Karla M. Corpus
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October 31, 2018

VIA ELECTRONIC DELIVERY

Honorable Kathleen H. Burgess
Secretary
New York State Public Service Commission
Three Empire State Plaza, 19th Floor
Albany, New York 12223-1350

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

NIAGARA MOHAWK POWER CORPORATION d/b/a NATIONAL GRID: COMMUNITY RESILIENCE REV DEMONSTRATION PROJECT – Q3 2018 REPORT

Dear Secretary Burgess:

Niagara Mohawk Power Corporation d/b/a National Grid ("National Grid") hereby submits for filing its quarterly update to the Community Resilience REV Demonstration Project Implementation Plan covering the period of July 1, 2018 through September 30, 2018 ("Q3 2018 Report") as required by the REV Demonstration Project Assessment Report filed by the New York State Department of Public Service Staff ("Staff") with the Commission on February 10, 2016 in Case 14-M-0101.

Please direct any questions regarding this filing to:

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National Grid looks forward to continuing to work collaboratively with Staff as it proceeds with the implementation of the Community Resilience REV Demonstration Project.

Respectfully submitted,

/s/ Karla M. Corpus

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Senior Counsel

Enc.

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nationalgrid

Community Resilience
REV Demonstration Project
Potsdam, New York

Q3 2018 Report

October 31, 2018

nationalgrid

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1.0 Executive Summary

Under the New York Public Service Commission's ("PSC") Reforming the Energy Vision ("REV") proceeding, this Community Resilience Demonstration Project (the "Project") consist of developing financial and engineering plans for a community microgrid that, once constructed, improves the local resiliency during severe weather events in the remote Village of Potsdam ("Potsdam") in upstate New York. Potsdam and surrounding St. Lawrence County have experienced multi-day power outages as a result of microbursts and winter ice storms; most notably the "Ice Storm of 1998" which left over 100,000 customers without power for up to 3 weeks in the North Country and recently, in December of 2013, another ice storm isolated over 80,000 customers for several days.

Image 1.1 – Photo of upstate New York after the 1998 Ice Storm[1]

Niagara Mohawk Power Corporation d/b/a National Grid ("National Grid" or the "Company") has partnered with GE Energy Consulting ("GE"), OBG (formerly O'Brien & Gere) , Nova Energy Specialists, LLC ("Nova Energy") and Clarkson University ("Clarkson") to develop an engineering design and an investment-grade financial model to build and operate a community resilience microgrid for Potsdam. The microgrid plan consists of a robust underground distribution network and coordination of new and existing distributed energy resources ("DER"), which may include natural gas generators, hydroelectric generators, and a large photovoltaic ("PV") solar array. Essential infrastructure that is expected to remain operational during prolonged power grid outages and which are planned to be connected to the microgrid include a hospital, the local police and fire departments, drinking water and wastewater treatment plants, Village of Potsdam government offices, two (2) higher education institutions, a high school, a bank, a drug store, a grocery store,

[1] Image was taken during the aftermath of 1998 Ice Storm.

hotel, and a gas station. The Project includes developing a new economic model for community microgrid projects which involves hybrid ownership and operation of assets between the utility and DER owners, as well as a unique tiered tariff design that recovers the cost of the utility's assets from the community segments that benefit from the microgrid's operation.

Concurrently, the project involves National Grid developing and evaluating new utility services and business model that may be required for further microgrid deployment in New York State. The four (4) services to be developed are:

1. Tiered recovery for storm-hardened, underground wires;
2. Central procurement for DER;
3. Microgrid control and operations; and
4. Billing and financial services.

While National Grid is leading the Project, this Project consists of a close-knit partnership effort between GE, Clarkson and National Grid. OBG and Nova Energy are also contributors via subcontracts under GE. Moreover, this project requires significant input from other major Potsdam stakeholders, such as the Village of Potsdam government, the Canton-Potsdam Hospital, and the State University of New York at Potsdam ("SUNY Potsdam").

Image 1.2 – The major stakeholder partners of the Community Resilience demonstration (clockwise, from top left: Clarkson University, SUNY Potsdam, Village of Potsdam Offices, and Canton-Potsdam Hospital)

During Q3 2018, the National Grid Project team continued the major efforts of the Detailed Engineering Design and Financial and Business Plan phase (Phase 2) of the Project. The majority

of the activities during this quarter focused on completing the draft GE reporting text, then conducing reviews and subsequent updating of text sections. Additionally, the customer engagement survey drafted in Q2 2018 was finalized, and the connected customers were surveyed regarding the four (4) proposed microgrid services

The Project team held several team calls, mostly on a bi-weekly basis, to discuss the status of each partner's report responsibilities and progress.

2.0 Highlights Since Previous Quarter

National Grid and the key Project partners made steady progress in Q3 2018. Figure 1-1 provides a reference timeline for 2017-2018 emphasizing the major milestones and accomplishments to date. Changes and additions are highlighted in yellow and are described in additional detail below in Section 3.1.

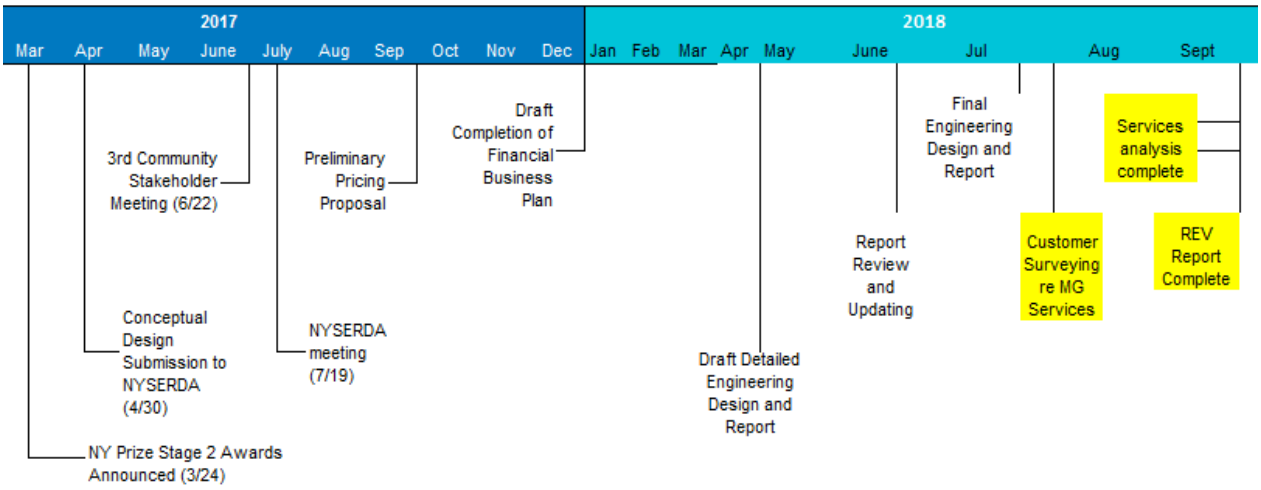

Figure 1.1 –2017-2018 Major Milestones Timeline*

**Note: The Project schedule stated in the Project Implementation Plan was predicated on the Project Conceptual Design, performed under a NYSERDA PON, being completed in mid- 2016. The conceptual design was completed approximately one year later, resulting in the need to extend this Project's schedule beyond the originally-planed completion date of Q2 2017.*

2.1 Major Task Activities

1. **Stage 2 Report Preparation**
   The Project report development team led by GE completed revising their draft report per the comments submitted by National Grid following its detailed reviews of the draft report. Several conference calls were held among reviewing parties and authors to discuss the feedback received and select the best approach to address each comment.

   Additionally, GE oversaw their two (2) Project subcontractors, Clarkson University and Nova Energy specialists. During Q3 2018 these contractors updated their respective report sections based on the review feedback they received. Both contractors participated in conference calls with National Grid to review National Grid comments.

Lastly, OBG, National Grid's contractor responsible for several of the equipment-related report sections, completed updating its draft report sections based on comments received from National Grid.

2. DER-CAM Analysis

The Distributed Energy Resources Customer Adoption Model ("DER-CAM2") is an economic, energy balance, and environmental model that is used for determining optimum sizing of DER assets in grid-connected and off-grid microgrid systems. A more detailed description of the DER-CAM model is provided in the Q2 2017 Project report.

There were no updates made to the DER-CAM analysis during this quarter.

3. Microgrid Configuration and Design

Staged Roll-out

There were no changes made this quarter to the Staged Rollout configuration or design. As noted in the Q2 2017 report, while the originally-envisioned community microgrid footprint involved supporting all critical services in the Town of Potsdam, the cost of the full microgrid was determined to be economically infeasible, so a staged approach to microgrid construction was subsequently developed. As noted in the Q3 2017 quarterly report, the decision was made by team members to adopt the staged roll-out approach, with Stages 1, 1b, and 2 all being constructed under Construction Phase 1, also termed 'the smaller footprint.' This approach allows the construction investment to occur over an extended period of time. Once selected, this decision was communicated to all members of the Project Team so that they could proceed with their tasks accordingly.

Data in Table 2.1 below describes the staged approach, while Figure 2.3 that follows provides a geographic location of each stage.

Stage	Start/Finish Point	Route (Streets)	Proposed Load Connections	Possible Generation Connections
Stage 1	Clarkson University (feeder 51) to Village Civic Center	Maple St. -> Main St.	Clarkson University, Kinney Drug Store, Stewart's Shops Gas Station, The Clarkson Inn, North Country Savings Bank, IGA Grocery, Civic Center/Rescue Squad	West Dam Hydro and Clarkson's new DERs, one available
Stage 1b	Maple St. to East Dam Hydro	Market St. -> Raymond St.	Stage 1 + Water Treatment Plant	West Dam Hydro + East Dam Hydro
Stage 2	Village Civic Center to Canton-Potsdam Hospital ("CPH")	Park St. -> Elm St. -> Lawrence Ave. -> Leroy St.	Stage 1 + Potsdam High School and CPH	West Dam Hydro + East Dam Hydro
Stage 3	CPH to Wastewater Treatment Plant	Grove St. -> Cherry St. -> Lower Cherry St.	Stage 2 + Wastewater Treatment Plant	West Dam Hydro + East Dam Hydro
Stage 4	Village Civic Center to SUNY Potsdam	Main St. -> SUNY at Morningside Dr.	Stage 3 + SUNY Potsdam	West Dam Hydro + East Dam Hydro + SUNY CHPs
Stage 5	SUNY Potsdam to solar PV via overhead line	Morningside Dr. -> Elm St.	Stage 4 + PV	West Dam Hydro + East Dam Hydro + SUNY CHPs + PV
Stage 6	Clarkson to National Grid Service Center	Pine St.	Stage 5 + National Grid Service Center	West Dam Hydro + East Dam Hydro + SUNY CHPs + PV

Table 2.1 – Staged Roll-Out Approach

Figure 2.2 – Staged Roll-Out Approach Map

Engineering Design of Staged Roll-out
There were no changes to the staged roll-out made this quarter. As stated in the Q4 2017 report, one-line diagrams for the large (full build-out) microgrid and small footprint (staged approach footprint through Stage 2) microgrid were previously developed and updated.

Cost Estimates of Staged Roll-out
Based on the final DER-CAM analysis completed in Q1 2018, a final amount of additional generation was determined. Prices for that generation equipment were then obtained. The updated total cost estimate for constructing Stages 1, 1A, and 2 is presented in Table 5-1. Individual costs for these three (3) stages were not calculated because they would only be constructed as a group. The updated estimates for engineering, procurement, construction, and ten (10) year operation and maintenance ("O&M") costs, were prepared this quarter by OBG, and are presented in Table 5-1.

Regulatory Developments
Pursuant to the PSC's Value of Distributed Energy Resources ("VDER") proceeding[2], the Project team continued to monitor development of value stack determinations and filings by NY PSC during this quarter as they relate to implications for the Potsdam Community Microgrid. There were no significant VDER-related developments by the PSC which directly affect this Project that were identified this quarter.

Customer Base - Tiered Recovery
These were no further activities conducted under this task during this quarter.

4. Financial Model Development
The Project's financial model was updated based on the staged-rollout pricing model using the cost data presented above. The customer-specific pricing proposal was included in the customer surveying, described below.

While the Tiered Recovery financial model addresses the grid materials and equipment costs, generation costs were expected to be recovered through other means. During Q1 2018, National Grid started developing a cost compensation model for DER owners. Development of this model was terminated in Q2 2018 due to the myriad of data essential to model development that cannot be determined until microgrid governance is finalized and a DER developer commits to providing power to the proposed microgrid. These steps are beyond the scope of this Project.

5. Stakeholder Outreach
The task of obtaining Tier 1A and 1B customer (which are the connected customers) opinions on whether or not they would choose National Grid to provide microgrid-related services was completed. All but one (1) of the thirteen (13) connected customers was surveyed; National Grid was not surveyed because of our inherent bias in the survey. The survey form presenting an explanation of each microgrid

[2] *See* Case 15-E-0751 *et al*., *In the Matter of the Value of Distributed Energy Resources* ("VDER Proceeding") *et al.*, Order on Phase One Value of Distributed Energy Resources Implementation Proposals, Cost Mitigation Issues, and Related Matters (issued September 14, 2017)("VDER Phase One Order").

service under consideration was finalized. Each Tier 1A and 1B customer was contacted to schedule 1:1 meetings with their leadership. In-person meetings were held with those able to meet, while those unable to meet were contacted by telephone. The survey purpose and content was explained during the meetings and calls; customers were asked to complete the survey on their own and return it to National Grid. Survey forms were received from all but one (1) Tier 1A customer and all but two (2) Tier 1B entities.

As described in the Project Implementation Plan the survey posed the question 'Who does a customer prefer to provide the following services?'

1. Tiered recovery for storm-hardened, underground wires;
2. Central procurement for DER;
3. Microgrid control and operations; and
4. Billing and financial services.

Question 1 presented the customer-specific monthly cost values as costs that would be recovered for a storm-hardened system. While the Implementation Plan prescribed presenting just the total cost, National Grid recognized that different customer costs would result from different amounts of external funding obtained to support microgrid construction. External funding could vary significantly depending on how many sources provided the funding, and the amount of funding provided. Without a firm commitment on outside funding, National Grid chose to pose Question 1 using three (3) scenarios. The first monthly cost estimate presented (Cost #1) was the total cost straight from the model. The second monthly cost estimate (Cost #2) assumed the project received $1M grant so Cost #2 was slightly smaller than Cost #1. The $1M grant amount was based on the possibility of this Project being awarded $1M in funding assistance under the NY Prize Stage 3 Program. Cost #3 assumed the Project would receive grant funding to pay fifty percent (50%) of the overall Project cost, resulting in Cost #3 being half of Cost #1.

All three (3) of these customer-specific monthly costs were based on a twenty-four (24)-month kilowatt ("kW") and kilowatt-hour ("kWh") (load and consumption) history, as applicable, calculated using the tiered recovery model. Each customer was asked if they would subscribe to the microgrid if the monthly cost consisted of an additional line item on their monthly electric bill in the amount of any of these options.

For survey questions 2-4, customers had to choose between "the utility" and 'a third party'. The purpose of structuring the utility option response generically is to help enable the overall tenor of the responses to be transferrable to other microgrid projects under consideration, regardless of the specific utility franchise or service territory.

6. Survey Findings

Table 2-2 presents the Tier 1A and 1B Customer Survey results. Discussions with, and written comments received from, surveyed customers included the following reasons why some customers would choose not to accept the microgrid connection under the proposed tiered recovery program:

1. Some customers can purchase and operate a portable generator or install a standby generator for a cost that would equate to ten (10) or fewer years of their proposed monthly microgrid bill increase. The microgrid monthly bill increase would exist for seventy-five (75) years, making the customer-owned generator more financially attractive to some customers; and

2. A connected customer may choose to shut down during an outage lasting anything longer than eight (8) hours. Certain customers felt it would not be practical to remain open throughout such power outage events, given that few people patronized their establishments during prior prolonged outages.

Question		Yes	No	Undecided	No Response
1. Would you participate as a microgrid customer if your bill increased by:	Base Cost	1	8	0	3
	Slightly reduced cost	1	8	0	3
	50% of Base Cost	1	7	1	3
2. Would you prefer the utility provide central procurement for a DER?		6	1	0	5
3. Would you prefer the utility be in control of the microgrid and its operations?		7	0	1	4
4. Would you prefer the utility provide billing and financial services?		7	0	1	4

Table 2-2: Tier 1A and 1B Results of Microgrids as a Service (MAAS) Survey

7. Go/ No-Go Decision

The overall outcome of the Tier 1A and Tier 1B survey indicates there is minimal interest in paying to connect to a microgrid. However, the other services are a 'go'. Table 2-3 lists the Go/ No-Go analysis findings based on the survey outcomes shown in Table 2-2.

Question	Go	No-Go
1. Would you participate as a microgrid customer if your bill increased?		X
2. Would you prefer the utility provide central procurement for DER?	X	
3. Would you prefer the utility be in control of the microgrid and its operations?	X	
4. Would you prefer the utility provide billing and financial services?	X	

Table 2-3: Go/ No-Go Outcomes of Microgrid Services Survey

The project Implementation Plan states the any of these microgrid services deemed a 'Go' would require binding agreements from each of the affected parties. However, with no formal microgrid developer and no governance plan in place, several customers advised they had no interest in signing a binding agreement at this time. Therefore, the survey expressly stated all responses were non-binding.

The Implementation Plan states any of the four hybrid utility microgrid services deemed a "Go," will require a second stage of demonstration. The second stage would consist of evaluation of each of the services to determine the effectiveness of the business model and the services provided. A more formal evaluation plan for the second stage was to be proposed in this quarterly report. However, considering the customers' lack of willingness to pay for a microgrid, National Grid will not pursue a second stage of analysis on the three (3) service deemed acceptable, as doing so would only be hypothetical.

Consistent with the Implementation Plan, National Grid considers the three (3) microgrid services that were deems a "Go" as possible commercial offerings available to other communities interested in pursuing a hybrid utility microgrid model. Future microgrid projects could start their own evaluation of customer acceptance of microgrid services utilizing data collected within this Project.

The following factors indicate that construction of the proposed Potsdam microgrid, or some component of the Potsdam microgrid, will not be constructed in the near-term.

1. An electric service interruption event (herein termed 'outage') history review shows that, contrary to anecdotal stories, there have been very few outages of any significant duration occurring in the Village over the past eight (8) years (the starting date of detailed outage history collection). From January 1, 2010 through December 31, 2017, forty-two (42) outages occurred. Three quarters of these outages lasted one (1) hour or less; and all but one (1) outage was less than four (4) hours. The longest outage was caused by an automobile accident; it lasted

4.5 hours, and affected one (1) of the thirteen (13) proposed connected-load customers. The review also found that the entire December 2013 ice storm duration resulted in one (1) outage event occurring in the Village, which lasted less than one (1) hour. (See Table 2-4).

Interruption Event Cause	Interruption Event Quantity	% of Total Events
Equipment Failure	18	43%
Tree-Related Event	8	19%
Weather-Related Event	7	17%
Unknown	4	10%
Vehicle	4	10%
Maintenance	1	2%
		100%

Table 2-4: Electric Power Interruptions in the Village of Potsdam for the Period of January 1, 2010 – December 31 2017

2. There is no developer leading construction of the proposed microgrid, nor is there an agreed-upon governance structure for a microgrid. Various governance structures were explored during preparation of the GE's report. These included a model based on establishing a consortium consisting of connected load customers; and a model in which an external developer provides the DER and also takes the lead on driving the microgrid m design and construction process, including obtaining all permits, executing stakeholder engagement, and leading the next engineering design steps. However, based on customer feedback and Project costs, further action on a microgrid is not warranted at this time.

3. The customer feedback survey conducted as a final step in the Project work scope showed a general lack of customer interest in paying an additional monthly fee to be connected to the microgrid. The survey also revealed that most of the connected load customers providing essential community services could either handle an outage of up to two (2) weeks on their own, or would close for the duration of the outage because need for their services would be reduced during a major storm (*e.g.,* the high school may not open due to transportation safety issues).

4. The electric transmission and delivery system serving the Village has proven sufficiently robust to be relatively unaffected by weather events (including microbursts). This electric service continuity has likely contributed to customer confidence that the system will continue to be reliable, and therefore, a microgrid is not needed in the Village.

2.2 Challenges, Changes, and Lessons Learned

The following issues or changes occurred during Q3 2018.

Issue or Change	What was the resulting change to Project scope/timeline?	Strategies to resolve	Lessons Learned
Surveys were not received from some customers.	The tallied survey results are less representative than intended.	The Project manager contacted customers via telephone to discuss the survey, and customer emailed their surveys to the Project manager.	Not all customers who express willingness to provide requested information will actually provide it.
An analysis of historical outages showed the Village of Potsdam had not experienced prolonged power outages (>4 hours) over the past eight (8) years.	This numerically supported the strong lack of interest in paying an additional fee for a microgrid because public perception is that there is strong electric reliability.	The analysis of historic outages should span a longer time frame to take into account a greater number of outage events.	Shorter term perspective can obstruct understanding the overall issue.

3.0 Next Quarter Forecast

Each of the two (2) primary tasks remaining to be conducted in the project were completed Q3 2018, as scheduled. Therefore, this project has now been completed. Activities planned for Q4 2018 consist only of closing out the project's accounting.

3.1 Checkpoints/Milestone Progress

	Checkpoint/Milestone	Anticipated Start-End Date	Revised Start-End Date	Status	
1	Clarkson University NYSERDA PON Study *(Conceptual Design)*	10/2015 – 6/30/16	10/2015 – 10/31/16	●	Complete
2	Initial Engineering Design Recovery Plan *(Tiered Recovery Plan)*	4/6/2016 – 7/26/16	5/1/2016 – 9/30/16	●	Complete
3	Preliminary Service Proposal & Pricing *(Pricing Proposal)*	7/01/16 – 11/01/16	11/01/16 – 8/31/18	●	Complete
4	Phase 2 Completion *(Detailed Engineering Design and Business Plan)*	3/16/16 – 6/30/17	10/1/16 – 7/31/18	●	Complete
5	Go/No Go Testing	5/1/18 – 9/30/18	Unchanged	●	Complete

Key

● On-Track

● Delayed start, at risk of on-time completion, or over-budget

● Terminated/abandoned checkpoint

1. Clarkson University NYSERDA PON Study – Task 4 *(Conceptual Design)*

Status: [●] - Complete
Start Date: 10/2015
End Date: 10/31/16

Given all research tasks associated with the NYSERDA study are now compete, the Project team considers this Conceptual Design checkpoint complete. The Clarkson team completed the final Report on April 30, 2017. A final close-out meeting with NYSERDA was held on July 19, 2017

2. Initial Engineering Design Recovery Plan *(Tiered Recovery Plan)*

Status: [●] - Complete
Start Date: 5/1/16
End Date: 9/30/16

While continued adjustments of the microgrid design will ultimately affect the results of the tiered recovery, the approach and design of the recovery mechanism is not expected to change during the Project. Therefore, the Project team considers this checkpoint complete.

3. Preliminary Service Proposal and Pricing *(Pricing Proposal)*

Status: [●]- Complete
Start Date: 11/1/16
End Date: Revised from 5/31/18 to 8/31/18

This milestone consists of presenting the preliminary service and pricing offerings to stakeholders. The Project team completed this task.

4. Phase 2 Completion *(Detailed Engineering Design and Financial and Business Plan)*

Status: [●] - Complete
Start date: 10/1/16
End date: Revised from 6/30/18 to 9/30/18

National Grid partnered with GE and OBG to develop a Detailed Engineering Design and Financial Business Plan Assessment consistent with NY Prize Stage 2. GE subcontracted Clarkson and Nova Energy to perform some of the tasks that are outside of GE's area of expertise.

The Project team originally anticipated most of this milestone to be completed by the end of 2017, which it was, with drafts of most Project report sections being completed. Report internal review was completed, and the report was finalized in Q3 2018.

The end objective of this Project was to collect and compile the data necessary to enable preparing a compelling NY Prize Stage 3 funding application. However, absence of a developer prevented completing some report sections paralleling the NY Prize Stage 2 reporting. Until a developer assumes control of this Project, there will be insufficient data available to apply for NY Prize Stage 3 funding.

5. Go/No Go Decision Status: [●] - Complete

Start date: 4/1/18
End date: 9/30/18

This task consisted of conducting stakeholder engagement efforts to determine which of the four (4) services offered under this Project the customers will accept from National Grid. As described in Part 2, above, surveying was conducted this quarter among all but one connected load customer, with National Grid abstaining.

4.0 Work Plan & Budget Review

4.1 Updated Work Plan

As noted in the Q2 2018 report, per discussions with PSC Staff the Project schedule was extended to the end of Q4 2018. However, Project completion and final quarterly reporting was targeted to be completed in Q3 2018. This target schedule was successfully met.

4.2 Updated Budget

Table 4.2 below displays the updated total expenditures through September 30, 2018.[3]

Project Task	3rd Quarter Total Spend	Project Total Spend to Date	Incremental Project Budget	Incremental Spend To Date	Incremental Remaining Balance
CapEx					
	$0	$0	$0	$0	$0
Grants Credited Against Incremental Capital Costs					
n/a	n/a	n/a	n/a		
OpEx					
Project Administration and Planning	$0	$341,494	$131,000		
Marketing and Community Engagement	$23,665	$85,390	$200,000		
Implementation	$7,939	$103,010	$275,000		
Audit Grade Detailed Engineering Design	$32,750	$903,064	$1,000,000		
Total	**$64,354**	**$1,432,954**	**$1,606,000**	**$1,295,684**	**$310,316**

Table 4.2 – Updated Budget

The 'Project Total Spend to Date' values listed in Table 4-2 are the combined incremental and non-incremental costs. The incremental costs associated with the Project as of September 30, 2018 total is $1,295,684 leaving a remaining Project budget balance of $310,316.

[3] The Company updated the Project budget to reflect incremental costs, and to illustrate costs that are capital or operating expenses.

This quarter the consultant (GE) submitted an invoice for work that had been completed to date. As noted in previous quarterly reports, while the Project Administration and Planning budget has been depleted, the Project team continued to record expenses in this category to track categorical administrative expenses of the Project.

5.0 Progress Metrics

The Project participant load size, participant quantity, and linear length of the microgrid dictate the projected cost and configuration of the microgrid construction. This section of the Quarterly Report tracks the current projected cost range of the microgrid depending on the most recent engineering design estimates, as well as the projected resiliency duration of the detailed design.

5.1 Total Cost of Microgrid

The total estimated cost of the microgrid has changed from Q2 2018. Table 5.1 lists these cost estimates. The staged rollout approach (described in Section 2 above) changes the timing of the expenditures and ultimately affects the successful business plan of the microgrid. Explanation of the staged rollout is provided in Section 2.1.

Metric	As of Q3 2016	As of Q4 2016	As of Q1 2017	As of Q3 2017 – Stages 1, 1B, and 2	As of Q4 2017 – Stages 1, 1B, and 2	As of Q3 2018 – Stages 1, 1B, and 2
Projected Cost Range of Microgrid Construction, including control and communications ("C & C") equipment and generation	$35M - $60M[1]	$26.4M - $61.3M[2]	$26.4M - $61.3M[2]	$26.4M	<$25M	$19M[5,6]
Underground Wire Cost Range	$11.3M - $11.8M	$7.4M - $12.0M	$15.4M - $23.8M[3]	$8.79M – $13.465M	$8.79M – $13.465M[4]	$13.6M[5]
Projected Resiliency Duration	14 Days	14 Days	14 Days	14 Days	14 Days	14 Days

[1] *Range includes three (3) generation equipment options and two (2) distribution equipment options.*
[2] *Range includes three (3) generation equipment options and three (3) distribution equipment options.*
[3] *Range includes cost of equipment and installation. Previous estimates only included equipment costs.*
[4] *Range includes cost of equipment installation.*
[5] *Based on using one (1) generation equipment option and one (1) distribution equipment option.*

Table 5.1 – Cost of Microgrid

The DER (generation) cost was estimated based on the peak demand calculated via DERCAM2, which was 2.9MW. While this cost estimate is for the maximum demand, maximum demand is expected to only occur for short durations each business day. Based on the variable nature of the demand, the DER cost estimate was based on using multiple generators rather than a single unit capable of generating 2.9MW. This multi-unit approach allows operating the amount of generation capacity that more closely matches the microgrid's prevailing load at different times of the day. Additionally, it was also discovered that the one (1) MW generators actually operate between 800 and 900 kW of output depending on various factors. Thus four (4) generators would be needed to meet the peak 2.9MW demand. Note that installing four (4) generators also allows operating fewer generators in the event any other connected generation, such as the Village's hydro generation, is available to supply the microgrid. Additionally, the 2.9MW estimate was based on implementing energy efficiency ("EE") measured identified by the energy audits of Clarkson University, SUNY

Potsdam, and Canton-Potsdam Hospital conducted under this Project The peak demand may be larger than 2.9 MW if the EE upgrades have not been implemented by the time the microgrid operates, and furthermore, the variance in demand may also be larger. Conversely, additional EE upgrades may be identified in the future, further reducing the peak demand below 2.9MW. The proposed multi-generator approach effectively addresses both of these EE-related matters.

National Grid's contractor, OBG, estimated the total purchase and installation cost of four (4) natural-gas fueled reciprocating engine generators to be $3,782,600, based on June 2018 price data.

5.2 Tiered Recovery Population

There were no changes to the tiered recovery population as stated in the Q4 2017 quarterly report. Customer counts are displayed in Table 5.2.

	Commercial	Residential	Total
Tier 1	12	0	12
Tier 2	404	2,171	2,575
Tier 3	480	2,945	3,425
Tier 4	235	3,360	3,595
Tier 5	1,394	12,736	14,130
Total	2,513	21,212	23,725

Table 5.2 – Tiered-Recovery Customer Quantities