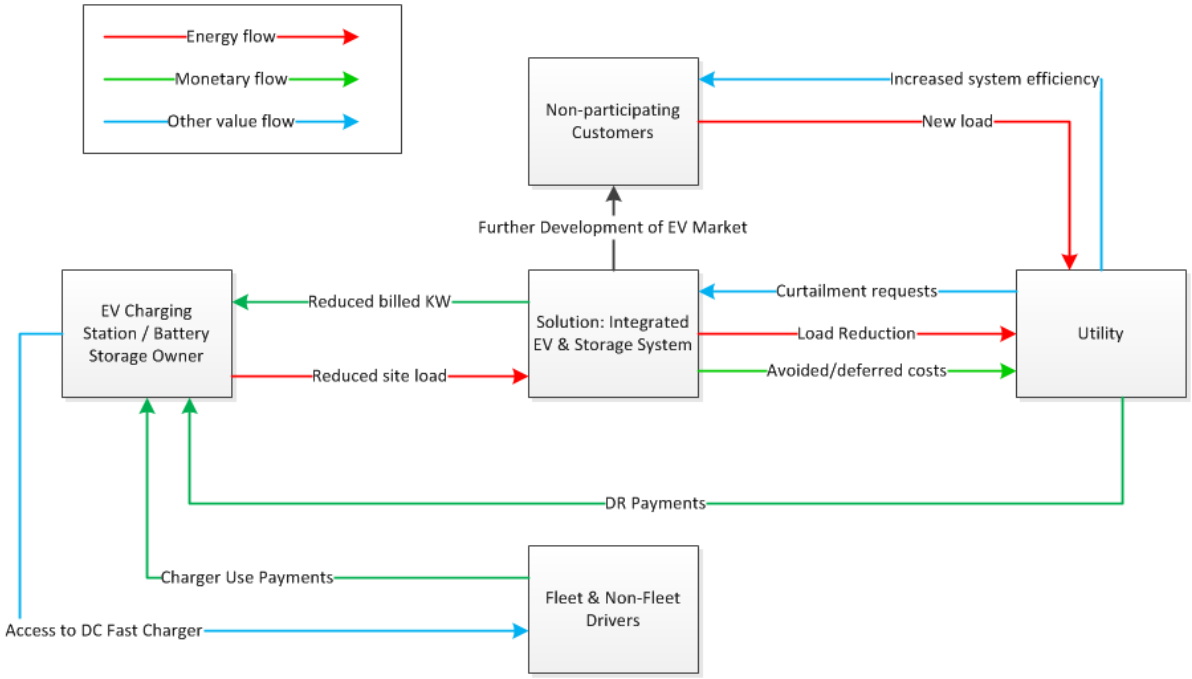

Figure 9: Value Exchange between Parties

i. Fleet & Non-Fleet Drivers

Fleet operators will have access to fast charging infrastructure to meet their transportation needs, allowing for the increased conversion of ICE vehicles to EVs. Fleet operators will benefit from reduced operating cost by utilizing energy storage to mitigate the peak demand caused by EV charging.

Customers and EV drivers will benefit from the additional DC fast charging. In addition to providing increased charging infrastructure, drivers will benefit by making the cost of utilizing DC fast charging affordable.

ii. EV Charging Station / Battery Storage Owner

The primary use of this charging infrastructure will be to serve the needs of RG&E fleet vehicles and will also serve to meet the fast charging needs of regional EV drivers in the Rochester area. This project will demonstrate an innovative solution for using storage and flexible charging to meet the charging needs of fleet and other vehicles without adversely impacting facility energy costs. Demonstrating and providing the learnings from a solution that reduces the cost of operating a DC fast charger will contribute towards DC fast charging becoming a viable business model.

iii. Utility

An increase in non-peak load will increase overall system efficiency. Utilizing the battery to avoid increases in peak load caused by the rise in EV charging demand, RG&E will defer or avoid investments in infrastructure to meet additional peak demand. Additionally, RG&E will gain insight regarding the value of energy storage to help meet distribution system needs. This learning will also inform future battery and EV rate design.

iv. Non-participating Customers

All customers will benefit from further development of the EV market. An increase in beneficial electrification that improves overall system efficiency can lead to reduced prices for all customers. As transportation is electrified, customers will also benefit from the associated environmental benefits including carbon emission reduction and improved air quality.

b. Customer Segmentation and Demographics

The primary targeted customers of this solution will include:

- RG&E and other employees who are utilizing the charging equipment
- RG&E facilities management

The charging equipment is expected be made available for public use in early 2019. At that phase users will be broken into the following categories:

RG&E fleet users

This will include EV fleet users from affiliated companies who may be traveling to the RG&E Scottsville Road office from other Company locations.

RG&E employee users (personal use)

Over 300 personnel work from this facility and will be encouraged to adopt EVs by having access to workplace charging during non-critical operational periods.

Municipal fleet users

The City of Rochester and Monroe County have been making efforts to add EVs to their fleet.

Private commercial fleet users

There is a continued trend toward greater adoption of EVs for private fleet use in the Rochester area.

Local private users

Monroe County currently has the 9th highest number of registered EVs in New York State and the 2nd highest out of the upstate New York Counties.

Traveling private users

There is demand for DC fast charging in western New York due to the current void of DC fast chargers in the Rochester region.

c. Channels

Communications related to this demonstration project will be directed toward the following customers:

- Employee fleet users
- Employee non-fleet users
- Municipal and commercial fleet users
- Local private users
- Regional private users
- EV Stakeholders

Employee fleet users will receive training and instructions regarding usage of the Level 2 and DC fast chargers. Employee non-fleet user communications will seek to promote and maximize the utilization of Company owned EV chargers. Municipal and commercial fleet users will be made aware of the opportunity to utilize these DC fast chargers through direct communication from RG&E's Public Affairs and Key Account personnel. RG&E will work with the local Rochester area outreach initiative, known as ROC EV, to publicize the DC fast charger to the local community. The participating EV network provider will publicize the DC fast charger to both local and regional EV drivers by making the location and charger details available on their mobile application. The location and charger details will also be made available through other mobile and web applications such as PlugShare. Overall results

from the project will be communicated to EV and other stakeholders through quarterly status reports.

In addition to direct channel outreach, community outreach and engagement will be an important aspect of this demonstration project. RG&E is leading by example with incorporating EV's into its ICE vehicle fleet which will help to normalize EV adoption for customers. The addition of DC fast charging infrastructure in the Rochester area will help customers to be comfortable with EV's being able to effectively meet their transportation needs. RG&E will leverage other regional efforts, such as the Rochester EV Accelerator Initiative, to supplement its own outreach.

Outreach will focus on several key themes:

1. Benefits of EV Ownership
2. Benefits and Availability of the DC Fast Charger

d. Ability to Scale

The Integrated EV and Battery Storage System has the ability to scale both as a whole system and with respect to its individual components. DC fast chargers can and will be installed as individual demands increase in the future. If a stationary battery is included with a DC fast charger installation, that battery can charge during lower price and off peak times and then be discharged when the DC fast chargers are being utilized. A key outcome of this project will be an assessment of the cost-benefit to utilize battery storage to offset the load impact of EV charging. RG&E anticipates this project providing particular insight on replication to commercial and municipal fleet owners as they consider electrifying their ICE vehicles.

4. Demonstration Plan

a. Metrics for Success

The table below in Figure 10 identifies the metrics and measures of success for the proposed demonstration project.

Hypothesis	Metric	Measure of Success
Utilizing and dispatching a stationary battery with flexible charging load can help meet customer transportation needs while minimizing cost and system impacts.	1. Building demand reduction	Reduce incremental monthly demand and associated demand charges by >80% month over month compared with no stationary battery and flexible load.
	2. Building Load Factor Improvement	Improve existing building load factor by 10%
	3. Circuit demand reduction	<10% of maximum potential demand from EV chargers is coincident with monthly circuit peak demand.
	4. Energy arbitrage	No increase in facility energy cost due to battery operation
	5. Demand Response Performance	Participate in 100% of NYISO and RG&E events called.
	6. Cost Effectiveness	Perform benefit cost analysis based on results of demonstration project
An integrated EV charging and battery storage system will provide valuable information for ratepayers, policy makers, and utilities.	1. Inform DC Fast Charger Distribution Infrastructure Impact	Produce and publish analysis on the effectiveness of battery storage to meet distribution upgrade needs for DC fast chargers.
	2. Inform rate design	Evaluate and inform alternative rate designs for DC fast charging when accompanied by storage.

Figure 10: REV Demonstration Metrics and Measures of Success

b. Timelines, Milestones and Data Collection

The demonstration project will cover a thirty-two month period that includes site preparation, construction, and commissioning of the EV charger and battery system. The installation of the system is envisioned to take eight months and be complete by the end of 2018. Once the systems have been installed, a twenty-four month timeframe will be used for hypothesis validation, scalability analysis, and reporting of results. Milestones and projected completion dates are shown in Figure 11 below.

Milestone	Date
EV Charger and Battery Vendors Selected	May 2018
EV Charger(s) and Battery Installation	June - December 2018
Hypothesis Validation and Data Collection	January 2019 – December 2020
Results and Report Creation	October 2020 – December 2020
Scalability Analysis	November 2020
Demonstration Project Completion	December 2020

Figure 11: REV Demonstration Project Milestones

Data Collection

Data will be a critical part of evaluating the performance and benefit of the Integrated EV Charging and Battery Storage System. Throughout the project, data will be collected, tracked, and evaluated. That data will include: charger utilization, charger load, battery load, battery output, facility load, circuit load, DR event participation, energy cost, and demand cost. All data will be collected in 15 minute increments or less.

c. Participation

This project will include strong collaboration between RG&E, an EV Network Provider, and the Battery System provider. EV drivers will also be a major participator in this project. Drivers will include RG&E employees, local municipal and commercial EV fleet drivers, and public EV drivers. Specific participating parties are as follows:

- **RG&E Project Team** – Responsible for development and delivery of the project along with measurement and dissemination of results. The RG&E project team will be supported by a 3rd party integrator.

- **EV Network Provider** – Provides a solution for user and system interface including EV applications, scheduling and curtailment functionality.

- **Battery System Provider** – Provides an intelligent system that controls and optimizes battery charging and discharging to optimize the value of the proposed use cases.

- **RG&E EV Drivers** – Users of electric vehicles, charging equipment, and charging scheduling application.

- **Commercial or Municipal EV Drivers** – Users of charging equipment and charging scheduling application.

- **Public EV Drivers** – Users of charging equipment.

d. Conditions / Barriers

This project is proposing an innovative approach to utilizing DC fast charging and demonstrating the value of battery storage. With this innovation comes potential barriers, such as:

Utilization of chargers – The exact level of utilization of the chargers by private users is unknown. Estimations have been made based on utilization of other DC fast chargers, but, those are in different regions. If utilization is higher than expected the battery may not have enough energy to reduce facility demand to the desired levels. This risk can be mitigated by varying the retail price for using the DC fast charger in order to reduce usage during critical periods.

Market for Storage Resources – Storage resources that are dispatched daily may not receive full credit when responding to demand response events. Also, small, behind-the-meter resources cannot participate in NYISO capacity markets. This project will help to inform future markets for energy storage resources.

5. Financial Elements / Revenue Model

a. Utility Revenue Streams

RG&E estimates the following revenues over the course of the thirty-two month demonstration period of this project as shown in Figure 12 below:

Revenue Stream	Projected Revenue
Public Charging Revenue[2]	$22
Demand Reduction Revenue[3]	$63
Demand Response Revenue	$0.2
Energy Arbitrage	$2
Total Revenue	***$88***

Figure 12: Estimated Total Demonstration Period Revenue ($000)

RG&E expects to test four revenue streams as part of this demonstration project:

i. **Public EV Charging** – An EV charging revenue stream will be created once public and third-party access is granted to the DC fast chargers in early 2019. Users will be charged based on to-be-determined rates and factors which will likely include a time increment and/or an energy increment.

ii. **Reduced Building Demand Charges** – Multiple aspects of this project will contribute to a reduction in site demand charges. The battery system will be dispatched specifically to reduce demand, both EV charging demand and building demand. In addition to battery dispatch, the EV chargers will curtail output at times of peak demand.

iii. **Demand Response Payments** – As part of this demonstration project the RG&E Scottsville Road site will participate in multiple demand response programs. These will include the RG&E Commercial System Relief Program, the NYISO Emergency Demand Response Program.

[2] Assumes a 10% DC fast charger utilization rate in 2019 and 15% utilization 2020, at an average rate of $10 per charge session escalating at 3% annually.

[3] Assumes a 3% annual escalation of the demand charge.

iv. **Energy Arbitrage** – As a general approach, the battery system will charge at low demand times, which also happen to be low price times. The battery system will be dispatched at high demand times, which also happen to be high price times. This differentiation in price between charging and discharging is expected to create revenue, or at a minimum, eliminate the financial impact of round trip efficiency of the battery system.

The yearly revenue streams for the demonstration period are shown in Figure 13 below.

Revenue Stream	2019	2020
Public Charging Revenue	$8	$13
Demand Reduction Revenue	$31	$32
Demand Response Revenue	$0.1	$0.1
Energy Arbitrage	$1	$1
Total Revenue	***$41***	***$46***

Figure 13: Estimated demonstration period yearly revenue streams ($000)

b. Investments

The total cost to develop, design, build, and implement the project is approximately $2,112,000 which includes the cost to develop the project specifications and technical requirements, install the batteries, battery management system, DC fast chargers, and level 2 chargers and maintenance for the two years after installation.

Categorization of the cost is as follows:

Figure 14: Cost Categorization ($000)

The yearly cash flow for the duration of the demonstration projects is depicted below in Figure 15 below.

	2017	2018	2019	2020
Estimated Costs	$154	$1,940	$8	$8

Figure 15: Estimated project cost ($000)

c. Returns

The Integrated EV Charging and Battery system has a life expectancy of 10 years once placed in service. If RG&E assumes the system is placed in service in 2018 and is taken out of service in 2028 expected revenue stream for the additional eight (8) years beyond the demonstration period would be $581,000 the breakdown of which is shown in Figure 15 below.

Revenue Stream	2021 – 2028
Public Charging Revenue[4]	$275
Demand Reduction Revenue[5]	$295
Demand Response Revenue	$0.9
Energy Arbitrage	$9
Total Revenue	***$581***

Figure 16: Total projected revenue for the 8 years beyond the demonstration period ($000)

d. Cost Effectiveness

Battery storage solutions are likely to become more and more cost effective as the market matures and the price for battery modules continues to decline. Some research suggests that battery prices could come down by more than 50% over the next ten years. In addition

[4] Assumes a 20% utilization rate in 2021, increasing by 5% annually through 2023 and then 2.5% annually through 2028, at an average rate of $10 per charge session escalating at 3% annually.

[5] Assumes a 3% annual escalation of the demand charge

to battery prices, we expect that a more mature market will lead to savings on project development and installation cost.

A simple payback and Internal Rate of Return ("IRR") cost analysis was performed using four scenarios to show the potential cost effectiveness if the battery portion of the integrated system was reduced by 25, 35, and 50 percent. This analysis is designed to simulate battery storage price reductions and remove cost variables attributed to the battery physical location or differing host company cost structures. The result of that analysis is shown in Figure 16 below.

Figure 17: Simple payback and IRR analysis utilizing various battery system cost reductions

[6] The battery cost used in these scenarios reflects the market cost of a150KW / 600kWh battery storage system intended to be paired with level 2 and fast DC chargers. These costs do not include RG&E overheads, development cost, or internal labor.

6. Reporting

RG&E will produce and submit quarterly reports to the Commission. The quarterly reports will include a description of progress toward project milestones, project cost performance (actual expenditures compared to budget), and the success metrics described in Section 4(a). In addition, quarterly reports will include lessons learned that will be applied during the remainder of the project. These lessons learned and final metrics will be summarized in a final evaluation report.

7. Conclusion

a. Post-Demonstration Benefits

Utilization of DC fast chargers will be critical for enabling mass market adoption and significant growth in EVs. DC fast chargers have a low load factor and if left unmanaged they will contribute to increased peak demand. Additionally, the high power requirements will create high demand charges for the charger owner. The Integrated EV Charging and Battery System project will help identify and inform the value of fast responding energy storage and how it can be used to decrease the peak demand impact of EV charging.

This project will help inform cost effective implementations of energy storage and how it can be paired with DC fast charging. This project will also help inform how utility rate design might value flexible loads such as EVs and help encourage the development of the EV market which in turn will provide a significant benefit to New York through emissions reduction fuel cost reductions for consumers.

The Integrated EV Charging and Battery System will enable the use of EVs in RG&E's fleet and will directly contribute to a reduction in facility and circuit peak demand. The reduction in peak demand, both directly attributed to this project and that which is informed by the results of this project, will also benefit New York through reduced need for peak generation.

Future investments and business models will be informed based on the learning within this project.

b. Plans to Scale

The Integrated EV Charging and Battery Storage System has opportunities to scale both as a whole system and as individual components. As a whole system, new DC fast chargers could be installed to help support the developing electric vehicle market. Energy storage will help reduce both the upfront cost and the ongoing cost of operating DC fast charging.

As individual components, RG&E and a market partner could offer energy storage as a service to its customers. The energy storage service would create value by reducing building, circuit, and system load and participating in applicable markets.

This project will also provide insight for any other customer and EV charger owner to utilize battery storage to offset their peak demand, especially in the case of DC fast chargers.