Karla M. Corpus
Senior Counsel
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January 31, 2017

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 – Q4 2016 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 October 1, 2016 through December 31, 2016 ("Q4 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.

Appendix E of the Q4 Report provides the names of stakeholder businesses, along with certain proprietary information for each stakeholder, for which National Grid does not have stakeholder authorization to make public. National Grid is submitting a redacted version of Appendix E with this filing, and will file an unredacted version, along with a request for confidential treatment, with the Commission's Records Access Officer contemporaneous with this filing.

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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Enc.

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Community Resilience

REV Demonstration Project

Potsdam, New York

Q4 2016 Report

January 31, 2017

nationalgrid

Table of Content

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") focuses on improving the local resiliency during severe weather events in the remote Village of Potsdam ("Potsdam") in Upstate New York with the creation of a community microgrid. Potsdam and surrounding St. Lawrence County have experienced a number of 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 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 Clarkson University in order to develop a community resilience microgrid for Potsdam with an underground distribution network and coordination of new and existing distributed energy resources ("DER"). Concurrently, the Company will develop and test new utility services that may be required for further microgrid deployment in New York State.

The four services to be developed and tested are:

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

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

While National Grid is leading the Project, this demonstration is actually a close-knit partnership effort between Clarkson University and National Grid. Moreover, it will require 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, Canton-Potsdam Hospital)

During the fourth quarter of 2016 the National Grid Project management team continued efforts to finalize the Conceptual Design phase (Phase 1) of the project and shepherd the project into the Detailed Engineering Design and Financial and Business Plan phase (Phase 2) of the project. The Project team took some time to review the basic assumptions that produced the Conceptual Design and create a solid framework for Phase 2. The New York State Energy Research and Development Authority ("NYSERDA") Program Opportunity Notice ("PON") 2715 Task 4 final report was received from partners Clarkson University and GE Energy Consulting containing the basis for the microgrid cost estimates as well as detailed societal benefit cost analysis ("BCA") for multiple scenarios.

In addition, the Project team continued to receive updates on the National Science Foundation ("NSF") Partnerships for Innovation: Building Innovation Capacity ("PFI:BIC") and the Department of Energy's ("DOE") Office of Electricity Delivery and Energy Reliability Enhanced Microgrid Control System ("eMCS") projects. Much of the fourth quarter activities involved contract negotiations with both existing and new partners as previous partnership agreements expired with the completion of the NYSERDA PON funding. The Project team took this opportunity to meet regularly to discuss each partner's responsibilities moving into the Detailed Engineering Design and Financial and Business Plan phase of the project.

2.0 Highlights Since Previous Quarter

National Grid and the key Project partners have made substantial progress in the fourth quarter of 2016, with all parties continuing to push for expected outcomes laid out in the Project Implementation Plan.[2] For a reference timeline emphasizing the major milestones and accomplishments, please see Figure 2.1. Changes and additions are highlighted in yellow and are described in additional detail in Section 3.1.

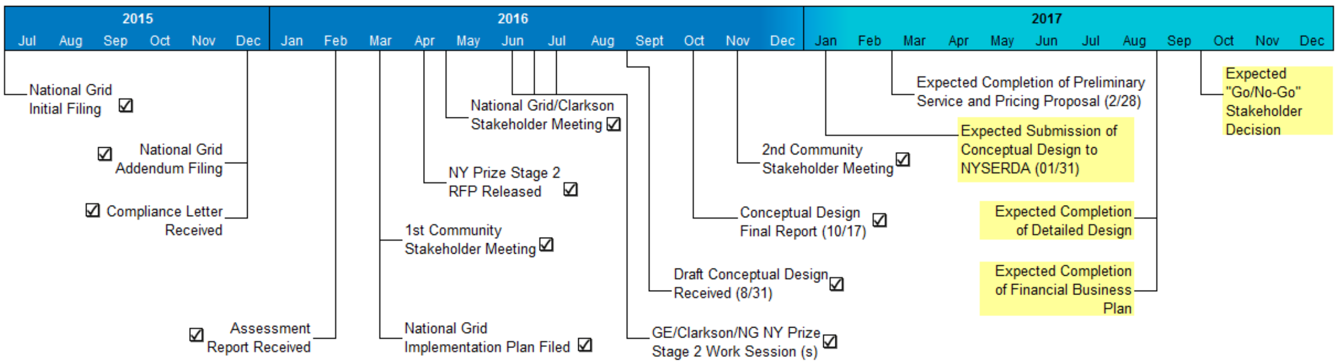

Figure 2.1 – Achievements and Milestones Timeline

2.1 Major Task Activities

1. **Conceptual Design Draft (NYSERDA PON Task 4)**
As noted in the 3rd quarter 2016 report, GE Energy Consulting delivered a draft of the NYSERDA PON Task 4 report (the "Report") to National Grid and Clarkson University on August 31, 2016. The draft Report contains the basis for the microgrid conceptual design with cost estimates, detailed one-line diagrams, and a societal BCA. The final Report was delivered to the Project partners on October 18, 2016.

Cost Breakdown
The cost estimates found within the Report were developed by GE Energy Consulting from actual equipment quotes, historical pricing, or raw estimations. A detailed material list was included in the Report with quantities, descriptions, specifications, and potential suppliers, but did not include specific costs by equipment item. Further material cost breakdowns will be included in the detailed engineering design during the next phase of the Project.

The draft Report provided cost estimates for three (3) new generation equipment options and two (2) distribution equipment options. The three (3) generation options include dual fuel, natural gas only, and a GE hybrid fuel cell/natural gas option, all with varying cost estimates. The two (2) distribution equipment options are distinguished between the number of circuit breakers needed for adequate protection

[2] Case 14-M-0101- *Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision* ("REV Proceeding"), National Grid Implementation Plan for Community Resilience REV Demonstration Project, Potsdam, New York (filed March 11, 2016).

and flexibility of the microgrid. After reviewing the cost information and one-line diagrams for each distribution option, the Project team required an additional option that would reduce the number of circuit breakers and utilize additional fused-switches to provide a strong level of protection and flexibility at a potentially lower cost.

The final Report (delivered on October 18, 2016) included the additional distribution option requested by the Project team. Distribution Option 3 contains a more basic protection scheme using a combination of breakers, relays, fuses, fused disconnects, and reclosers. Option 3 provides an acceptable level of protection while sacrificing a significant amount of flexibility, but at a much lower cost when compared with Option 1 or Option 2. All three distribution one-line diagrams presented in the NYSERDA PON report are found in attached Appendix B.

In addition to the third distribution protection option, the Project team requested additional detail within each option that was not provided in the draft Report. Table 2.1 below details the estimated costs of each component of the proposed microgrid and provides that additional detail.

Category	Equipment Costs	Installation Costs	Total
Generation			
Option 1 (Dual Fuel Engine Option)	$4,000,000[1]	$1,500,000	$5,500,000
Option 2 (Natural Gas Engine Option)	$2,700,000	$1,500,000	$4,200,000
Option 3 (GE Hybrid Fuel Cell/Natural Gas Engine Option)	$25,000,000[2]	$3,500,000	$28,500,000
Distribution System (Includes Interconnection Cable, Breakers, and Switches)			
Option 1 Total	$12,013,000	$11,855,000	$23,867,000
Transformer Total	$535,388	$514,500	$1,049,888
Underground Cable System Total	$5,813,300	$6,770,000	$12,583,300
Capacitor Bank Total	$54,000	$30,000	$84,000
Switchgear Total	$5,609,900	$4,540,000	$10,149,900
Option 2 Total	$11,577,000	$11,475,000	$23,051,000
Transformer Total	$535,388	$514,500	$1,049,888
Underground Cable System Total	$5,813,300	$6,770,000	$12,583,300
Capacitor Bank Total	$54,000	$30,000	$84,000
Switchgear Total	$5,174,000	$4,160,000	$9,334,000
Option 3 Total	$7,460,000	$8,115,000	$15,474,000
Transformer Total	$535,388	$514,500	$1,049,888
Underground Cable System Total	$5,813,300	$6,770,000	$12,583,300
Capacitor Bank Total	$54,000	$30,000	$84,000
Switchgear Total	$957,000	$800,000	$1,757,000
Protection System			
Option 1 and 2	$1,964,000	$630,000	$2,571,000
Option 3	$312,000	$105,000	$393,000
Control and Communications	$2,783,000	$1,450,000	$4,233,000
Energy Storage Equipment Option	TBD	TBD	TBD
Gas Extension and Connections	n/a	n/a	$150,000

Gas Extension, Diesel Storage, and Connections	n/a	n/a	$200,000
Miscellaneous Equipment	n/a	n/a	$750,000
Engineering and Design	n/a	n/a	$1,000,000
Testing and Commissioning	n/a	n/a	$250,000

[1] Dual Fuel Engine cost is a conceptual estimate only; no quote was received from supplier.
[2] GE Hybrid Fuel Cell/Natural Gas Engine cost is still in development.

Table 2.1 – Conceptual Design Cost Information

With the inclusion of the third distribution option, the final Report displayed a variety of cost alternatives for the proposed microgrid giving nine (9) different possibilities for execution. Table 2.2 below details those nine (9) options.

Project Total Estimate Options	
Dual Fuel Engine with Option 1 Protection	$38,390,000[1]
Dual Fuel Engine with Option 2 Protection	$37,580,000[1]
Dual Fuel Engine with Option 3 Protection	$27,820,000[1]
Natural Gas Engine with Option 1 Protection	$37,040,000
Natural Gas Engine with Option 2 Protection	$36,230,000
Natural Gas Engine with Option 3 Protection	$26,470,000
Hybrid Fuel Cell-Natural Gas with Option 1 Protection	$61,340,000[2]
Hybrid Fuel Cell-Natural Gas with Option 2 Protection	$60,530,000[2]
Hybrid Fuel Cell-Natural Gas with Option 3 Protection	$50,770,000[2]

[1] Dual Fuel Engine cost is a conceptual estimate only; no quote was received from supplier.
[2] GE Hybrid Fuel Cell/Natural Gas Engine cost is still in development.

Table 2.2 – Project Total Cost Estimates

Benefit Cost Analysis

As described in the 3rd quarter 2016 report, GE Energy Consulting used the societal BCA model promulgated by Industrial Economics, Inc. (“IEc”) for the benefit-cost analysis. While an economic BCA is important in any investment, a societal-based BCA is required for resilient community microgrids to justify the investment based on the net benefits to the society as a whole. Therefore, the model takes into account the benefits of maintaining operations at the facilities served by the microgrid in the event of a prolonged emergency.

The BCA model considers costs and benefits for two scenarios:

- Scenario 1: No major power outages over the assumed 20-year operating period (*i.e.*, normal operating conditions only).
- Scenario 2: The average annual duration of major power outages required for project benefits to equal costs, if benefits do not exceed costs under Scenario 1.

The BCA results in the draft Report indicated that under current assumptions, assuming no major power outages during a twenty (20) year time horizon, the Potsdam microgrid’s societal present value of costs would exceed its present value of benefits, resulting in a societal benefit to cost ratio of 0.80 (Scenario 1). By incrementally adding fractions of major power outage days to the BCA model, it was determined that with 0.73 days of outages per year, the Potsdam microgrid would achieve a societal benefit/cost ratio of 1.0 (Scenario 2). The results of both Scenario

1 and Scenario 2 analysis were provided in Q3 2016 report and can be found in attached Appendix A.

This initial BCA used the Dual Fuel Engine generation option with the initial distribution Option 1. However, given that the research has provided numerous options for generation and distribution, the Project team requested additional BCA calculations to measure the potential effectiveness of each scenario.

Table 2.3 below details the societal BCA results for all nine cases. The results show the scenario with the highest benefit/cost ratio is the natural gas engine option with distribution Option 3.

		Total Costs ($M)[1]	Total Benefits ($M)[1]	Net Benefits ($M)[1]	Benefit/Cost Ratio	Outage Days/Year Needed for B/C=1
Dual Fuel Engine Option	Distribution Option 1	109.67	88.11	-21.55	**0.80**	**0.73**
	Distribution Option 2	108.85	88.11	-20.74	**0.81**	**0.72**
	Distribution Option 3	99.1	88.11	-10.98	**0.89**	**0.38**
Natural Gas Engine Option	Distribution Option 1	108.37	88.11	-20.25	**0.81**	**0.70**
	Distribution Option 2	107.55	88.11	-19.44	**0.82**	**0.67**
	Distribution Option 3	97.8	88.11	-9.68	**0.90**	**0.33**
Hybrid Fuel Engine Option	Distribution Option 1	132.67	88.11	-44.55	**0.66**	**1.56**
	Distribution Option 2	131.85	88.11	-43.74	**0.67**	**1.53**
	Distribution Option 3	122.1	88.11	-33.98	**0.72**	**1.19**

[1] Net Present Value over 20 Years in 2014 dollars

Table 2.3 – Potsdam Societal BCA Results for all Nine Cases

The executive summary for the final Report was finalized by all Project partners in November 2016, with Clarkson University's anticipated submission to NYSERDA expected by the end of January 2017.

2. **Phase 2 Planning & Feasibility Study Reflection**
Many of the fourth quarter 2016 activities involved contract negotiations with both existing and new Project partners, as previous agreements expired with the completion of the NYSERDA PON funding. Some of these delays were the result of GE Energy Consulting's potential conflict of interest, as they are an active participant in the ongoing NYSERDA NY Prize competition and do not want to exclude

themselves from future consideration. This created complexities for the contract negotiations with all Project partners moving into the next phase of the Project. Fortunately, contract terms and conditions were ultimately finalized with GE Energy Consulting on December 22, 2016.

In light of GE Energy Consulting's potential conflict concerns, an engineering firm was engaged to offer independent quotes for equipment specifications proposed for the microgrid in the Detailed Engineering Design. OBG (formally known as O'Brien & Gere) is a Syracuse-based engineering firm focused on energy, advanced manufacturing, and environmental sustainable solutions. The OBG team will be working with the Project team in the next phase of the Project to execute energy audits and provide equipment specifications.

The Project team took the opportunity this quarter to meet regularly to discuss each Project partner's responsibilities moving into the Detailed Engineering Design and Financial and Business Plan phase of the Project. Using the NYSERDA NY Prize Stage 2 scope of work as a template, the Project team developed a detailed responsibility matrix and Project schedule for the tasks associated with this next phase. The Project schedule and responsibility matrix for Phase 2 are found in attached Appendices C and Appendix D, respectively.

In order to start working on the detailed engineering design, the Project team took some time this quarter to review the basic assumptions that produced the Conceptual Design and create a solid framework for Phase 2. Review of all load facilities, generation assets, and fuel/electricity rates was necessary in order to produce the most accurate assessment of current conditions. Full detail of all critical load and generation data is located in attached Appendix E.

Load Analysis

Over the past eighteen (18) months, the majority of the microgrid study in Potsdam was driven by Clarkson University's NYSERDA PON study, with most critical decisions being executed by that initial project design. The initial analysis of the potential microgrid participants included the following ten (10) customers:

- Clarkson University Campus
- SUNY Potsdam Campus
- Canton Potsdam Hospital
- Village Water Plant
- Village Wastewater Plant
- Potsdam Central High School
- IGA Grocery Store
- Stewart's Shop
- Kinney Drugs
- Village Offices/Civic Center (incl. Police, Fire, Rescue)

These customers would see improved business continuity and ability to provide critical emergency services during extreme weather events. While this list includes much of the community's critical infrastructure, National Grid's REV Demonstration Project proposed that additional services be included to increase the resiliency factor the microgrid intends to influence. (Note: IGA Grocery Store and Kinney Drugs were not in the original REV Demonstration Implementation Plan[3] but will remain in the Stage 2 analysis.)

National Grid Service Center
Given that the microgrid is intended to function during times of emergencies, it is important to have access to the utility's workforce and equipment during potential storms. By including National Grid's Service Center in the microgrid, the Company would offer critical emergency services and act as central hub for recovery efforts in the area. During the 1998 ice storm, the National Grid Service Center was without heat and power for a number of days, hindering the already stressed recovery efforts. The Project team sees this inclusion as critical to a successful microgrid functioning during times of emergencies. The National Grid Service Center (20 Pine Street) is located near the proposed underground distribution network and its inclusion is expected to have only a nominal impact on the cost estimates previously calculated.


Image 2.1 – National Grid Service Center – Potsdam

Clarkson Inn
Shelter is essential during times of weather emergencies. While both Clarkson University and SUNY Potsdam can provide shelter, depending on the time of year, each university could have a large number of college students on campus. The Potsdam High School is also included in the microgrid as potential shelter for the community. However, the Clarkson Inn can provide up to 40 additional rooms for recovery workers and community members displaced from their homes. The Clarkson Inn (1 Main Street) is located on the proposed underground distribution network and its inclusion is expected to have only a nominal impact on the cost estimates previously calculated.


Image 2.2 – Clarkson Inn

[3] Case 14-M-0101, s*upra* note 2.

North Country Savings Bank
While most of the critical services offered by the microgrid are emergency related, some will require potentially at-risk community members and recovery workers have cash readily available for purchases at local businesses (*e.g*., IGA Grocery Store, Kinney Drugs, Stewart's Shops). Therefore, the Project team deems it essential that one financial institution in the Village have access to banking and ATM services. The North Country Savings Bank (31 Main Street) is located on the proposed underground distribution network and its inclusion should have only a nominal impact on the cost estimates previously calculated.

Image 2.3 – North Country Savings Bank

The Project team has reached out to both the Clarkson Inn and North Country Savings Bank to offer information regarding the proposed microgrid design and purpose. Both institutions provided feedback indicating positive interest in the opportunity. Further communication with these and the other potential microgrid customers will continue over the coming months.

Generation Analysis
In addition to the review of load participants, the Project team also reviewed the current data and assumptions used to establish the critical generation sources for the microgrid. The initial Conceptual Design indicated a need for an additional 4 MW of generation needed in order for the microgrid to function during islanding mode. Critical to that calculation is the inclusion of multiple renewable generation sources as well as a number of existing thermal generation units.

Renewable Generation
As noted by NYSERDA, "[r]enewable energy sources alone should not be considered reliable sources of emergency power. Their output varies based on forces of nature, not the microgrid load. However, with careful design that includes energy storage, renewable energy can be used as a supplement to reduce the rate of fuel use by other generators."[4] The current model includes three potential renewable generation resources: the Clarkson University-leased 2 MW solar photovoltaic ("PV") array, the Village-owned East Hydro plant, and the Clarkson University net-metered West Hydro plant. In addition to cost, the social objectives and environmental benefits were considered when evaluating the renewable generation sources.

The solar PV array is located at the municipal airport, nearly 1.5 miles outside the proposed microgrid underground distribution system. This distance adds over 16,000

[4] *Microgrids for Critical Facility Resiliency in New York State,* NYSERDA Report Number 14-36, (December 2014), p. 86, *available at*: http://nyssmartgrid.com/wp-content/uploads/Microgrids-for-Critical-Facility-NYS.pdf

feet of underground conduit and cable necessary to connect the solar PV array to the microgrid at a cost of nearly $3M – one quarter the cost of the full underground system. In addition, it is noted that as a resilient microgrid, the primary function of the proposed microgrid would be its islanding capabilities during extreme weather events (*i.e.*, ice storms, snow storms, and summer microbursts). That being said, the reliability of the solar PV generation during such events is minimal at best.

After much consideration and deliberation the Project team decided that the solar PV generation source was important to include as a renewable resource, but the costs associated with the underground system and unreliability of the DER precluded it from being included in the underground network. However, since the proposed microgrid will potentially function during mostly blue-sky days, solar PV generation could add energy to the microgrid's dispatch onto possible wholesale markets. Therefore, it is proposed that the solar PV generation source be included in the system via overhead lashed aerial cable on the existing facilities. This would dramatically reduce the investment cost of the connection, while offering the renewable DER as an asset for the microgrid entity. Additional cost estimates for such an overhead investment will be further analyzed in Stage 2 of the Project.

In addition to the solar PV array, the Conceptual Design incorporates the Village of Potsdam's two hydroelectric generating facilities located on the Raquette River in the microgrid analysis.[5] As noted in previous reports, both hydro facilities have encountered several operational issues over the past years with neither running consistently. East Dam has been inoperable since August 2015 when the gears inside one of the gearboxes began eroding the unit and the bearings popped out of the other gearbox. The Village is currently evaluating proposals to fix the ailing gearboxes and is working to secure a $250,000 grant from the state to aid in the refurbishment, estimated to cost $1M to $1.3M.[6] The West Dam issue, while considerably less extreme, did require generator realignment and West Dam is currently back in operation providing remote net metering credits to Clarkson University's electric accounts.[7]

[5] Clarkson University entered into a contractual arrangement with the Village of Potsdam whereby it co-operates the West Dam hydro facility as well as provides engineering expertise for unit maintenance and repairs. Clarkson University is the customer-of-record for West Dam. This enables Clarkson University to be the recipient of remote net metering credits from the facility.

[6] *See* http://northcountrynow.com/news/250000-state-funding-could-bring-east-hydro-facility-back-line-potsdam-0184005

[7] *See* http://northcountrynow.com/news/one-hydro-generator-realigned-restarted-potsdams-west-dam-powerhouse-0181575


Image 2.4 – Potsdam East Hydro Facility and Dam

Given the recent issues with each hydro facility's functionality and reliability, a discussion was required to evaluate their inclusion in the microgrid study. After consideration of continued efforts and investment in each facility, along with the location of the hydroelectric facilities in relation to the proposed underground system, it was determined that both renewable resources should continue to be a part of the microgrid study.

Thermal Generation/Standby Generation
While renewable energy is important to further REV initiatives, any microgrid must have black start capabilities enabled with the inclusion of thermal DER assets. The feasibility of the Potsdam microgrid is improved as a significant amount of generation capability already exists in the form of combined heat and power ("CHP") plants and standby generation at the major entities of the microgrid. The Conceptual Design study included some, but not all, existing thermal generation and back-up sources. Appendix E displays the list of existing units.

All existing units producing less than 200 kW of energy were excluded from the microgrid analysis due to the high cost of retrofitting and integrating them into the microgrid network. Each unit would require upgraded control and communication system hardware and software in order to interact with the islanding capabilities of the microgrid. In addition, diesel units were excluded due to the additional costs of maintaining two (2) weeks of diesel fuel storage (as required by the NY Prize Competition), as well as to adhere to the Project's and REV's emissions goals.

The resulting thermal generation units that were included in the original feasibility study include:

- Two 1.4 MW CHP units on the SUNY Potsdam campus
- One 290 kW piston engine on the Clarkson University campus
- One 370 kW piston engine on the Clarkson University campus

All four units operate on natural gas fuel and will be included in the Detailed Engineering Design in Phase 2 of the Project. Annual energy data for both load and generation analysis are located in Appendix E with Table 2.4 below summarizing the combined analysis below.

	Annual Energy (kWh)	Annual Non-Coincident (kW)
LOAD		
Load Included In Conceptual Design:		
Small Load	3,578,468.00	859.32
Large Load	52,287,448.05	9,730.84
Total Load (Coincident Peak):	55,865,916.05	10,590.16
Potential New Load:	3,169,478.00	1,052.90
Total New Load:	**59,035,394.05**	**11,643.06**
GENERATION		
Existing Non-Renewable Generation		3,460.00
Existing Renewable Generation	6,674,762.84	2,888.88
Total Existing Generation:		**6,348.88**
Potential Curtailable Load		2,000.00
Potential New Generation Needs (2 x 2 MW)		4,000.00
Total New Generation:		**12,348.88**

Table 2.4 – Load and Supply Summary

Load and generation data from 2013-2014 were used for the analysis during the Conceptual Design phase. One of the first action items moving into Phase 2 will be to access and analyze new 2015-2016 interval meter data on all load and generation sites to produce the most accurate assessment of current conditions.

3. **Bill Impact Analysis of Tiered Recovery**
   As stated in the 3rd quarter 2016 report, the Project team analyzed the tiered recovery of new storm-hardened, underground wires over the past six (6) months. Additional detail regarding the calculations and approach is provided below. Table 2.5 below displays the established tiers based on access to critical infrastructure and services of the microgrid.

		Participants[1]
DIRECT	Tier 1a	Generating Facility participants: Clarkson University, SUNY Potsdam, Village Government
	Tier 1b	Load-only participants: Clarkson Inn, Canton-Potsdam Hospital, North County Savings Bank,[2] Kinney Drug Store, IGA Grocery Store, Stewarts Gas Station, High School, National Grid Service Center
INDIRECT	Tier 2	Village of Potsdam Border
	Tier 3	Town of Potsdam Border
	Tier 4	Village of Potsdam, Village of Norwood, Town of Potsdam, Town of Pierrepont, Town of Colton, Town of Stockholm (portion), Town of Norfolk (portion)[3]
	Tier 5	Zip codes: 13625, 13695, 13639, 13635, 13684, 13652, 13630, 13687, 13672, 13617, 13676, 13699, 13660, 13668, 13696, 13697, 12965, 12967, 13613, 13667, 13621, 13694, 12922, 12927, 13677, 13647, 13678

[1] All tiers are exclusive of previous tier's customers.
[2] Key Bank was replaced by North Country Savings Bank in the new analysis.
[3] Tier 4 based on Potsdam Volunteer Rescue Squad's ("PVRS") service territory, which covers portions of the Towns of Stockholm and Norfolk.

Table 2.5 – Tiered Approach Parameters

As stated in the Project Implementation Plan[8], National Grid proposes a cost allocation model where those customers physically connected to the microgrid pay for the greatest portion of the wire investment costs, while the group of customers who live in the surrounding area benefit from added community resiliency and therefore pay a smaller portion of the wires investment costs. The Company believes it is appropriate to consider residential cost-share as it is the residential community at-large that will benefit from the availability of critical services enabled by the microgrid. With that rationale in mind, the Project team initially allocated the largest percent of the wire investment to the connected participants with minor contributions by the indirect community tiers. However, given there are relatively few customers connected to the microgrid compared to the number in the indirect tiers, this approach provided an unsustainable recovery model resulting in higher-than-average bill increases for the connected customers.

In addition, while the initial concept specified connected customers pay, "the greatest portion of the wire investment costs,"[9] it did not factor in actual usage of each participant compared to the general recovery effort. Therefore, a more practical approach focuses on distribution based on the impact that each customer's bill would experience for this investment recovery. This approach would create a model whereas the connected customers' would experience the greatest impact on their delivery charges versus a much smaller impact for those in the community further away from the microgrid center.

[8] Case 14-M-0101, s*upra* note 2.
[9] Case 14-M-0101, s*upra* note 2, p. 6.

The Project team used this foundation to allocate the costs of the wire investment among the target population included in all tiers of the recovery service territory. The results of this approach produced the allocations shown below in Table 2.6.

		Number of Customers	Percent of Annual Revenue Requirement	Share of Annual Revenue Requirement
DIRECT	Tier 1a	2	6.0%	$89,296
	Tier 1b	10	1.5%	$22,324
INDIRECT	Tier 2	2,757	14.0%	$208,356
	Tier 3	3,709	18.0%	$267,887
	Tier 4	4,024	10.0%	$148,826
	Tier 5	16,022	50.5%	$751,571
	Total:	**26,524**	**100.00%**	**$1,488,259**[10]

Table 2.6 – Tiered Allocation of Annual Revenue Requirement

While preliminary observations might consider the allocated amounts to be contrary to the initial concept that connected participants contribute more to the investment, inclusion of the number of customers in each tier as well as typical usage by class, produces a more accurate distribution based on each customer's bill impact.

Based on the above allocation, two (2) different approaches were used to calculate the bill impact for the tiered-recovery; one for the connected Project participants and one for the non-connected community customers.

The customer impact dollar amounts and percent increases were calculated for Tiers 2 through 5 (non-connected community members) using a typical bill model method.[11] This method is used when factoring in new charges to rate payers and takes the current monthly charges each rate class pays to calculate potential new bill amounts.

Table 2.7 below provides an example of the calculations for Tier 2 of the recovery effort. The Project team used 2015 kWh and kW usage data for each service class within the designed tiers (column A & B, Table 2.7) to calculate the surcharge amount

[10] For annual revenue requirement calculated using a levelized approach, *see* Case 16-G-0059 *et al*., *Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of The Brooklyn Union Gas Company d/b/a National Grid NY for Gas Service et al.,* Joint Proposal (filed September 7, 2016), Appendix 1, Schedule 3.
[11] *See* Case 12-E-0201 *et al*., *Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Niagara Mohawk Power Corporation d/b/a National Grid for Electric Service et al.*, Joint Proposal (filed December 7, 2012), Appendix 2, Schedules 9,10,11 &12.

(column E, Table 2.7). Each service class' expected contribution is weighted based on kWh and kW usage.

NIAGARA MOHAWK POWER CORPORATION d/b/a NATIONAL GRID ALLOCATION OF ESTIMATED Potsdam COSTS 2018 Yr1					
Design Service Class	Annual kW Billed (A)	Annual kWh Sales (B)	Rev Req Weighted Allocator (C)	Allocation of Estimated T&D Costs $ (D)	Surcharge Rate $/kWh (E)
SC1	-	10,122,464	28.28%	$58,915	$ 0.00582
SC1C	-	379,219	1.06%	$2,207	$ 0.00582
SC2ND	-	1,791,917	5.01%	$10,429	$ 0.00582
SC2D	43,692		39.53%	$82,353	$ 1.88
SC3					
Secondary	16,385		20.32%	$42,338	$ 2.58
Primary	4,384		5.81%	$12,114	$ 2.76
Subtrans/Trans	-		0.00%	$0	#DIV/0!
Total	20,770	-	26.13%	$54,452	
SC3A					
Secondary/Primary	-		0.00%	$0	#DIV/0!
Subtransmission	-		0.00%	$0	#DIV/0!
Transmission	-		0.00%	$0	#DIV/0!
Total	-	-	0.00%	$0	
Total PSC 220/214			100.00%	$208,356	

Table 2.7 – Allocation Estimating Tool Example (Tier 2)

In this analysis, the only variable that affects the Potsdam customer's bill is the potential microgrid surcharge. The Project team used a Typical Bill Impact tool (Appendix F) with these surcharge amounts to calculate the proposed impact on each service class' bill.

Given the wide range of usage within and among the proposed tiers, the Project team used typical levels seen in rate cases and other proceedings[12] to display the typical range of bill impact figures. Table 2.8 below shows typical usage levels used to display the bill impacts on each rate class as well as the resulting bill impact figures.

[12] Case 12-E-0201, *supra* note 11.

	Typical Usage		Current	Proposed	Difference	% of Total Bill Impact
SC-1	600	kWh				
TOTAL ELECTRIC DELIVERY CHARGE			$48.85	$52.46	$3.61	4.1%
TOTAL ELECTRIC SUPPLY CHARGE			$39.39	$39.39	$0.00	0.0%
TOTAL ELECTRIC CHARGE			$88.24	$91.85	$3.61	4.1%
SC-2ND	1,500	kWh				
TOTAL ELECTRIC DELIVERY CHARGE			$116.36	$125.18	$8.82	4.1%
TOTAL ELECTRIC SUPPLY CHARGE			$97.94	$97.94	$0.00	0.0%
TOTAL ELECTRIC CHARGE			$214.30	$223.12	$8.82	4.1%
SC-2D	7,200	kWh				
	25	kW				
TOTAL ELECTRIC DELIVERY CHARGE			$356.31	$403.91	$47.60	6.0%
TOTAL ELECTRIC SUPPLY CHARGE			$440.36	$440.36	$0.00	0.0%
TOTAL ELECTRIC CHARGE			$796.67	$844.27	$47.60	6.0%
SC-3 Pri	216,000	kWh				
	500	kW				
TOTAL ELECTRIC DELIVERY CHARGE			$5,924.69	$7,320.15	$1,395.46	7.7%
TOTAL ELECTRIC SUPPLY CHARGE			$12,233.45	$12,233.45	$0.00	0.0%
TOTAL ELECTRIC CHARGE			$18,158.14	$19,553.60	$1,395.46	7.7%

Table 2.8 – Typical Thresholds by Rate Class

For the Connected Project participants, Tier 1a and Tier 1b, historical usage data from 2015 were used to calculate bill impacts. Each service class' expected contribution was weighted based on kWh or kW usage and then multiplied by the allocated dollar amount distributed in Table 2.9 below. Given the relatively few customers within these tiers, the bill impact could be calculated by multiplying the potential surcharge by historical monthly usage (plus any increase in Tariff Surcharge due to higher taxable dollars).

Customer	Service Class	Average kWh	Average kW	Potsdam MG Rate	Tariff Surcharge	Additional Bill Amount
[redacted]	SC3A Pri	2,272,155	2364.4	$1.0936	1.0101%	$2,611.75
	SC3A Pri	2,148,450	4440.2	$1.0936	1.0101%	$4,904.71

Table 2.9 – Example of Tier 1a and 1b bill impact analysis

As offered in the 3rd quarter 2016 report, this allocation approach results in the bill impact percentages by customer class displayed in Table 2.10 below.

	Customer Bill Impact on Delivery Charges (%)					
	Residential	**Sm. Com (Non-Demand)**	**Sm. Com (Demand)**	**Lg. Com (Primary)**	**Lg. Com (Trans)**	
	SC1	**SC-2ND**	**SC-2D**	**SC-3Pri**	**SC-3A Tran**	***AVG***
Tier 1a	N/A	N/A	N/A	7.94%	N/A	7.94%
Tier 1b	N/A	N/A	8.56%	5.85%	N/A	7.48%
Tier 2	4.09%	4.12%	5.97%	6.69%	N/A	5.47%
Tier 3	3.20%	3.22%	4.19%	5.89%	5.52%	4.40%
Tier 4	3.14%	3.16%	4.13%	3.48%	N/A	3.48%
Tier 5	2.12%	2.13%	3.03%	2.16%	4.70%	2.83%

Table 2.10 – Customer Monthly Bill Impact Percentages

The Project team believes this approach is the most fair and equitable offered by the Project thus far. While deviating slightly from the original concept, this model allows for both contributions by indirect beneficiaries to the Company's cost recovery for the underground wire investment as well as connected customer's larger financial impact based on current usage calculations. On average, the connected participant would experience an increase of eight (8) percent on their delivery charge, while the surrounding supportive tiers would see decreasing levels of impact ranging from six (6) to two (2) percent increase on their delivery charges.

It is important to note that this analysis was conducted using the Conceptual Design's most aggressive and expensive option for the underground wire network (roughly $12M). As stated in previous section, the Project team is considering three (3) separate distribution systems with different equipment specifications and costs. Furthermore, after much consideration, the Project team decided to remove the most costly section of the underground wire network extending out to the solar PV array located at the municipal airport. Both the options for distribution protection and the removal of the solar PV from the underground network have the potential to reduce the overall bill impact calculations described above. Therefore, it is likely that these figures will decrease upon completion of final cost estimates of the Project. This proposed model will be utilized during the next phase of the Project once final distribution figures are calculated.

4. Second Stakeholder Meeting

As stated in the Project Implementation Plan,[13] the completion of the Conceptual Design offers an opportunity to engage microgrid stakeholders and inform them on the initial design and cost ranges for the proposed microgrid. In anticipation of the delivery of the final Conceptual Design, National Grid and its partners scheduled a stakeholder outreach session during the last week of October 2016.

[13] Case 14-M-0101, *supra* note 2.

The meeting took place on Clarkson University's campus and was attended by, National Grid, GE Energy Consulting, Nova Energy, and representatives from the following potential microgrid stakeholders:

- Village of Potsdam
- SUNY Potsdam
- Canton-Potsdam Hospital
- Clarkson University

The meeting allowed the Project team an opportunity to convey the findings of the Conceptual Design study including initial cost estimates, potential business models, and results of the societal BCA. In addition, the tiered recovery approach to the underground wire network was explained in detail to the group.

The intent was not to offer precise financial solutions to each stakeholder but to convey the work that had been completed thus far. Meeting participants conveyed their desire for more concrete numbers showing likely profit or loss from the potential microgrid. The Project team explained that the cost figures produced during the Conceptual Design are general estimates and more detail is expected in the next phase of the Project. In addition, while the societal BCA described in the Conceptual Design shows relatively low required annual outage for positive ratios, the participants are looking for business case benefit-cost analysis showing how the investment will produce a positive return-on-investment ("ROI") for customers and potential investors.

Administrators from both the Canton-Potsdam Hospital and the Village of Potsdam noted their need for possible replacement of current backup capabilities. The hospital's diesel backup generator is reaching the end of its life and replacement is needed in the near future. Similarly, the Village's backup generator located at the wastewater treatment plant is in need of replacement in the coming years. Both look to the microgrid as a potential source of replacement in lieu of investing in new units. Further information is needed in order to understand likely options for including synchronizable generation units at those sites. However, with the need for 4 MW of additional generation for the microgrid, this could offer an opportunity for new CHP units.

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2.2 Challenges, Changes, and Lessons Learned

Qtr. 2016	Issue or Change	What was the resulting change to Project scope/timeline?	Strategies to resolve	Lessons Learned
Q1	Change in Project Management.	Michael Duschen (Project Manager, Solutions Delivery Team of New Energy Solutions, Michael.Duschen@nationalgrid.com) and Daniel Payares (Project Manager, Solutions Delivery Team of New Energy Solutions, Daniel.PayaresLuzio@nationalgrid.com) replaced Christopher Yee as the Project Managers for the Community Resilience REV Demonstration Project.	Detailed transition task list developed by the former Project Manager to facilitate the transition.	Strong communication between all stakeholders is needed in order to maintain direction.
Q1	National Grid designated Executive Sponsor.	Philip Austen (Director, Solution Delivery Team of New Energy Solutions, PAusten@nationalgrid.com) designated as the Executive Sponsor for the Community Resilience REV Demonstration.	N/A	Corporate project sponsors can often facilitate resources and provide solutions for the development of the project.
Q1	Delayed release for NY Prize Stage 2 RFP.	Project timeline may be modified due to the delayed release of the NY Prize Stage 2 RFP which was originally scheduled to be released in the fall of 2015, but was actually released on April 20, 2016.	Analyze which Project tasks are and are not dependent on the NY Prize Stage 2 RFP release. To ensure minimal delays, National Gird has progressed on independent tasks and will reassess timeline changes for tasks that are dependent.	Delays and changes to the project timeline are still being analyzed due to the delay of the Stage 2 RFP release. Some delays may be unavoidable but with good planning and communication, they may be controlled and minimized. Project delays, if any, will be specified in a subsequent quarterly report.

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Qtr. 2016	Issue or Change	What was the resulting change to Project scope/timeline?	Strategies to resolve	Lessons Learned
Q1	Financial and technical issues for the Village of Potsdam: 1. Village under documented financial constraints 2. East Dam hydro facility is currently in disrepair.	The teams from Clarkson University and National Grid have been working together to develop alternative solutions that can be financially viable for the Village.	Looking for strategic partnerships or funding options to repair the East Dam hydro facility without posing a burden for the Village of Potsdam.	It is important to work alongside the different stakeholders, keeping communication channels open and honest.
Q2	Some of the microgrid stakeholders may consider the costs to outweigh the added benefits and opt out.	If the major stakeholders opt out of the microgrid, the Project could not be constructed.	Create and maintain a list of available alternative commercial customers to reach out to if this happens. Another alternative is to scale back the size of the microgrid to make it more affordable.	It is important to be flexible with the design and assumptions of the microgrid design. The Project may need to be scaled back to accommodate fewer stakeholders.
Q2	Some of the major stakeholders do not have local decision-making authority (*e.g.*, SUNY Potsdam, Kinney Drugs).	Securing approval for capital investments may take a significant amount of time or ultimately be denied, as decision makers are not direct beneficiaries.	Engage decision makers early in the process to help alleviate potential delays. In some cases (*e.g.,* bank, pharmacy), investigate alternative locations that may have more local control.	It is important to engage the appropriate decision makers early to anticipate delays in approvals.
Q2	Capital investment for the 4 MW of additional and necessary DER might not provide an acceptable return on investment ("ROI") for potential owners.	If the additional DER necessary to operate the microgrid is not procured, the Project might not be financially/technically feasible.	Have the Company backstop the generation from the additional DER through PPA agreements in order to have an acceptable ROI for the owners.	Contingency plans are needed to adjust microgrid size based on DER procurement.
Q2	Gas station confident with their own resilience provided by back-up generators.	Minor stakeholder may not want to work with microgrid team if they have adequate on-site generation.	Work within National Grid to find alternatives to participation of gas station site and mitigate other stakeholder self-generating alternative(s).	The team must understand each stakeholder's individual resiliency to calculate benefit from microgrid.
Q2	Wires recovery model challenged with current microgrid layout and target population.	May delay delivery of "Preliminary Service Proposals & Pricing" and may increase costs associated with pricing aspect of the Project.	Look for alternate funding sources, expand target population, or eliminate branches of microgrid (or some combination thereof).	It is important to establish target population size early in process. This will affect ability to recover costs.

Qtr. 2016	Issue or Change	What was the resulting change to Project scope/timeline?	Strategies to resolve	Lessons Learned
Q2	Village progressing on possible repair of East Dam hydro facility turbine gear boxes (see Appendix B).	The East Dam hydro facility's gear box damage could be a major risk to the Project. Additional DER is required if this hydro generating facility cannot be returned to service.	Continued communication with the Village to assess timeframe and cost of possible repair.	Contingency plans are needed to account for possible additional DER.
Q3	American Society of Heating, Refrigerating and Air Conditioning Engineers ("ASHRAE") Level II audits are needed for NY Prize Stage 2 and therefore additional funding may be required.	NY Prize Stage 2 requires full ASHRAE Level II energy efficiency audits. This could result in additional cost and cause further delays.	Work with Clarkson University to assess need and establish which loads require full audit.	The team needs to know full cost of detailed design prior to execution.
Q3	Issue discovered in the West Dam hydro facility generator (see Appendix B).	The West Dam Hydro plant's generator issue could be a major risk to the Project. Additional DER is required if this hydro generating facility cannot be returned to service.	Continued communication with the Village and Clarkson University to assess timeframe and cost of possible repair.	Contingency plans are needed to account for possible additional DER.
Q3	There is ongoing conversation regarding business options for the microgrid, including possible special utility districts that remove assets from National Grid's balance sheet.	There is a risk that partners could decide that a municipal district is more appropriate than proposed REV structure, resulting in a NO-GO decision.	Develop an internal plan that promotes REV demo framework over municipal district and communicate with stakeholders.	All business model options need to be fully analyzed and discussed with stakeholders.
Q3	The estimated energy bill impact figures are considerably higher for commercial accounts than residential accounts due to the fact the analysis is based on usage.	Larger commercial account holders may challenge the tiered-recovery approach.	Create contingency plans within the tiered-recovery calculation to factor in the possible removal of commercial accounts.	Usage might not be the best metric for tiered-recovery approach.
Q4	Partners and stakeholders find it difficult to decide on final generation and load selections.	The Project timeline has been delayed by pushing final Go/No-Go decision into August 2017.	Project Manager must establish decision-making deadlines and facilitate final selections to move on in Project.	Decision-making hierarchy is not always clear in multi-stakeholder collaborations.
Q4	Delays with partner contract negotiations.	The Project timeline has been delayed by pushing final Go/No-Go decision into August 2017.	Focus energy on procurement office to push for final contract.	Need to allocate sufficient time for contracting with vendors.

Qtr. 2016	Issue or Change	What was the resulting change to Project scope/timeline?	Strategies to resolve	Lessons Learned
Q4	There is a risk that the solar PV owner will not allow the array to be included in the microgrid resulting in less renewable generation in the mix.	Possible removal of existing solar PV array from renewable generation options.	Project team reaching out to solar PV owner to include as stakeholder moving forward.	Due diligence is needed early in the process to understand all customer and generation ownership structures.

3.0 Next Quarter Forecast

In the 1st quarter of 2017, the Project team will focus its efforts on the next phase of the Project with its partners. Given that terms and conditions have been finalized with GE Energy Consulting and the agreement with OBG is expected by the end of January 2017, the Project team expects to begin this phase of the Project immediately after the new year.

The initial task in the next quarter is the review of updated historical load and existing generation data to verify the Conceptual Design's assumptions for additional required generation for the proposed microgrid. Data used during the NYSERDA PON study was from 2013-2014. Access to 2015-2016 meter data on all load and generation sites will provide the most accurate assessment of current conditions for the microgrid. Since data sharing agreements have expired with the microgrid customers, new agreements are required before data can be shared with Project partners.

In addition, while energy efficiency and demand response recommendations were part of the initial NYSERDA Project, a more comprehensive assessment of the larger load profiles is required moving into the next phase of the Project. Project partner OBG will be conducting energy audits on the three major load centers of the proposed microgrid: SUNY Potsdam, Clarkson University, and Canton-Potsdam Hospital. The analysis will be done during the first quarter of 2017 and will provide added information for accurate calculations concerning additional required generation for the microgrid.

Much of the preliminary information required in the next phase of the Project has already been researched and documented in the NYSERDA PON project. Therefore, Project partners will begin summarizing this information in reports to describe site characteristics, fuel specifications, load profiles, current generation sources, future generation needs, as well as other general information into an initial report. Furthermore, Project partners will begin the process of more extensive DER modeling, power quality analysis, and quantitative performance requirements beyond the initial Conceptual Design study.

While the technical analysis of the microgrid will be refined and polished, major efforts in Q1 2017 will focus on the development of the ownership and business model for the proposed legal entity, including the National Grid's role in the hybrid microgrid. As described in NYSERDA's NY Prize Stage 2 RFP, the Project team must present a clear and compelling case that the benefits to the community, stakeholders, and utility outweigh associated costs and risks. This emphasis will be displayed in the description of the value proposition developed by the Project team in the first two (2) quarters of 2017.

Key to the value proposition will be National Grid's Preliminary Pricing Proposal, expected to be completed during Q1 2017. This proposal will provide the Company the opportunity to explain the pricing of each of the four (4) proposed services to Project partners and stakeholders. The final version of the tiered recovery of the underground wire network will also be included.

The Project team will also continue analyzing potential benefits and costs associated with the Company's investment, as well as potential customer or third-party investment. The Project schedule provides an opportunity for an economic-based BCA during each month moving forward – the first at the end of January 2017.

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 – 2/28/17	Ongoing
4	Phase 2 Completion *(Detailed Engineering Design and Business Plan)*	3/16/16 – 12/1/17	10/1/16 – 9/30/17	Ongoing

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

As conveyed in 3rd quarter 2016 report, GE Energy Consulting presented a draft of the NYSERDA PON Task 4 report (the “Report”) to the Project team on August 31, 2016. The Report represents the Conceptual Design for the REV Demonstration Project and signifies the final technical task of the NYSERDA PON project. It aims to accomplish the following items:

- Detailed cost of all aspects of the microgrid;
- Benefit-Cost analysis for the microgrid;
- Further refinement of microgrid performance.

GE Energy Consulting submitted the final version of the Report to the Project team on October 18, 2016. In addition, the NYSERDA PON grant requires a cumulative report combining the findings of all three (3) tasks noted above as well as a final executive summary. The executive summary of the Report was finalized by all partners in November 2016 with Clarkson University’s anticipated submission to NYSERDA expected by the end of January 2017. Given that all research tasks associated with the NYSERDA study are now compete, the Project team considers this Conceptual Design checkpoint complete.

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

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

The National Grid Project team continued to refine the tiered recovery analysis as described in section 2.1. The structure of the model defined in the Q3 2016 report did not change significantly during the last quarter of the year. This final approach aims to validate each tier based on access to critical services with decreasing availability as they expand outward from the microgrid itself.

With the expanded population figures and revised depreciation rates, this second tiered recovery approach has resulted in a more palatable bill increase scenario. The monthly bill impact percentages for each tier can be found in Table 2.7. Given that this analysis was conducted using the Conceptual Design's most expensive option for the underground wire network and includes the distance to the solar PV array, it is highly likely that these figures will decrease upon final execution of the Project. Therefore, the Project team considers this checkpoint complete.

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

Status: ● - Ongoing
Start Date: 11/1/16
End Date: 2/28/17

In the Project Implementation Plan,[14] National Grid offered this milestone as an opportunity to present findings of the Conceptual Design along with a preliminary service and pricing offerings to stakeholders. The Project team took the opportunity during this quarter to meet with stakeholders to convey the final findings of the Conceptual Design study. However, due to the delays in the Conceptual Design as well as delays with partner contracts, the pricing options have yet to be analyzed and/or formalized. The adjusted timeline shifts the emphasis of this task into the first quarter of 2017, with a presentation of findings to stakeholders anticipated in February 2017.

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

Status: ● - Ongoing
Start date: 10/1/16
End date: 9/30/17

National Grid has agreed to partner with GE Energy Consulting to work on the Detailed Engineering Design and Financial and Business Plan Assessment in line with NY Prize Stage 2. Much of the fourth quarter 2016 activities involved contract negotiations with GE Energy Consulting and OBG, as previous partnership agreements expired with the completion of the NYSERDA PON funding. GE Energy Consulting will subcontract with Clarkson University and Nova Energy Solutions to perform some of the tasks that are outside of GE Energy Consulting's area of expertise. OBG will perform energy audits and provide autonomous equipment specifications. Contract terms and conditions were ultimately finalized with GE Energy Consulting on December 22, 2016. The contract with OBG is expected to be finalized during the first weeks of January 2017. While the original timeline for completion of the Detailed Engineering Design and Financial and Business Plan assessment was twelve (12) months, the Project team anticipates completion by the end of the third quarter of 2017.

[14] Case 14-M-0101, s*upra* note 2.

4.0 Work Plan & Budget Review

4.1 Updated Work Plan

Updated Gantt chart from Project Implementation Plan is below:

	Task Name	Duration	Start	Finish
7	**REV Demonstration**	**469 days**	**Tue 12/15/15**	**Fri 9/29/17**
8	Demonstration Approval	1 day	Tue 12/15/15	Tue 12/15/15
9	**General Project Management**	**335 days**	**Mon 3/21/16**	**Fri 6/30/17**
23	Benefit Analysis for Stakeholder Engagement	3.2 mons	Mon 1/2/17	Thu 3/30/17
24	**Stakeholder engagement and community outreach**	**223 days**	**Wed 12/16/15**	**Mon 10/24/16**
25	Initial Stakeholder Engagement	64 days	Wed 12/16/15	Mon 3/14/16
26	Initial Stakeholder Meeting	0 days	Mon 3/14/16	Mon 3/14/16
27	Second Stakeholder Meeting	0 days	Mon 10/24/16	Mon 10/24/16
28	Conceptual Design Complete Milestone	0 days	Mon 10/17/16	Mon 10/17/16
29	Initial Engineering Design Recovery Plan (Capital Costs)	4 mons	Mon 6/13/16	Fri 9/30/16
30	Initial Tariff Design (Commodity Costs)	2.5 mons	Mon 12/19/16	Fri 2/24/17
31	Preliminary Service Proposals & Pricing Milestone	0 days	Tue 2/28/17	Tue 2/28/17
32	Stakeholder feedback on initial cost estimates and recovery/payment plan & additional community outreach	1 mon	Tue 2/28/17	Mon 3/27/17
33	Coordinate and incorporate stakeholder feedback with Detailed Design Study team	1.5 mons	Tue 3/28/17	Mon 5/8/17
34	Revise tariffs based on possible changes to NY Prize technical study	1.5 mons	Tue 5/9/17	Mon 6/19/17
35	Draft contracts for Go/No-Go meeting with refined tariffs and business cases	1.5 mons	Tue 6/20/17	Mon 7/31/17
36	Financial/Business Plan & Contracting	2 mons	Mon 8/7/17	Fri 9/29/17
37	Completion of Financial/Business Plan ("Go/No-Go")	0 days	Fri 9/29/17	Fri 9/29/17

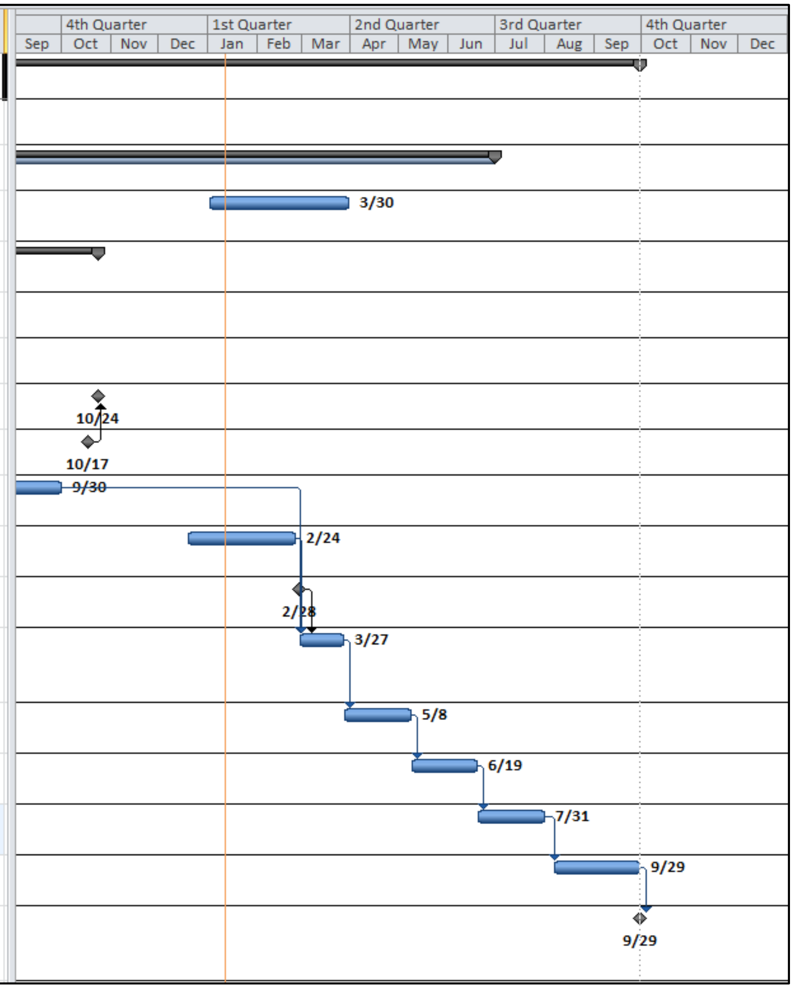
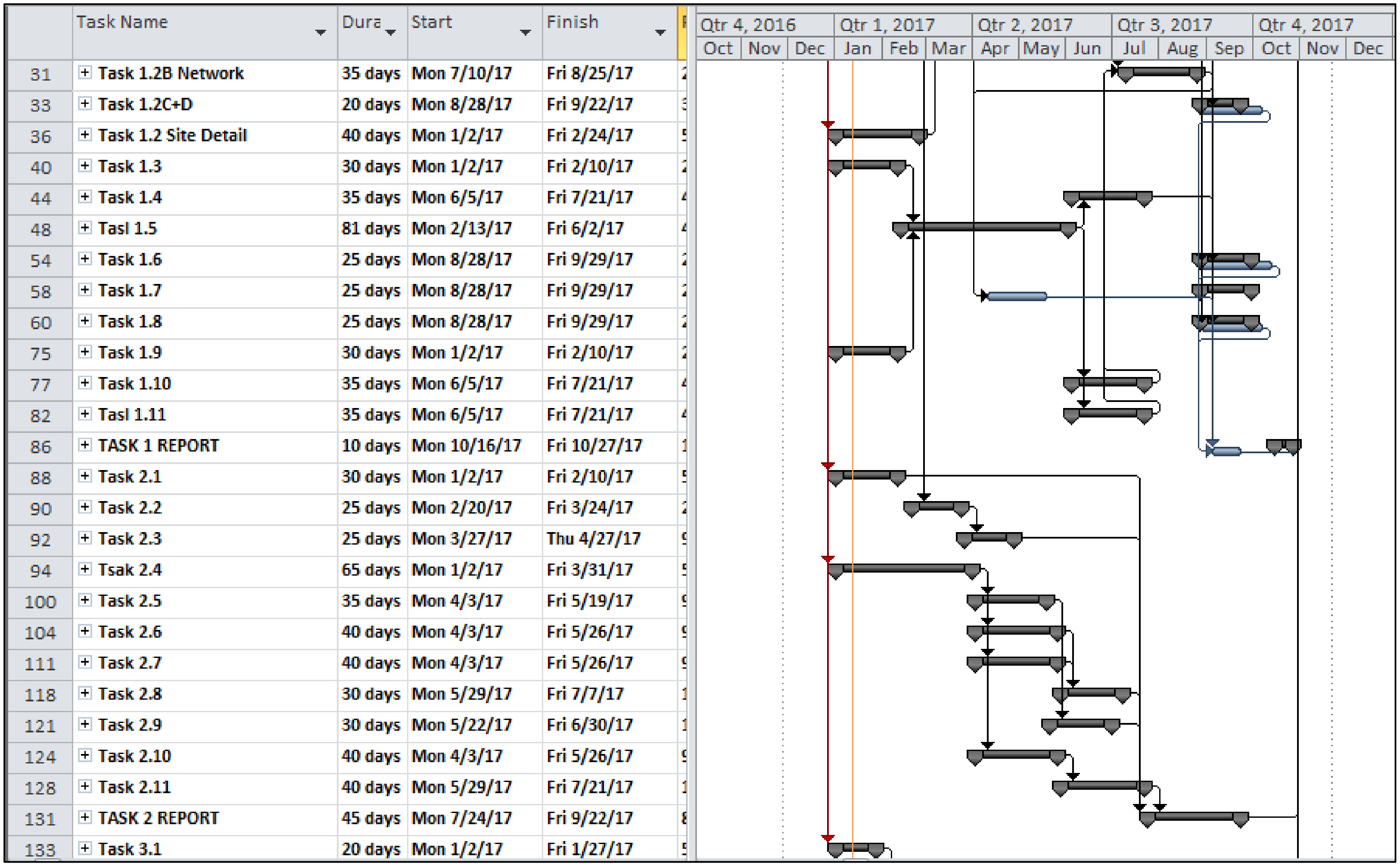


Figure 4.1 – Updated Gantt Chart from Project Implementation Plan.

Based on the NY Prize Stage 2 RFP, the Project team developed a more detailed Gantt Chart for phase 2 of the Project:



	Task Name	Duration	Start	Finish
31	Task 1.2B Network	35 days	Mon 7/10/17	Fri 8/25/17
33	Task 1.2C+D	20 days	Mon 8/28/17	Fri 9/22/17
36	Task 1.2 Site Detail	40 days	Mon 1/2/17	Fri 2/24/17
40	Task 1.3	30 days	Mon 1/2/17	Fri 2/10/17
44	Task 1.4	35 days	Mon 6/5/17	Fri 7/21/17
48	Tasl 1.5	81 days	Mon 2/13/17	Fri 6/2/17
54	Task 1.6	25 days	Mon 8/28/17	Fri 9/29/17
58	Task 1.7	25 days	Mon 8/28/17	Fri 9/29/17
60	Task 1.8	25 days	Mon 8/28/17	Fri 9/29/17
75	Task 1.9	30 days	Mon 1/2/17	Fri 2/10/17
77	Task 1.10	35 days	Mon 6/5/17	Fri 7/21/17
82	Tasl 1.11	35 days	Mon 6/5/17	Fri 7/21/17
86	TASK 1 REPORT	10 days	Mon 10/16/17	Fri 10/27/17
88	Task 2.1	30 days	Mon 1/2/17	Fri 2/10/17
90	Task 2.2	25 days	Mon 2/20/17	Fri 3/24/17
92	Task 2.3	25 days	Mon 3/27/17	Thu 4/27/17
94	Tsak 2.4	65 days	Mon 1/2/17	Fri 3/31/17
100	Task 2.5	35 days	Mon 4/3/17	Fri 5/19/17
104	Task 2.6	40 days	Mon 4/3/17	Fri 5/26/17
111	Task 2.7	40 days	Mon 4/3/17	Fri 5/26/17
118	Task 2.8	30 days	Mon 5/29/17	Fri 7/7/17
121	Task 2.9	30 days	Mon 5/22/17	Fri 6/30/17
124	Task 2.10	40 days	Mon 4/3/17	Fri 5/26/17
128	Task 2.11	40 days	Mon 5/29/17	Fri 7/21/17
131	TASK 2 REPORT	45 days	Mon 7/24/17	Fri 9/22/17
133	Task 3.1	20 days	Mon 1/2/17	Fri 1/27/17

Figure 4.2 – Phase 2 Gantt Chart based on NY Prize Stage 2 RFP.

4.2 Updated Budget

Table 4.1 below displays the updated total expenditures through December 31, 2016.

Task	Budget	Quarterly Spend	Spend to Date	Remaining Balance
Project Administration and Planning	$131,000	$41,760	$171,839	-$40,839
Marketing and Community Engagement	$200,000	$9,063	$64,327	$135,673
Implementation	$275,000	$12,587	$32,693	$242,307
Audit Grade Detailed Engineering Design	$1,000,000	$9,782	$14,239	$985,761
Totals:	**$1,606,000**	**$73,192**	**$283,099**	**$1,322,901**

Table 4.1 – Updated Budget

The incremental costs associated with the Project as of December 31, 2016 total $6,375. Continued monitoring and reporting of incremental costs will be included in subsequent quarterly reports.

As the Project moves out of the initial planning and Conceptual Design phase and into the Detailed Engineering Design and Implementation phase, the budget will shift reliance to the latter's expense line items. While the majority of the Project Administration and Planning budget has been depleted, the Project team will continue to record expenses in this category to track categorical administrative expenses of the Project.

5.0 Progress Metrics

The size and number of participants in the microgrid will dramatically change the projected cost and configuration of the microgrid construction. This section will track the current projected cost range of the microgrid depending on the most recent engineering estimates as well as the projected resiliency duration of the detailed design.

5.1 Total Cost of Microgrid

Metric	As of Q2 2016	As of Q3 2016	As of Q4 2016
Projected Cost Range of Microgrid Construction	$36M[1]	$35M - $60M[2]	$26.4M - $61.3M[3]
Underground Wire Cost Range	$11.3M - $11.8M	$11.3M - $11.8M	$7.4M - $12.0M
Projected Resiliency Duration	14 Days	14 Days	14 Days

[1] Includes all aspects of microgrid (underground wires, controller, new DER).
[2] Range includes three (3) generation equipment options and two (2) distribution equipment options.
[3] Range includes three (3) generation equipment options and three (3) distribution equipment options.

Table 5.1 – Cost of Microgrid

5.2 Tiered Recovery Population

The National Grid team's final approach to the tiered recovery model used the customer counts is set out below:

	Commercial	Residential	Total
Tier 1	12	0	12
Tier 2	518	2,239	2,757
Tier 3	463	3,246	3,709
Tier 4	331	3,693	4,024
Tier 5	1,718	14,304	16,022
Total	**3,042**	**23,482**	**26,524**

Table 5.3 – Tiered-Recovery Customers

Other metrics may be added to subsequent quarterly reports as they become more relevant as the Project progresses.

6.0 Appendices

Appendix A: Initial Societal BCA Figures

Scenario 1 with no annual major power outages:

Cost or Benefit Category	Present Value Over 20 Years (2014$)	Annualized Value (2014$)
Costs		
Initial Design and Planning	$1,250,000	$110,272
Capital Investments	$37,271,000	$2,807,043
Fixed Operation and Maintenance ("O&M")	$3,926,650	$346,400
Variable O&M (Grid-Connected Mode)	$11,160,556	$984,558
Fuel (Grid-Connected Mode)	$33,362,340	$2,943,148
Emission Control	$0	$0
Emissions Allowances	$0	$0
Emissions Damages (Grid-Connected Mode)	$22,697,293	$1,481,179
Total Costs	$109,667,838	$8,672,601
Benefits		
Reduction in Generating Costs	$42,525,428	$3,751,495
Fuel Savings from CHP Facilities	$0	$0
Generation Capacity Cost Savings	$8,690,644	$766,668
Distribution Capacity Cost Savings	$0	$0
Reliability Improvements	$1,878,695	$165,845
Power Quality Improvements	$6,666,383	$588,093
Avoided Emissions Allowance Costs	$19,071	$1,682
Avoided Emissions Damages	$28,334,071	$1,849,024
Major Power Outage Benefits	$0	$0
Total Benefits	**$88,114,291**	**$7,122,807**
Net Benefits	**-$21,553,547**	**-$1,549,794**
Benefit-Cost Ratio	**0.80**	

Table 6.1: Potsdam Societal BCA Results (with No Annual Major Power Outages)

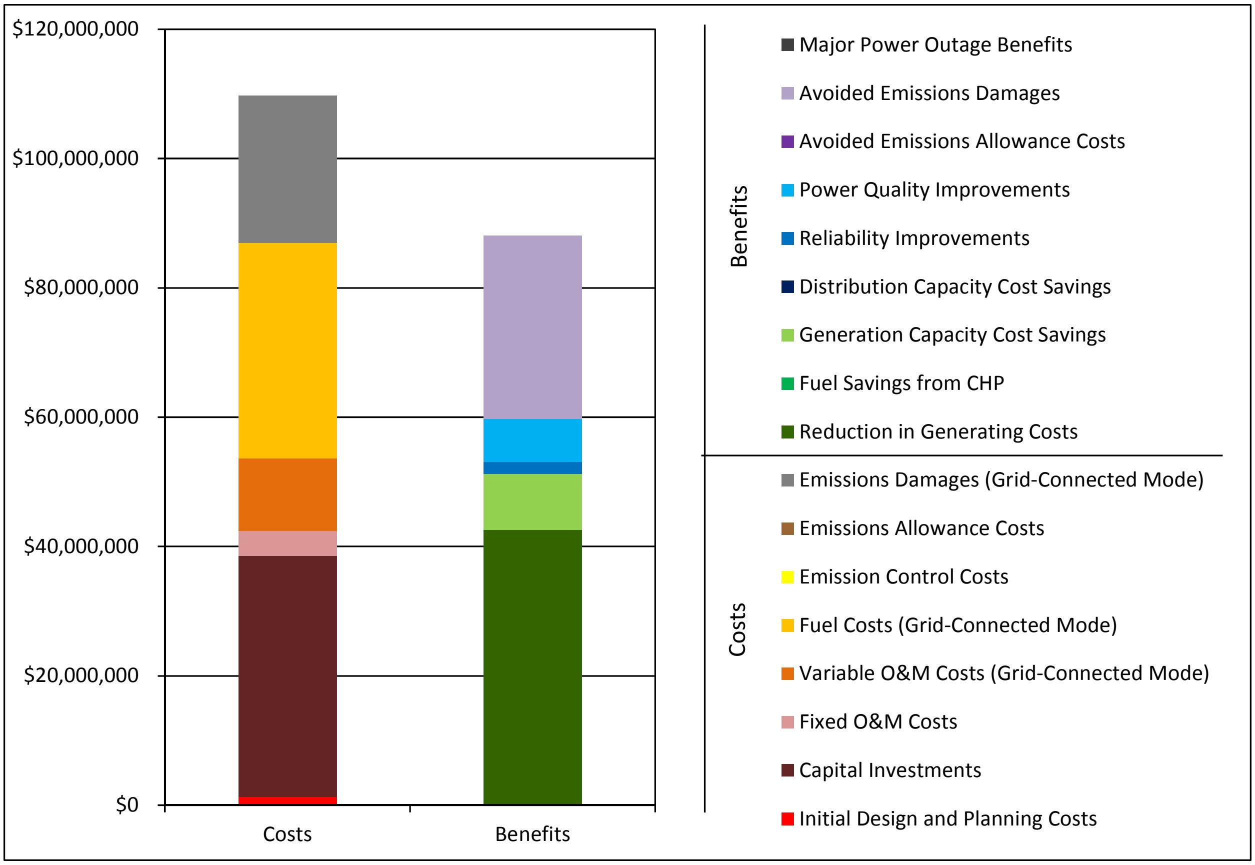


Figure 6.1: Potsdam Microgrid Societal BCA Results (with No Annual Major Power Outages)

Scenario 2 with 0.73 days of annual major power outages:

Cost or Benefit Category	Present Value Over 20 Years (2014$)	Annualized Value (2014$)
Costs		
Initial Design and Planning	$1,250,000	$110,272
Capital Investments	$37,271,000	$2,807,043
Fixed Operation and Maintenance ("O&M")	$3,926,650	$346,400
Variable O&M (Grid-Connected Mode)	$11,160,556	$984,558
Fuel (Grid-Connected Mode)	$33,362,340	$2,943,148
Emission Control	$0	$0
Emissions Allowances	$0	$0
Emissions Damages (Grid-Connected Mode)	$22,697,293	$1,481,179
Total Costs	$109,667,838	$8,672,601
Benefits		
Reduction in Generating Costs	$42,525,428	$3,751,495
Fuel Savings from CHP Facilities	$0	$0
Generation Capacity Cost Savings	$8,690,644	$766,668
Distribution Capacity Cost Savings	$0	$0
Reliability Improvements	$1,878,695	$165,845
Power Quality Improvements	$6,666,383	$588,093
Avoided Emissions Allowance Costs	$19,071	$1,682
Avoided Emissions Damages	$28,334,071	$1,849,024
Major Power Outage Benefits	$21,727,455	$1,918,118
Total Benefits	**$109,841,746**	**$9,040,925**
Net Benefits	**$173,907**	**$368,324**
Benefit-Cost Ratio	**1.00**	

Table 6.2: Potsdam Societal BCA Results (with 0.73 days of Annual Major Power Outages)

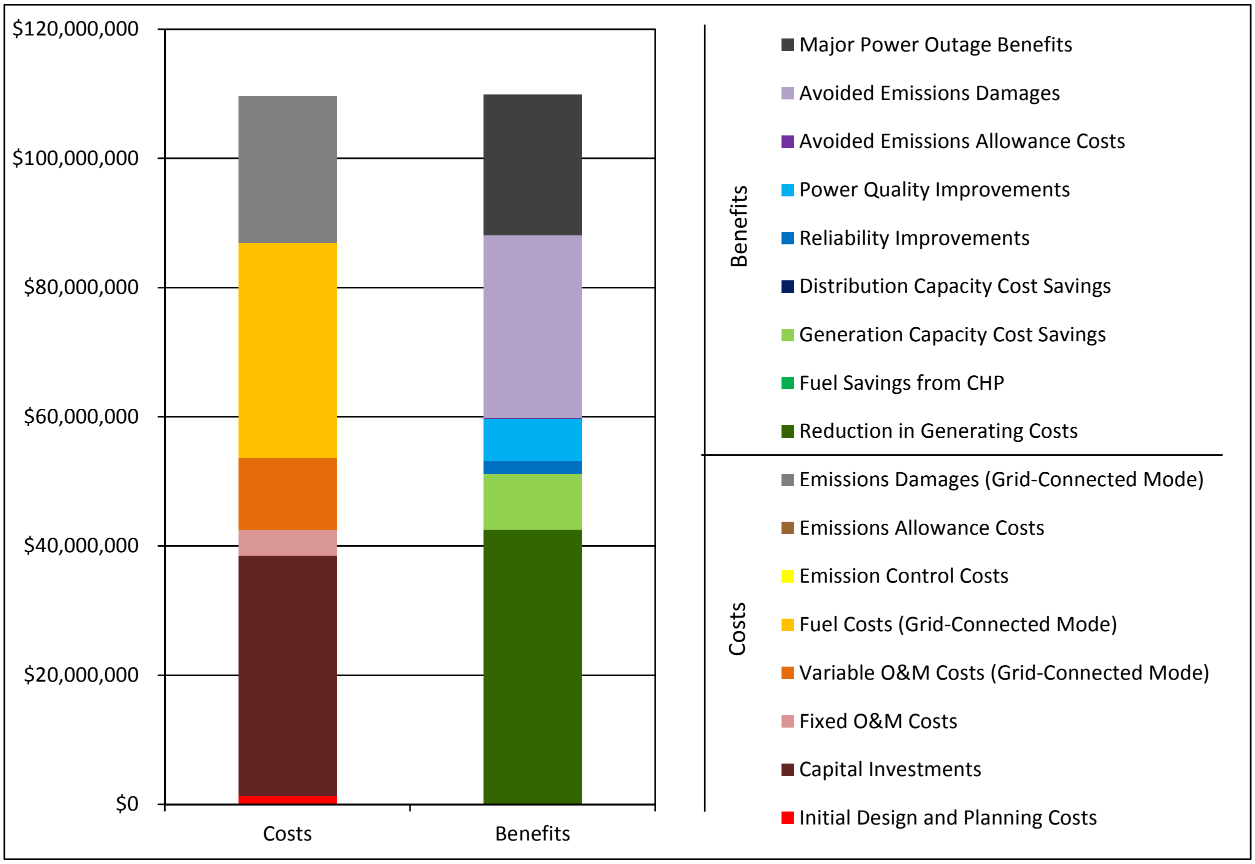
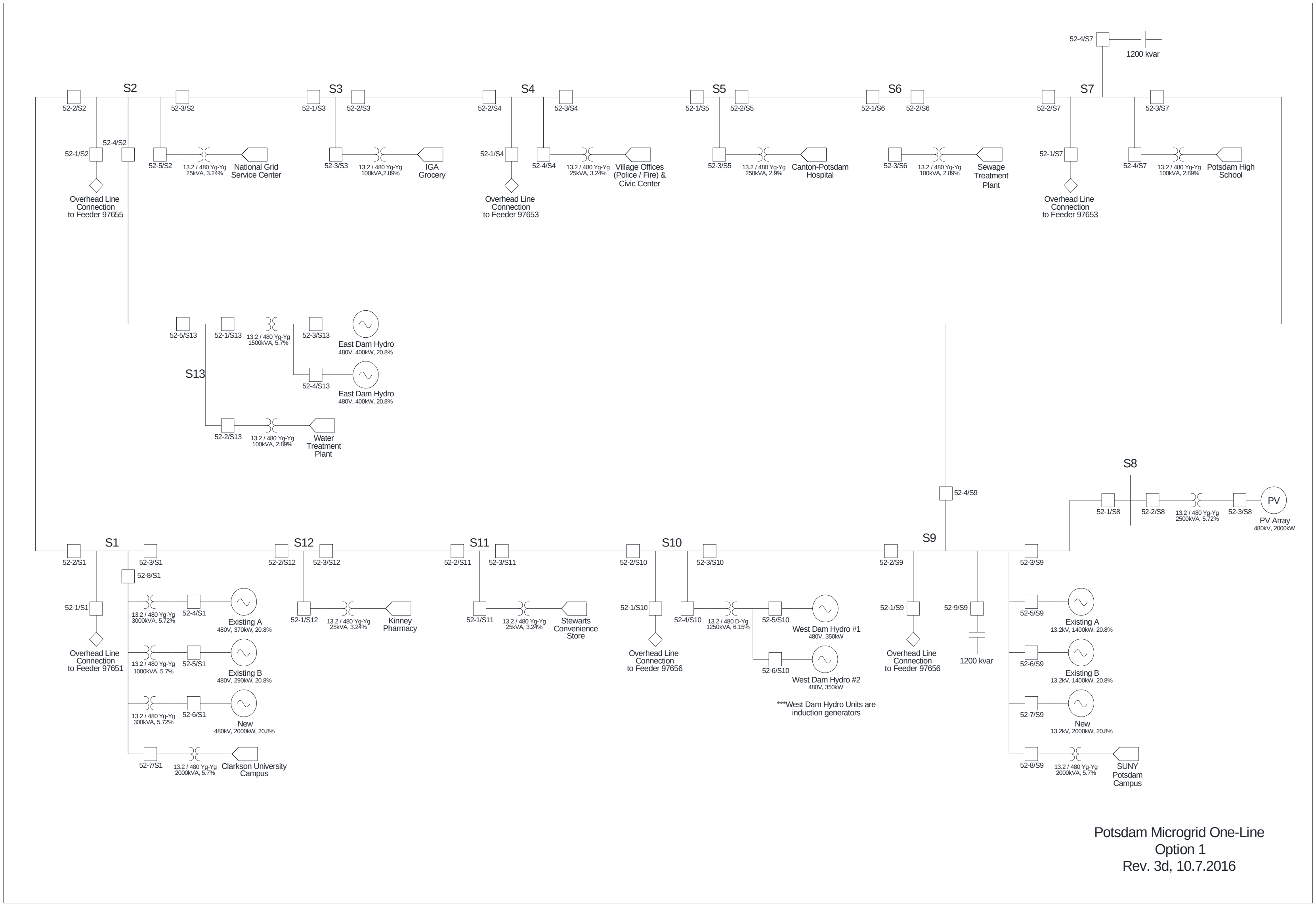
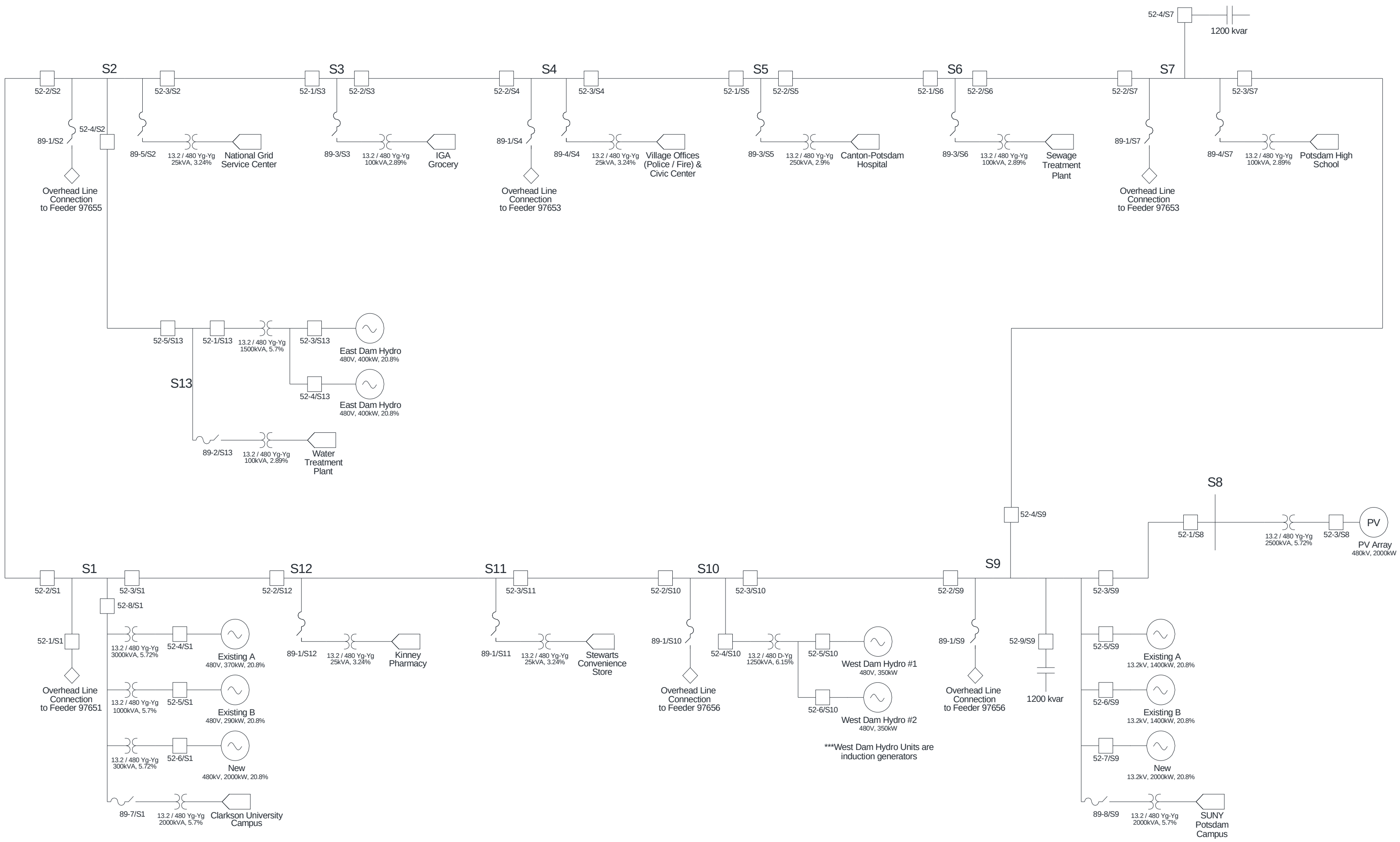


Figure 6.2: Potsdam Microgrid Societal BCA Results (with 0.73 days of Annual Major Power Outages)

Appendix B: NYSERDA PON One-Line Diagrams

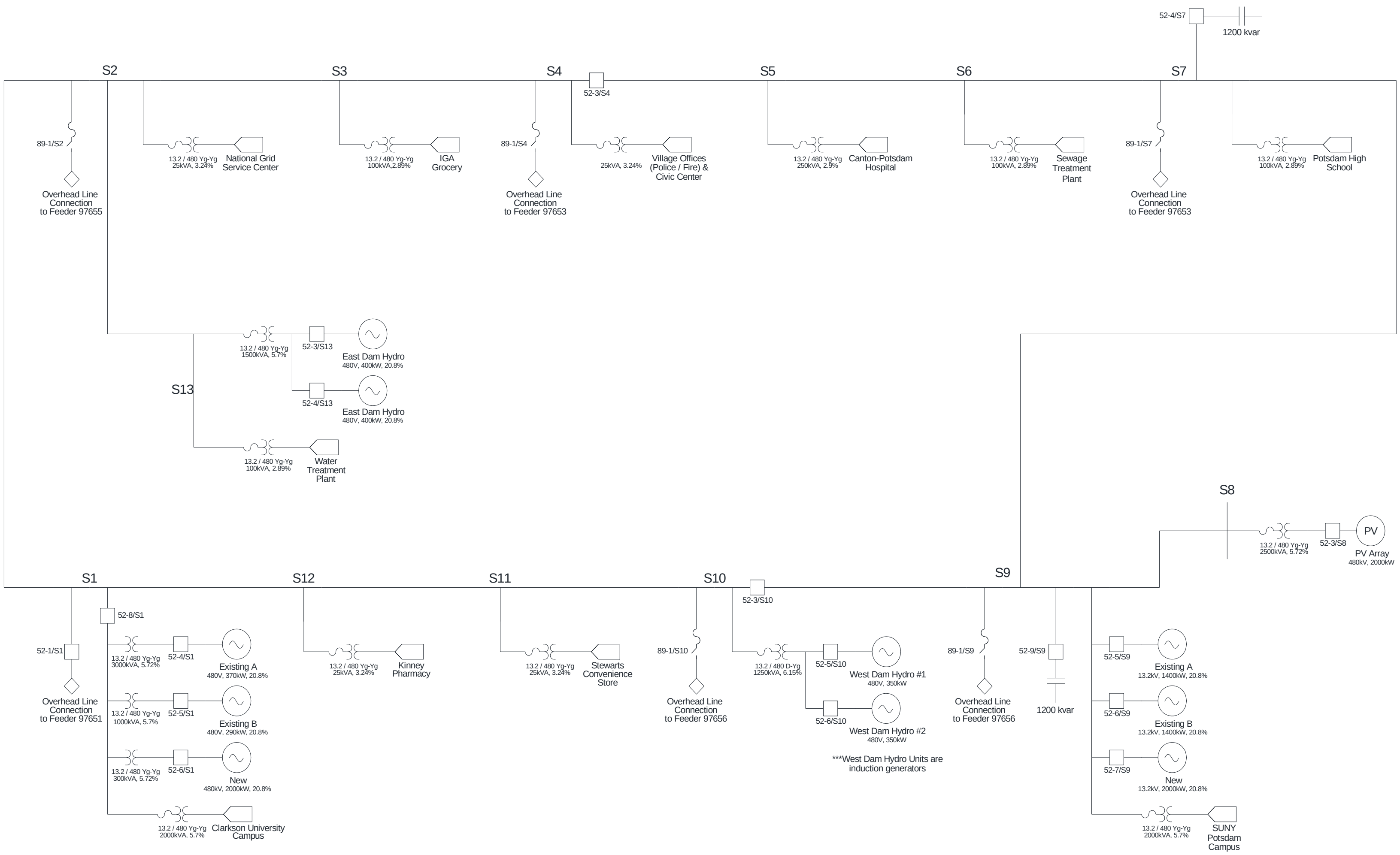


nationalgrid



Potsdam Microgrid One-Line
Option 2
Rev. 0, 10.7.2016

nationalgrid



Potsdam Microgrid One-Line
Option 3
Rev. 0, 10.7.2016

Appendix C: Phase 2 Responsibility Matrix

Code	Description
L	Lead - Ownership of task and deliverables
C	Collaborator - Provider of significant Contribution
S	Supporter - Provider support if needed
N	None - No Contribution or Support Needed

Abbreviations		
GE EC = GE Energy Consultants	Legal-REG = Legal TBD	NG = National Grid
GE GS = GE Global Research	CU = Clarkson University	
GE GA = GE Grid Automation	NE = Nova Energy	
WurldTech = GE WurldTech	EF = OBG	

Task 0 – Project Management and Progress Reporting		GE EC	GE GS	GE GA	WurldTech	Legal-REG	CU	NE	EF	NG
0	Responsibility	C	N	N	N	N	N	N	N	L
0.1	Progress Reporting	L	C	C	N	C	C	C	C	C
0.2	Project Kick Off Meeting	L	N	N	N	N	C	C	C	C
0.3	Project Completion Meeting	L	N	N	N	N	C	C	C	C
0.4	Project Metric Reporting	L	N	N	N	N	N	N	N	C
Task 1 - Develop Detailed Technical Design Configuration and Costs		**GE EC**	**GE GS**	**GE GA**	**WurldTech**	**Legal-REG**	**CU**	**NE**	**EF**	**NG**
1.1 A	Demonstrate "Minimum Required Capabilities"	L	N	N	N	N	S	S	C	S
1.1 B	Indicate Degree of "Preferred Capabilities"	L	N	N	N	N	S	S	C	S
1.1 B1	Level II Energy Audits	S	N	N	N	N	S	N	L	S
1.1 B2	Demonstrate Community Benefits	C	N	N	N	N	L	N	S	S
1.1 B3	Others (REV, Multi-Perspective BCA, Private Capital)	L	N	N	N	N	C	N	S	S
1.2 A	Reference Layout Diagrams	C	N	N	N	N	S	N	L	S
1.2 B	Electrical One-Line Diagrams	C	N	N	N	N	S	N	L	S
1.2 C	Communications and Control Schematics	C	N	L	S	N	S	N	C	S
1.2 D	Piping and Instrumentation Diagrams	S	N	N	N	N	S	N	L	S
1.2.1	Site Characterizations	C	N	N	N	N	L	N	C	S
1.2.2	Fuel Specifications	C	N	N	N	N	L	N	C	S
1.2.3	Water and Other Utility Supplies	S	N	N	N	N	L	N	S	S
1.3.1	Electrical and Thermal Loads	C	N	N	N	N	C	N	L	S
1.3.2	Quantitative Performance Requirements	L	N	N	N	N	C	C	C	S
1.3.3	Codes, Standards, and Regulations	C	N	S	S	N	S	C	L	S
1.4 A	DER Analysis (Excluding DR, EE, and Hydropower)	C	N	N	N	N	S	S	L	S
1.4 B	DER Analysis (DR, EE, and Hydropower)	C	N	N	N	N	S	S	L	S
1.4 C	DER Analysis (Control & Communications Integration Req.)	C	N	L	N	N	S	S	S	S
1.5.1	Variable Output Resources	L	C	N	N	N	C	N	C	S
1.5.2	CHP and Dispatchable Resources	C	S	N	N	N	C	N	L	S
1.5.3	Energy Efficiency and Demand Response Design	C	N	C	N	N	C	N	L	S
1.6.1	Power Distribution Equipment	C	C	N	N	N	C	S	S	L
1.6.2	Power Distribution System Controls and Protection	C	C	N	N	N	C	S	S	L
1.6.3	Meters and Sensors	C	C	N	N	N	C	S	S	L
1.7.1	Functionality	L	N	N	N	N	C	S	S	S
1.8.1	Microgrid Monitoring and Protection	C	N	L	N	N	S	S	S	S
1.8.2	Fault Response	C	N	L	N	N	S	S	S	S
1.8.3	Voltage and Frequency Response	C	N	L	N	N	S	S	S	S
1.8.4	Switchgear Management	C	N	L	N	N	S	S	S	S
1.8.5	Transition to Island Mode	C	N	L	N	N	S	S	S	S
1.8.6	Black Start Sequence	C	N	L	N	N	S	S	S	S
1.8.7	Island Mode Operation	C	N	L	N	N	S	S	S	S
1.8.8	DER Optimization and Dispatch	C	N	L	N	N	S	S	S	S
1.8.9	Energy and Ancillary Service Market	C	N	L	N	N	S	S	S	S
1.8.10	Communications Infrastructure	C	N	L	S	N	S	S	S	S
1.8.11	Integration with External Systems	C	N	L	S	N	S	S	S	S
1.8.12	Cyber Security	S	N	N	L	N	S	S	S	S
1.8.13	Hardware and Software Requirements	C	N	L	S	N	S	S	S	S
1.8.14	Applications Requirements	C	N	L	S	N	S	S	S	S
1.9	Microgrid Load Analysis	C	N	N	N	N	C	S	L	S
1.10.1	Steady-State Load Flow Analysis	L	N	N	N	N	S	C	S	S
1.10.2	Short Circuit and Protection Analysis	L	N	N	N	N	S	C	S	S

Code	Description
L	Lead - Ownership of task and deliverables
C	Collaborator - Provider of significant Contribution
S	Supporter - Provider support if needed
N	None - No Contribution or Support Needed

Abbreviations

GE EC =	GE Energy Consultants	Legal-REG =	Legal TBD	NG =	National Grid
GE GS =	GE Global Research	CU =	Clarkson University		
GE GA =	GE Grid Automation	NE =	Nova Energy		
WurldTech =	GE WurldTech	EF =	OBG		

Code	Description	GE EC	GE GS	GE GA	WurldTech	Legal-REG	CU	NE	EF	NG
1.10.3	System Dynamic Study	L	N	N	N	N	S	C	S	S
1.10.4	Grid Synchronization	L	N	N	N	N	S	C	S	S
1.11.1	Harmonic Study	L	N	N	N	N	S	C	S	S
1.11.2	Flicker Study	L	N	N	N	N	S	C	S	S
1.11.3	Unbalance Study	L	N	N	N	N	S	C	S	S
Task 2 - Microgrid Commercial/ Financial Business Plan		**GE EC**	**GE GS**	**GE GA**	**WurldTech**	**Legal-REG**	**CU**	**NE**	**EF**	**NG**
2.1	Project Team	C	N	N	N	N	L	S	S	C
2.2	Commercial Viabilities – Customers	C	N	N	N	N	L	N	N	S
2.3	Microgrid Services	L	C	N	N	N	C	N	N	S
2.4.1	Business Model	C	N	N	N	C	L	N	N	C
2.4.2	Community Value Proposition	C	N	N	N	S	L	N	N	C
2.4.3 A	Grid Value Proposition	C	N	N	N	S	L	N	N	C
2.4.3 B	Other Stakeholder Value Proposition	C	N	N	N	S	L	N	N	C
2.4.4	Purchaser Value Proposition	C	N	N	N	S	L	N	N	C
2.5.1	Community and Government Support	C	N	N	N	N	L	N	N	C
2.5.2	Financiers	C	N	N	N	N	L	N	N	C
2.5.3	Grid Support	C	N	N	N	N	L	N	N	C
2.6.1	Project Planning	N	N	N	N	N	S	N	L	S
2.6.1.1	Construction Management Services	N	N	N	N	N	S	N	L	S
2.6.2	Suppliers	N	N	N	N	C	S	N	L	S
2.6.2.1	Supplier Agreements	N	N	N	N	C	S	N	L	S
2.6.3	Engineering, Procurement, and Construction Costs	N	N	N	N	N	S	N	L	S
2.6.4	Operating Costs	N	N	N	N	N	S	N	L	S
2.7.1	Assets	L	N	N	N	N	C	N	S	S
2.7.2	Control & Monitoring	C	N	L	N	N	C	N	S	S
2.7.3	Distribution Strategy	L	N	N	N	N	C	N	N	C
2.7.4	Maintenance	C	S	N	N	N	C	N	L	S
2.7.5	Reliability	L	C	N	N	N	C	N	N	S
2.7.6	Taxes	N	N	N	N	L	C	N	N	S
2.8.1	Profitability	L	N	N	N	S	C	N	S	S
2.8.2	Revenue	L	N	N	N	S	C	N	S	S
2.9.1	Government Financing	C	C	N	N	S	L	N	N	S
2.9.2	Private Financing	C	C	N	N	S	L	N	N	S
2.10.1	Management of Regulation	C	N	N	N	L	C	N	N	S
2.10.2	Ownership Structure	C	N	N	N	L	C	N	N	S
2.10.3	Rights to Operate/Permits and Approvals	S	N	N	N	L	C	N	C	S
2.11.1	Energy Services Agreements	S	N	N	N	L	C	N	C	S
2.11.2	Other Stakeholder Agreements	S	N	N	N	L	C	N	C	S
Task 3 - Develop Information for Benefit Cost Analysis		**GE EC**	**GE GS**	**GE GA**	**WurldTech**	**Legal-REG**	**CU**	**NE**	**EF**	**NG**
3.1	Facility and Customer Description	C	N	N	N	N	L	N	C	S
3.2	Characterization of DER	L	N	N	N	N	C	N	C	S
3.3	Capacity Impacts and Ancillary Services	L	N	N	N	N	C	N	S	S
3.4	Project Costs	L	N	N	N	N	C	N	C	S
3.5	Costs to Maintain Service during a Power Outage	C	N	N	N	N	L	N	S	S
3.6	Services Supported by the Microgrid	C	N	N	N	N	L	N	C	S

Appendix D: Phase 2 Project Schedule

	Months After Start	1	2	3	4	5	6	7	8	9	10
Task 0 – Project Management and Progress Reporting											
0	Responsibility										
0.1	Progress Reporting										
0.2 A	Project Kick Off Meeting										
0.2 B	Project Interim Meetings										
0.2 C	WebEx / Conference Calls										
0.3	Project Completion Meeting										
0.4	Project Metric Reporting										
Task 1 - Develop Detailed Technical Design Configuration and Costs											
1.1 A	Demonstrate "Minimum Required Capabilities"										
1.1 B	Indicate Degree of "Preferred Capabilities"										
1.1 B1	Level II Energy Audits										
	Data Acquisition – Provided by others (National Grid)										
	PEA										
	Walk Through										
	Letter Report										
1.1 B2	Demonstrate Community Benefits										
1.1 B3	Others (REV, Multi-Perspective BCA, Private Capital)										
1.2 A	Reference Layout Diagrams										
1.2 B	Electrical One-Line Diagrams										
1.2 C	Communications and Control Schematics										
1.2 D	Piping and Instrumentation Diagrams										
1.2.1	Site Characterizations										
1.2.2	Fuel Specifications										
1.2.3	Water and Other Utility Supplies										
1.3.1	Electrical and Thermal Loads										
1.3.2	Quantitative Performance Requirements										
1.3.3	Codes, Standards, and Regulations										
1.4 A	DER Analysis (Excluding DR, EE, and Hydropower)										
1.4 B	DER Analysis (DR, EE, and Hydropower)										
1.4 C	DER Analysis (Control & Communications Integration)										
1.5.1	Variable Output Resources										
1.5.2	CHP and Dispatchable Resources										
	Decision: Clarkson Go/No Go for CHP										
	GE Sizing and Spec Determination										
	If GO – Engage SOW – OBG										
1.5.3	Energy Efficiency and Demand Response Design										
1.6.1	Power Distribution Equipment										

1.6.2	Power Distribution System Controls and Protection										
1.6.3	Meters and Sensors										
1.7.1	Functionality										
1.8.1	Microgrid Monitoring and Protection										
1.8.2	Fault Response										
1.8.3	Voltage and Frequency Response										
1.8.4	Switchgear Management										
1.8.5	Transition to Island Mode										
1.8.6	Black Start Sequence										
1.8.7	Island Mode Operation										
1.8.8	DER Optimization and Dispatch										
1.8.9	Energy and Ancillary Service Market										
1.8.10	Communications Infrastructure										
1.8.11	Integration with External Systems										
1.8.12	Cyber Security										
1.8.13	Hardware and Software Requirements										
1.8.14	Applications Requirements										
1.9	Microgrid Load Analysis										
1.10.1	Steady-State Load Flow Analysis										
1.10.2	Short Circuit and Protection Analysis										
1.10.3	System Dynamic Study										
1.10.4	Grid Synchronization										
1.11.1	Harmonic Study										
1.11.2	Flicker Study										
1.11.3	Unbalance Study										
Task 2 - Microgrid Commercial/ Financial Business Plan											
2.1	Project Team										
2.2	Commercial Viabilities – Customers										
2.3	Microgrid Services										
2.4.1	Business Model										
2.4.2	Community Value Proposition										
2.4.3 A	Grid Value Proposition										
2.4.3 B	Other Stakeholder Value Proposition										
2.4.4	Purchaser Value Proposition										
2.5.1	Community and Government Support										
2.5.2	Financiers										
2.5.3	Grid Support										
2.6.1	Project Planning										
2.6.1.1	Construction Management Services										
2.6.2	Suppliers										
2.6.2.1	Supplier Agreements										
2.6.3	Engineering, Procurement, and Construction Costs										
2.6.4	Operating Costs										

2.7.1	Assets										
2.7.2	Control & Monitoring										
2.7.3	Distribution Strategy										
2.7.4	Maintenance										
2.7.5	Reliability										
2.7.6	Taxes										
2.8.1	Profitability										
2.8.2	Revenue										
2.9.1	Government Financing										
2.9.2	Private Financing										
2.10.1	Management of Regulation										
2.10.2	Ownership Structure										
2.10.3	Rights to Operate/Permits and Approvals										
2.11.1	Energy Services Agreements										
2.11.2	Other Stakeholder Agreements										
Task 3 - Develop Information for Benefit Cost Analysis											
3.1	Facility and Customer Description										
3.2	Characterization of DER										
3.3	Capacity Impacts and Ancillary Services										
3.4	Project Costs										
3.5	Costs to Maintain Service during a Power Outage										
3.6	Services Supported by the Microgrid										
	Interim Benefit Cost Analysis										
	Interim Benefit Cost Analysis										
	Interim Benefit Cost Analysis										
	Interim Benefit Cost Analysis										
	Interim Benefit Cost Analysis										
	Interim Benefit Cost Analysis										
	Interim Benefit Cost Analysis										
	Billing Milestones										

Appendix E: Conceptual Design Data Summary

Load Summary					
ID	Microgrid Load	Data Type	Data Vintage	Annual Energy (kWh)	Annual Non-Coincident Peak (kW)
1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
2					
3					
4					
5					
6					
7					
8					
9					
10					
	Total Load Included in Conceptual Design:			[redacted]	[redacted]
11	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
12					
13					
	NEW Load to be Included in Detail Design:			[redacted]	[redacted]

Renewable Generation Summary					
ID	Renewable Source	Data Type	Data Vintage	Annual Energy (kWh)	Annual Non-Coincident Peak (kW)
1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
2					
3					
	Total Load Included in Conceptual Design:			[redacted]	[redacted]

Thermal Generation Summary					
ID	**Name**	**Type**	**Fuel**	**In Microgrid?**	**Maximum Capacity (kW)**
1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
4	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
5	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
6	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
7	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
8	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
9	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
10	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
11	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
12	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
13	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
14	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
15	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
16	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
17	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
18	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
19	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
20	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		Total Existing Generation (kW):			[redacted]

Notes:
All existing units less than 200 kW were excluded from the microgrid as these units are assumed to be too small and too costly to be integrated into the microgrid network (in terms of need for upgrading their control and communications system and associated network hardware costs).
Diesel units were excluded in order to avoid issues with multiple fuel sources and additional costs of maintaining two weeks of diesel fuel storage.
Units designated as Small NG and Small DS are actually aggregation of small units of less than 100 kW in capacity.

Appendix F: Bill Impact Spreadsheet

NIAGARA MOHAWK POWER CORPORATION d/b/a NATIONAL GRID
TYPICAL BILL IMPACTS - RATE YEAR ONE
SC2-SMALL GENERAL SERVICE (UNMETERED DEMAND)
Central Region (Load Zones 2C, 3E and 31D)

	Delivery				Commodity				Total			
kWh Usage	Current	Proposed	Difference	Change	Current	Proposed	Difference	Change	Current	Proposed	Difference	Change
100	$27.57	$28.16	$0.59	2.14%	$6.53	$6.53	$0.00	0.00%	$34.10	$34.69	$0.59	1.73%
200	$33.92	$35.09	$1.17	3.45%	$13.06	$13.06	$0.00	0.00%	$46.98	$48.15	$1.17	2.49%
300	$40.26	$42.02	$1.76	4.37%	$19.59	$19.59	$0.00	0.00%	$59.85	$61.61	$1.76	2.94%
400	$46.60	$48.95	$2.35	5.04%	$26.12	$26.12	$0.00	0.00%	$72.72	$75.07	$2.35	3.23%
500	$52.94	$55.88	$2.94	5.55%	$32.65	$32.65	$0.00	0.00%	$85.59	$88.53	$2.94	3.43%
600	$59.28	$62.81	$3.53	5.95%	$39.18	$39.18	$0.00	0.00%	$98.46	$101.99	$3.53	3.59%
700	$65.62	$69.74	$4.12	6.28%	$45.71	$45.71	$0.00	0.00%	$111.33	$115.45	$4.12	3.70%
800	$71.97	$76.67	$4.70	6.53%	$52.23	$52.23	$0.00	0.00%	$124.20	$128.90	$4.70	3.78%
900	$78.31	$83.60	$5.29	6.76%	$58.76	$58.76	$0.00	0.00%	$137.07	$142.36	$5.29	3.86%
1,000	$84.65	$90.53	$5.88	6.95%	$65.29	$65.29	$0.00	0.00%	$149.94	$155.82	$5.88	3.92%
1,100	$90.99	$97.46	$6.47	7.11%	$71.82	$71.82	$0.00	0.00%	$162.81	$169.28	$6.47	3.97%
1,200	$97.33	$104.39	$7.06	7.25%	$78.35	$78.35	$0.00	0.00%	$175.68	$182.74	$7.06	4.02%
1,300	$103.67	$111.32	$7.65	7.38%	$84.88	$84.88	$0.00	0.00%	$188.55	$196.20	$7.65	4.06%
1,400	$110.02	$118.25	$8.23	7.48%	$91.41	$91.41	$0.00	0.00%	$201.43	$209.66	$8.23	4.09%
1,500	$116.36	$125.18	$8.82	7.58%	$97.94	$97.94	$0.00	0.00%	$214.30	$223.12	$8.82	4.12%
1,600	$122.70	$132.10	$9.40	7.66%	$104.47	$104.47	$0.00	0.00%	$227.17	$236.57	$9.40	4.14%
1,700	$129.04	$139.03	$9.99	7.74%	$111.00	$111.00	$0.00	0.00%	$240.04	$250.03	$9.99	4.16%
1,800	$135.38	$145.96	$10.58	7.82%	$117.53	$117.53	$0.00	0.00%	$252.91	$263.49	$10.58	4.18%
1,900	$141.72	$152.89	$11.17	7.88%	$124.06	$124.06	$0.00	0.00%	$265.78	$276.95	$11.17	4.20%
2,000	$148.07	$159.82	$11.75	7.94%	$130.59	$130.59	$0.00	0.00%	$278.66	$290.41	$11.75	4.22%

Current			Proposed		
Customer Charge		$21.02	Customer Charge		$21.02
T&D Energy Charge	kWh x	$0.05696	T&D Energy Charge	kWh x	$0.05696
Reliability Support Service	kWh x	$0.00000	Reliability Support Service	kWh x	$0.00000
Revenue Decoupling Mechanism	kWh x	$0.00000	Revenue Decoupling Mechanism	kWh x	$0.00000
Legacy Transition Charge	kWh x	$0.000330	Legacy Transition Charge	kWh x	$0.000330
Electricity Supply Rate Mechanism	kWh x	$0.000000	Electricity Supply Rate Mechanism	kWh x	$0.000000
Commodity Energy Charge	kWh x	$0.06261	Commodity Energy Charge	kWh x	$0.06261
Transmission Revenue Adjustment Charge	kWh x	-$0.00170	Transmission Revenue Adjustment Charge	kWh x	-$0.00170
Systems Benefits Charge	kWh x	$0.007189	Systems Benefits Charge	kWh x	$0.007189
Incremental State Assessment Surcharge	kWh x	$0.00000	Incremental State Assessment Surcharge	kWh x	$0.00000
Merchant Function Charge	kWh x	$0.00203	Merchant Function Charge	kWh x	$0.00203
Potsdam Charge	kWh x	$0.000000	Potsdam Charge	kWh x	$0.005820
Gross Receipts Tax			Gross Receipts Tax		
Commodity	Bill /	0.9900	Commodity	Bill /	0.9900
Delivery	Bill /	0.9900	Delivery	Bill /	0.9900

Delivery includes Customer Charge, T&D, Reliability Support Service, Legacy Transition Charge, TRA, SBC, Incremental State Assessment, NYPA Hydro Benefit, and Delivery GRT.
Commodity includes the Commodity Energy charge, Electricity Supply Rate Mechanism, Merchant Function Charge and Commodity GRT.