nationalgrid

Fruit Belt Neighborhood Solar

REV Demonstration
Q1 2016 Report

May 2, 2016

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1.0 Executive Summary

The Niagara Mohawk Power Corporation d/b/a National Grid ("National Grid") Fruit Belt Neighborhood Solar REV Demonstration Project ("Demonstration Project"), through the partnership with Buffalo Niagara Medical Campus ("BNMC"), Solar Liberty, and the New York State Energy Research and Development Authority ("NYSERDA") ("the Partnership"), provides solar-generated energy and financial benefits to low-to-moderate income ("LMI") customers while delivering grid efficiencies to the local electric distribution system. The concentration of 100 rooftop systems totaling 0.5 MW of solar photovoltaic ("PV") generation capacity within a specific neighborhood provides the technical conditions necessary for exploring grid efficiency as well as the opportunity to build positive relationships with the local residential community, increasing energy awareness and project participation. Using utility-owned solar PV equipment mounted on residential roofs, participating bill-paying residents will receive a monthly electric bill credit for the lifespan of the PV system.

This Demonstration Project will test the following hypotheses:

- Providing solar bill credits to participants in a LMI neighborhood, as well as partnering with NYSERDA to deliver energy efficiency programs to further drive energy bill savings, will have a positive impact on bill payment behavior and enable customers to better manage their arrears.
- Concentrating distributed solar PV resources with reactive power support within a boundary served by a common substation versus scattered deployment of conventional solar PV will deliver measurable grid efficiency benefits.

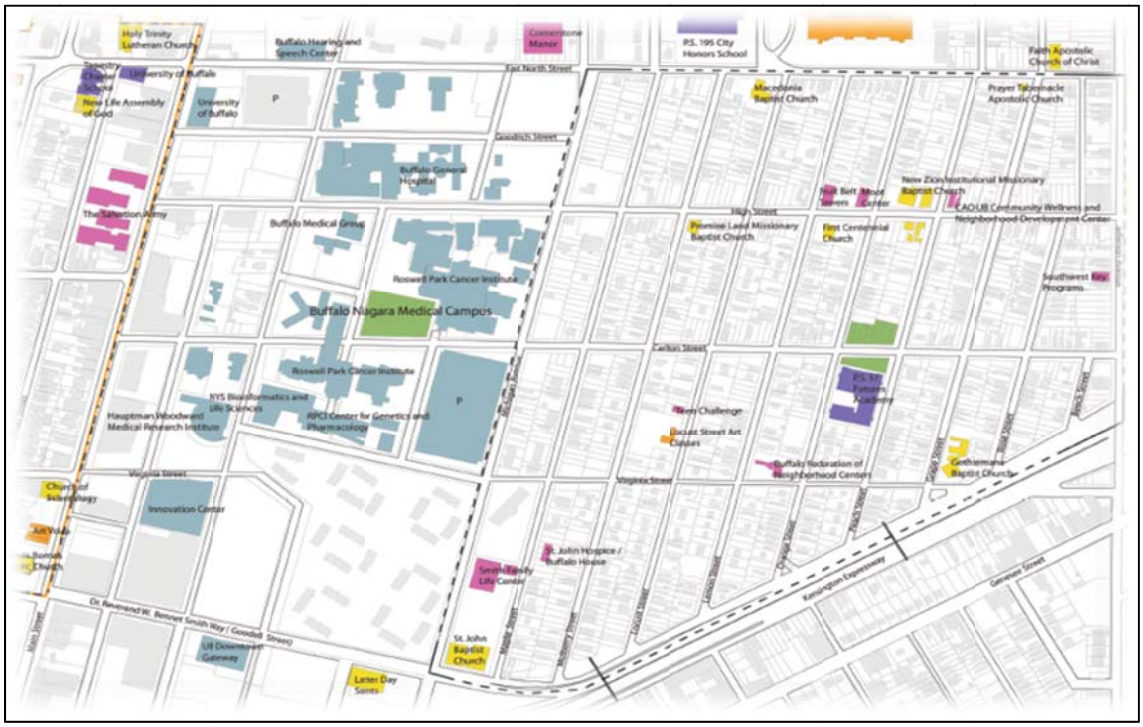


Figure 1-1: Location of the Fruit Belt Neighborhood (dashed perimeter), located adjacent to the Buffalo Niagara Medical Campus

REV Goal Support

The Demonstration Project supports multiple REV goals using an innovative approach to clean energy collection in a residential area. The electricity generated offsets demand for fossil-fuel generated electricity, thereby meeting the REV goal of reducing greenhouse gas emissions. Local energy production adds resiliency to the local grid, and hiring local and training residents on system sales and installation fulfills yet another REV goal – that of creating new jobs and business opportunities. Collectively, the Demonstration Project's support of multiple REV goals makes it highly valuable by testing the effectiveness of REV objectives as well as modeling how to effectively attain REV goals in a cost-effective, integrated manner.

Progress to Date and Planned Q2 Goals

In Q1 2016, National Grid has made significant progress on this project. Activities during Q1 2016 include: filing of the final implementation plan with the Commission, developing draft agreements with partners, finalizing technology decisions, and drafting customer consent forms and agreements for this unique solar PV project. Internally, National Grid developed marketing collateral, enrollment criteria, points of community contact, and draft approaches for metering, pricing, and billing. At the end of the quarter, the Partnership began to identify potential early adopting solar hosts through preliminary shading analyses and community interest. Solar Liberty identified approximately 180 suitable solar PV host sites based on an initial shading analysis and four potential early adopters were identified by the BNMC.

Q2 2016 goals include finalizing the first generation of marketing collateral, holding the initial public meetings, and finalizing contracts ahead of enrollment kick-off to ultimately install and connect the first solar PV systems. Throughout Q2 2016, education and awareness events will continue alongside enrollment and installations. The Partnership anticipates data generation for enrollment, generation, distribution efficiency effects, and bill credits to begin in Q2 2016.

2.0 Highlights since Previous Quarter

2.1 Major Tasks Completion

- Regulatory Filings:
  - January 4, 2016: Final Implementation Plan was filed.

- Community Engagement:
  - Initial community meetings were scheduled for April, 2016 with neighborhood leaders.
  - National Grid and Solar Liberty identified a preliminary list of neighborhood groups that could contribute to workforce development.
  - Four interested parties reached out through BNMC to express interest in becoming early adopters. They will require screening to determine eligibility.

- Internal Engagement:
  - Drafted electric pricing strategy.
  - Initiated community outreach with BNMC.
  - Developed bill credit process.
  - Developed toll free number and call management process.

- Data Evaluation, Measurement &Verification ("EM&V"):
  - Selected metering system.

- Marketing:
  - Drafted call center script and training.
  - Developed marketing collateral consisting of a door hanger, post card, and poster for the public meetings and drop-in sessions.

- Partner Work:
  - Finalized partner evaluation and selection:
    - Solar Liberty was selected as general contractor and solar PV installation partner due to their solar industry experience, their established presence in the local community, their competitive pricing for technologies and services, and their reliance on tested core solar array components.
    - The first round marketing approach was drafted with NYSERDA
  - Finalized subcontractor selection:
    - Enphase was chosen for microinverters due to capabilities and price.
    - ConnectDER was chosen for interconnection devices due to unique capabilities.
    - GE was chosen for analysis and data EM&V work.
  - Contract development.
  - Partner work scope development completed.
  - Drafting of terms and conditions for Solar Host Agreement commenced.
  - Technologies finalized.
  - 180 homes preliminarily identified by Solar Liberty as 'solar viable' based on Google Maps imagery.

2.2 Key Metrics

Key project metrics were developed based on the data needs and the proposed work scope, and the ability of the selected equipment and systems to provide the key metric data was verified. Appendix C contains the Key Metric Reporting Matrix that will be utilized, starting in Q2 2016. Q1activiites consisted primarily of establishing the proposed project framework, including partner selection. The Demonstration Project has not yet progressed to the stage of gathering residential participation and solar PV systems have not yet been installed at this early stage. Thus there is no data on the key metrics as of the end of Q1 2016.

2.3 Challenges, Changes, and Lessons Learned

Issue or Change	What was the resulting change to scope/timeline?	Strategies to resolve	Lessons Learned
Jon Nickerson named National Grid Project Lead. Dennis Elsenbeck was appointed Executive Sponsor.	No change.	N/A	N/A
Unanticipated costs: • Removal of system after 25 years will cost $1,500 per rooftop (not including inflation). • Removal and reinstallation of PV systems during the 25-year asset life will cost $5000 per rooftop (not including inflation). • Budget set aside $2,000 for roof reinforcements, roof repairs and/or electrical panel repairs. With re-roofing costs anticipated to be n in the range of$4,000-$8,000, homes requiring re-roofing will not be eligible.	• Added $1,500 per solar PV system in budget for removal. • Re-allocated$5,000 per home after year 10; $500,000 added. • Limited repair funds may limit eligible host site pool. • Fewer roofs may be eligible to be Solar Ready using the $2,000/roof budget	• Solar Liberty offered removal service at $1,500/PV system. Some of the avoided costs from technology selection can be applied toward this increased amount. • Some of the avoided costs from technology selection can be applied toward this increased amount. • Identified another feeder that serves local residences to include if participation is capped for this reason. • Re-allocate existing contractor budget to allow for removal and replacement (once during life and once at end-of-life). • Depending on the quantity of solar ready roofs, we may need to explore expanding project area to include another feeder serving nearby homes.	Solar PV array removal and replacement during system life is commonly required when re-roofing is not completed at the time of the initial solar PV installation. Roof replacements rather than repair may be required. Depending on the quantity of homes made solar ready for $2,000 or less, we may need to either request a budget increase or expand the project area to include homes located on an adjacent feeder.
Information sharing • Need information to reach the community and building trust	No change.	Establish communication platform with the community to ensure transparency, build trust, and receive continuous feedback that can be incorporated into the	Start the communication process as early as possible to obtain input from the affected community, and establish a point of contact to

		project design through community meetings.	streamline communication.
Lead time for tasks. • The solar PV system requires multiple supporting components, and the metering equipment requires 6 weeks to obtain.	First interconnection delayed four weeks from approximately early April 2016 to early May 2016.	Equipment orders will be grouped and submitted in anticipation of project participation to ensure that equipment availability does not become a limiting factor. As of the end of Q1 2016, equipment for 10 systems has been ordered for the "early adopters".	Individual component lead times will vary by provider and technologies should be selected and ordered early to accommodate any production and shipping delays.
Interoperability and communication between devices. • Technologies must be chosen for their ability to communicate.	Optimizing subcontractor selection took longer than anticipated.	Chose technologies carefully and found the lowest-cost grouping of inter-operable technologies.	Price out options as inter-operable groups. The lowest cost of each part may require additional material- at cost- to cross-communicate.

3.0 Next Quarter Forecast

The Partnership experienced various delays in Q1 2016 due to technology selection, contract discussions, and legal reviews among each stakeholder, as well questions regarding the ownership of the solar PV panels. Delays affected, most notably, the customer enrollment and solar PV installation start date. Throughout Q1 2016, internal effort in systems capabilities, billing, and marketing were conducted, and preliminary site selection and permit preparation was performed by partner Solar Liberty. The status of the checkpoints and milestones reported in the January 4, 2016 Implementation Plan is shown below:

3.1 Checkpoints/Milestone Progress

	Checkpoint/Milestone	Anticipated Start-End Date	Revised Start-End Date	Status
1	Customer/Stakeholder Outreach	Ongoing	Ongoing	
2	Commence Enrollment	12/15-03/16	04/16-09/17	
3	Partner Contracts Executed	11/15	04/16	
4	Solar Assessments	01/01/16 ongoing	05/16 ongoing	
5	Site Selection, Design, Permitting	01/01/16 ongoing		
6	Meter Installation	01/01/16 ongoing	05/16 ongoing	
7	Permitting	01/01/16 ongoing	04/16 ongoing	

8	Solar PV Installation	03/16-08/17	05/16-10/17	
9	Billing System in place	Q1 2016		
10	Recruit Local Roofers	01/16-02/16		
11	Recruit Local Solar Employees	02/16 ongoing	5/16 ongoing	
12	GE grid efficiency work	11/15-07/17	04/16 ongoing	
13	Internal Systems Capability	10/15-04/16		

Key

On-track

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

Terminated/abandoned checkpoint

1. Customer/Stakeholder Outreach.

Status:
The focus of Q1 2016 was planning and development within the community. The Partners developed draft collateral including door hangers, FAQs, posters, and a one-page information sheet to raise awareness about the Demonstration Project. The Partners coordinated to plan conversations with local community groups, informational meetings, and drop-in sessions for April to announce the project initiate enrollment, and answer questions. Partnership representatives plan to attend events to answer questions regarding general concerns, enrollment, billing changes, educational resources, workforce development, solar PV, energy efficiency, and more. The initial meeting was moved from late March to April due to the complexity of developing the customer host agreements.

Target in Q2 2016:

- Get 25 total residents to express interest in hosting a PV system.
- Hold 3 community meetings.
- Respond to 100% of calls received from the project's toll-free number.

Solutions/strategies in case of results below expectations:

If results fall below expectations, National Grid and the Partnership would hold additional community meetings, distribute additional collateral, and engage early adopters to spread word-of-mouth information.

2. Commence Enrollment.

Status: **[(Revised) 05/2016 ongoing]**
Enrollment was postponed due to delays in finalization of customer hosting agreement (which was found to be more complex than initially anticipated), homeowner access agreement, and the frequently asked questions (FAQs) document. Enrollment will begin in April 2016, the scheduled date of the first community meeting, and will continue until residents of 100 solar-ready homes have committed to being a solar PV host. Initial focus will be on a group of early

adopters with solar-ready rooftops to demonstrate project benefits and encourage familiarity/trust surrounding the Partnership.

Actuals:
No enrollment as of Q1 2016 ends in Tier I, II, or III.

Target in Q2 2016:

- 10 early adopters sign Access Agreements in April 2016.
- 5 total participants enrolled as Tier I in Q2 2016.
- 10 total participants signed up for lottery as Tier II in Q2 2016.
- 10 total participants referred to NYSERDA as Tier III in Q2 2016.

Solutions/strategies in case of results below expectations:

Similar to Stakeholder Outreach, if the participation levels are low, the strategies noted in the "Customer/Stakeholder Outreach" section, above, will be implemented. If participation levels are low due to additional factors such as solar host capability, the Partnership may consider including homes served by a nearby third feeder to expand the pool of eligible participants.

3. Partner Contracts Executed.

Status: [(Revised) 04/2016]
Delays in technology selection and legal review by all partners led to a delay in contract finalization. This collectively has led to a one-month delay in contract execution.

Actuals:
Draft contracts with Solar Liberty and with GE; draft Statement of Work ("SOW") with BNMC; and draft memorandum of understanding ("MOU") with NYSERDA were developed.

Target in Q2 2016:
All contracts will be signed by end of April 2016.

4. Solar Assessments.

Status: [(Revised) 04/19/2016 – 09/2017]
Solar PV assessments were postponed due to contract and enrollment delays, as explained above.

Actuals:
No solar PV assessments were completed in Q1 2016.

Target in Q2 2016:

- 10 solar PV assessments completed.
- 100% of solar PV assessments completed within 10 business days of National Grid receiving the completed Solar Host Agreement.

Solutions/strategies in case of results below expectations:

If the solar PV assessment quantity is low due to enrollment, the strategies noted in Section 1, above, will be implemented. If the process from the Solar Host Agreement completion to execution of solar PV assessment is greater than 10 business days, National Grid and Solar Liberty will work together to identify the problem, whether it is due to a resource shortage, lack of communication, or other issues, to construct a targeted, actionable solution.

5. Site Selection, Design, Permitting.

Status: 🟢
Solar Liberty and National Grid have overlaid boundaries of the designated neighborhood and the two feeders that serve it with aerial views to determine which roofs may be excluded due to excessive shading or sub-optimal roof orientation. When enrollment begins, the Partnership will be able to compare the interested address with preliminary information to better inform the first in-person visit.

Actuals:
177 high- and medium solar-eligible probability roofs were identified within the Fruit Belt neighborhood boundaries. Additional roofs were identified on a third feeder serving the neighboring residences in case of minimal enrollment.

6. Meter Installation.

Status: 🟡 **[(Revised) 05/2016 ongoing]**
Metering will be done in concert with the solar PV panel installation, as the metering system is built into microinverters used in the PV system equipment. Separate, independent electrical meters are no longer planned for use on this project.

Actuals:
Meters were not installed in Q1 2016.

Target in Q2 2016:
- 5 systems installed, which will include metering.
- 100% of solar PV panel arrays are connected and being metered within 10 business days of completing solar PV system installation.

Solutions/strategies in case of results below expectations:

Metering is part of the solar PV panel installation. If a solar PV panel system is not active within 10 days of installation completion, National Grid will communicate with Solar Liberty and Enphase to determine what is preventing the timely interconnection, and will then address the findings so that all subsequent PV systems are active within the 10-day time frame.

7. Permitting.

Status: 🟡 **[(Revised) 04/2016 ongoing]**
Permitting was postponed due to the delay in the equipment availability, as explained above. Materials were ordered at the end of Q1 2016 with the expectation of obtaining ten early adopter installations in 05/2016. Communication with the City of Buffalo has been ongoing to streamline the approval of these ten initial systems. Typically, the lag time for the permitting is between four and six weeks.

Actuals:
No kits or permits were completed in Q1 2016.

Target in Q2 2016:
- Permits ready for early adopters in 05/2016 – 6/2015.
- Permit filing for all interested parties to be occurring within 5 days of a roof being deemed solar- ready.

Solutions/strategies in case of results below expectations:

As Q2 2016 progresses, attention will be paid to the enrollment and approval of Tier I participants. From the rate of participation, optimal equipment quantities can be determined to enable ordering equipment such that it is available in a timely manner. This will minimize installation delays due to equipment unavailability. Permitting lag time will depend on the City of Buffalo, but maintaining communication regarding rate of enrollment will be helpful in the City anticipating workload.

8. Solar Installation.

Status: [(Revised) 05/2016-10/2017]
Solar installation was postponed due to all aforementioned delays. As of Q1 2016, early adopters were identified, community meetings and drop-ins were scheduled, equipment for the first ten systems was ordered, and initial site selection via aerial photos was completed in order to begin installations May 2016. Installations will continue throughout Q2 2016.

Actuals:
No rooftop solar PV systems were installed in Q1 2016.

Target in Q2 2016:
- 2 rooftop solar PV systems installed.

Solutions/strategies in case of results below expectations:

The Partnership will identify the specific problems in the process to identify actionable, timely solutions. Communication and transparency will be essential in this process.

9. Billing System in Place.

Status:
Internal development was completed in Q1 2016 to accommodate bill credits as an extra line item on Tier I and Tier II participants' electric utility bills. Initial credits will be applied manually if the automated system is not fully prepared, but National Grid has confirmed with the Billing department that there is capacity to do so as early as April 2016.

10. Recruit Local Roofers.

Status:
The Partnership has been in contact with Buffalo roofing companies throughout Q1 2016. Solar Liberty will work with local roofing contractors to approve roof conditions during the on-site rooftop assessment. As necessary, roofers will develop cost estimates for roof repairs to determine if some meet the $2,000-or-less repair threshold for Tier I eligibility. Solar Liberty already retains electrical contractors for any related electric panel work and carpentry contractors for any needed roof reinforcement work.

11. Recruit Local Solar Employees.

Status: [(Revised) 05/2016 - Ongoing]
Solar Liberty has committed to hiring five new permanent employees as part of the workforce development of this project. The job positions may be in solar installations, sales, or any other part of Solar Liberty's Buffalo operation. As project enrollment gets underway, the areas of

additional need will become more apparent. National Grid and Solar Liberty have worked with BNMC throughout Q1 2016 to identify community groups to help recruitment.

Target in Q2 2016:

- One job position identified and posted.

Solutions/strategies in case of results below expectations:

Workforce development timeline is uncertain due to uncertainty of where the staffing needs will lie. Community groups will be a large part of the recruitment process, and Solar Liberty, National Grid, and the BNMC will keep communication to identify qualified individuals as soon as staffing quantity and skill needs are confirmed.

12. GE Grid Efficiency Work.

Status: **[(Revised) 04/2016 ongoing]**
GE grid efficiency work was delayed due to delays in contract finalization and solar/meter installations. Contracts will be finalized April 2016 and when early adopters' solar PV systems are interconnected, data will be created and monitored. From there, GE will collect, track, and monitor effects of concentrated PV solar on the larger distribution grid. The work scope includes feeder modeling and simulation, controls integration, and grid testing.

13. Internal Systems Capability.

Status:
The billing system has been put into place along with the toll-free number. In Q2 2016, additional efforts will address grid monitoring and will include substation metering, and the aforementioned work with GE.

4.0 Work Plan & Budget Review

4.1 Updated Work Plan

The overall work scope and work plan remain unchanged. The timeline has changed due to the delays previously mentioned.

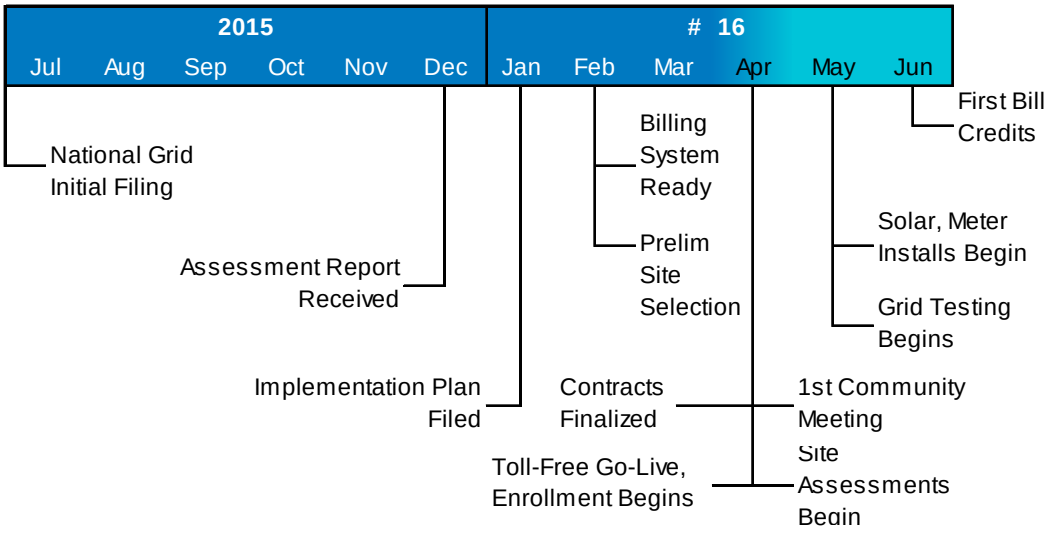


Figure 4.1 – Updated Timeline

4.2 Updated Budget

The updated project budget is presented below:

Task	Budget	Quarterly Spend	Spend to Date	Expected Completion	Variance
Operational Expenditures					
General Administration and Planning	$ 455,000	$2,875	$2,875	$ 455,000	$ -
Marketing and Community Engagement	$ 125,000	$4,171	$4,171	$ 125,000	$ -
Incentives	$ -	$ -	$ -	$ -	$ -
Implementation	$ 1,389,375	$ -	$ -	$ 1,389,375	$ -
Evaluation & Analysis	$ 300,000	$ -	$ -	$ 300,000	$ -
Totals:	**$ 2,269,375**	**$ 7,046**	**$ 7,046**	**$ 2,269,375**	**$ -**
Capital Expenditures					
100 Solar PV Systems	$ 1,023,000	$ -	$ -	$ 1,023,000	$ -
Totals:	**$ 1,023,000**	**$ -**	**$ -**	**$ 1,023,000**	**$ -**
Project Totals:	**$ 3,292,375**	**$ 7,046**	**$ 7,046**	**$ 3,292,375**	**$ -**

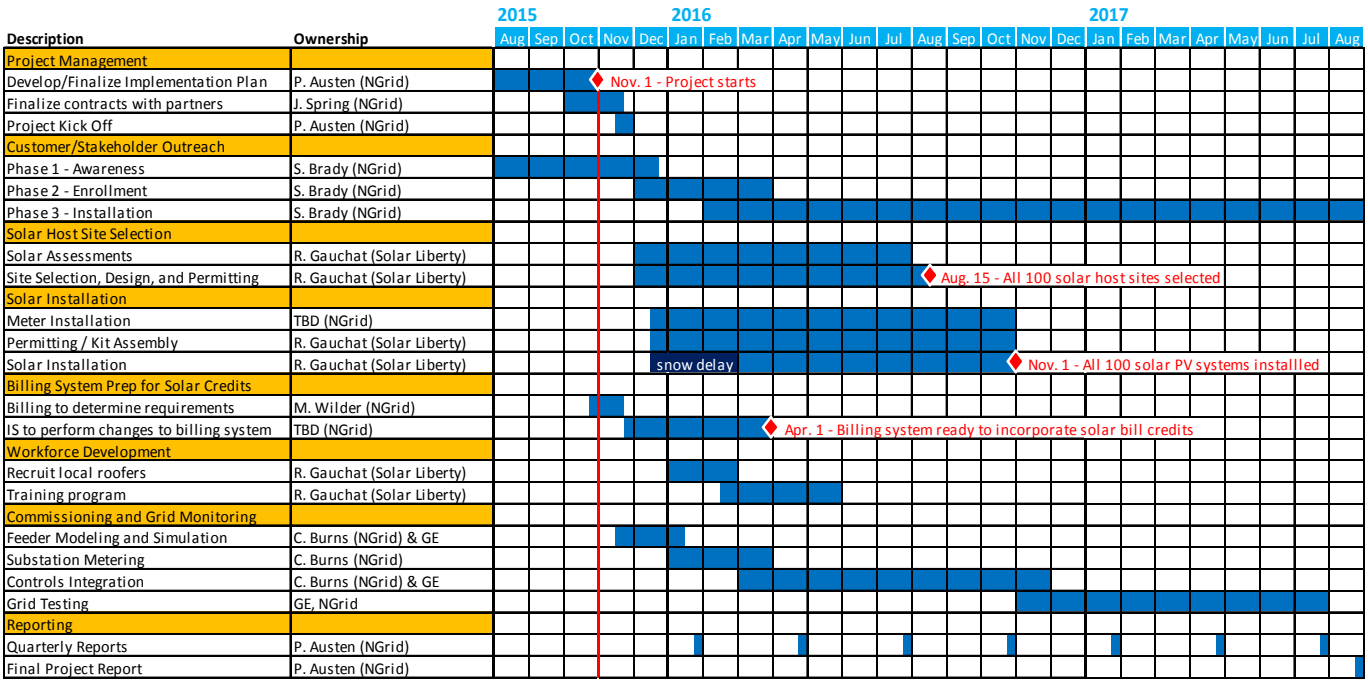
The final equipment vendors selected result in a lower project material cost. The additional cost of the solar PV panel removal and re-installation during any future roof repairs/replacements, as well as the cost of removing the solar PV panels after 25 years of service, will be derived from re-allocating some funds originally budgeted for the more expensive vendors that we initially planned on using. Therefore, we are not seeking to increase the project budget to address future solar panel removal/replacement or final solar panel removal.

5.0 Progress Metrics

Selected metrics will be tracked quarterly and represented with info graphics here (please refer to attached Appendix C). This reporting is not included in the present Q1 2016 report as this report is the first in this series.

Appendices

Appendix A: Former Gantt Chart



Description	Ownership
Project Management	
Develop/Finalize Implementation Plan	P. Austen (NGrid)
Finalize contracts with partners	J. Spring (NGrid)
Project Kick Off	P. Austen (NGrid)
Customer/Stakeholder Outreach	
Phase 1 - Awareness	S. Brady (NGrid)
Phase 2 - Enrollment	S. Brady (NGrid)
Phase 3 - Installation	S. Brady (NGrid)
Solar Host Site Selection	
Solar Assessments	R. Gauchat (Solar Liberty)
Site Selection, Design, and Permitting	R. Gauchat (Solar Liberty)
Solar Installation	
Meter Installation	TBD (NGrid)
Permitting / Kit Assembly	R. Gauchat (Solar Liberty)
Solar Installation	R. Gauchat (Solar Liberty)
Billing System Prep for Solar Credits	
Billing to determine requirements	M. Wilder (NGrid)
IS to perform changes to billing system	TBD (NGrid)
Workforce Development	
Recruit local roofers	R. Gauchat (Solar Liberty)
Training program	R. Gauchat (Solar Liberty)
Commissioning and Grid Monitoring	
Feeder Modeling and Simulation	C. Burns (NGrid) & GE
Substation Metering	C. Burns (NGrid)
Controls Integration	C. Burns (NGrid) & GE
Grid Testing	GE, NGrid
Reporting	
Quarterly Reports	P. Austen (NGrid)
Final Project Report	P. Austen (NGrid)

Table A.1 – Former Gantt Chart

Appendix B: Updated Gantt Chart

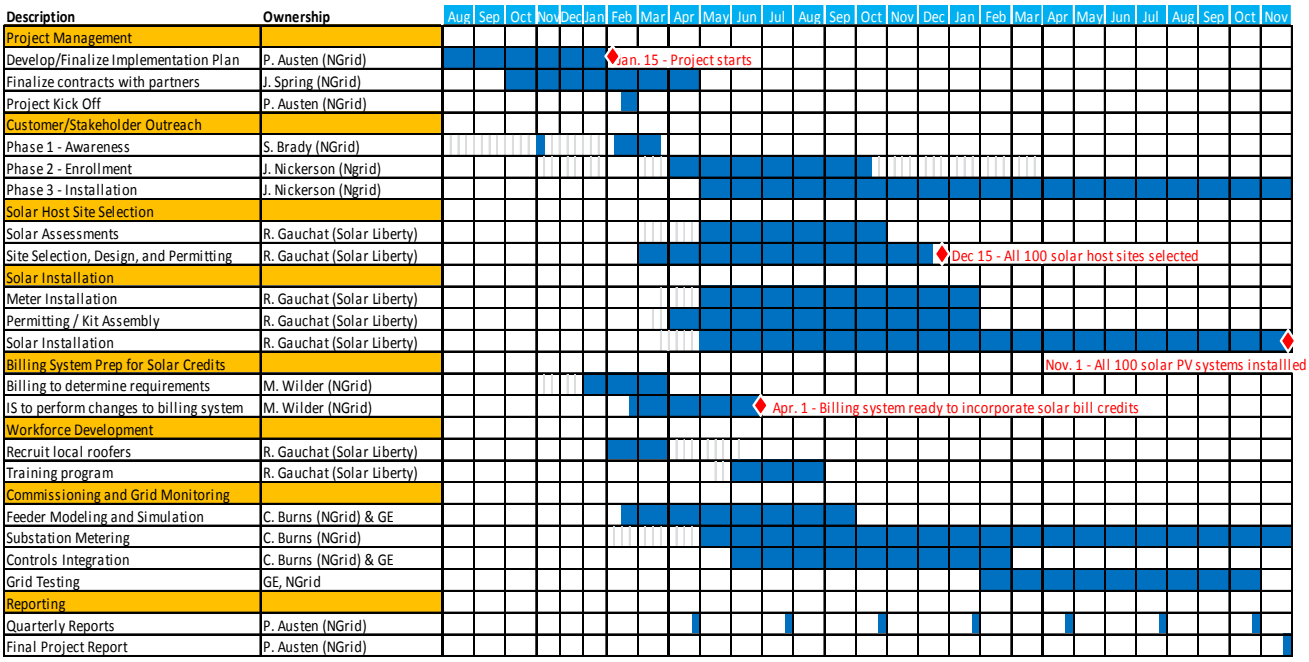


Table B.1 – Updated Gantt Chart

Appendix C: Metric Tracking

	Customer Tier			Solar Installation Progress						Generation and Credits					Outreach
Quarter	Tier 1 Sign Up	Tier 2 Sign up	Tier 3 Sign up	Program Eligibility Eval	Roof Assess-ment	Structural Assess-ment	Electrical Assess-ment	Rootop Systems Installed	Systems Con-nected	kW on-line	kWh gener-ated	Credits Gener-ated [$]	Credit recip-ients [#]	Credit/ recipient [$]	Toll Free Calls Received
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table C.1 – Metric Tracking table

Appendix D: Draft Marketing Collateral

Figure D.1 – Postcard for Public Meeting Announcement

Figure D.2 – Public Meeting Announcement Door Hanger

Figure D.3 – Public Meeting Poster