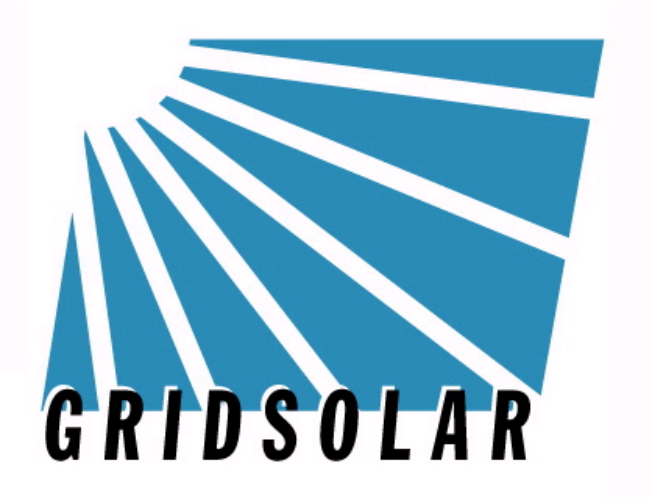
INTERIM REPORT
BOOTHBAY SUB-REGION SMART GRID RELIABILITY PILOT PROJECT

Prepared by
GridSolar, LLC



for

Docket No. 2011-138
CENTRAL MAINE POWER Request for Approval of Non-Transmission Alternative (NTA) Pilot Project for the Mid-Coast and Portland Areas

March 4, 2014

I. EXECUTIVE SUMMARY

Over the last decade, the Public Utilities Commission has been repeatedly confronted with the question of whether deployment of smart grid technologies, known as non-transmission alternatives (NTAs), can solve electric grid reliability needs at lower cost and with less pollution than new transmission lines or transmission system upgrades. In 2012, the Commission established the Boothbay Smart Grid Reliability Pilot project (Pilot) to test the NTA hypothesis.

The specific Pilot project design sought to reliability reduce transmission load by 2 megawatts (MW) in the Boothbay sub-region of Central Maine Power Company's (CMP or Company) electric grid in order to avoid the need for an estimated $18 million rebuild of the 34.5 kV electric line from Newcastle to Boothbay Harbor. In addition, the Pilot sought to discover the availability and pricing of a full range of NTAs in Maine, operational characteristics and limitations, and whether NTA's could be used at scale in other regions of the CMP and Emera Maine grids in Maine.

Pursuant to Commission Order, GridSolar, LLC (GridSolar) was designated as the project coordinator, and GridSolar and CMP jointly developed operations, measurement and verification plans, which established applicable NTA eligibility requirements and performance criteria, communications and operations protocols, legal and payment provisions, and procedures to validate and report on results.

In 2012 and 2013, GridSolar issued two Requests for Proposals, both of which exceeded bid targets (reduced to 1.8 MW) and included a full range of NTA resources, including efficiency, PV Solar, demand response, back up generation, and energy storage.[1] Of the accepted bids, approximately 400 kW has been deployed and is operational, 789 kW is under contract and construction is complete or near complete, and 189 kW is in contract negotiations. An additional 500kW (back up generator) is operational but is awaiting final interconnection approval from CMP.

GridSolar has developed a secure digital communications network to monitor passive NTA resources (efficiency and PV Solar) and to dispatch and control active NTA resources (generators, storage, demand response). The system is partially deployed and is being expanded as additional NTA resources come on line. Additionally, GridSolar is about to begin initial testing the dispatch command interface with CMP, which will include paper scenarios followed by live test events.

Based on the RFP results, the Pilot has already demonstrated that a wide range of NTA solutions are available in Maine at reasonable cost that can meet reliability requirements and which are both scalable and replicable in other areas of the CMP and Emera Maine electric grids. All NTAs bid – individually, by category, and in aggregate – could meet reliability needs in the pilot area for less than the transmission only solution. The net cost of the accepted NTAs, together with administrative and operational

[1] Only one NTA resource category – dynamic pricing – was lacking from the Pilot, but this is primarily due to limitations in the metering and billing infrastructure for this region of CMP's electric grid.

[2] The 2 MW load reduction target is not a static figure; rather it represents CMP's estimate of the amount of load reduction (or in-region generation) that would be necessary to avoid voltage or thermal violations in the Boothbay

expenses, is projected to be approximately one-third of the cost of building a new power line and will save ratepayers approximately $17.6 million over the 10 year project life. Even if the Pilot was terminated early (the worst case scenario), it would result in net savings of $2.5 million (3 years) to $10.5 million (6 years).

The NTA solution is also projected to result in net reductions in energy use, lower emissions and reductions in fossil fuel consumption. Additionally, the NTAs will result in enhanced consumer choice and cost savings for participating businesses and home owners.

While the Pilot is not yet complete and will continue to provide further valuable information, recent amendments to Maine law have already answered one of the key questions of the Pilot – should NTA program be expanded. Pursuant to Maine's new transmission planning requirements, the Commission now must evaluate NTA solutions for all new transmission lines or transmission projects/upgrades, and must give preference to non-transmission alternatives where NTAs will lower costs and reduce emissions. 35-A M.R.S.A. §§ 3132, 3132-A. The Pilot results support this new law and will help inform the NTA analysis for future projects, by providing actual data on costs, performance, and necessary operational protocols and standards.

The Pilot has also demonstrated, however, that to successfully and continually meet grid reliability requirements, NTA solutions require intensive up-front coordination, a dedicated communications and dispatch infrastructure, and ongoing administrative support and oversight. The operational capacity gained from the Pilot has been designed to be both modular and scalable. It is working well in Boothbay, will be further refined and improved, and is available to advance NTA solutions and other smart grid functions elsewhere in Maine.

II. PILOT PROJECT DESIGN

On April 30, 2012, the Commission approved the Boothbay Smart Grid Reliability Pilot Project (Pilot) to evaluate the ability of non-transmission alternatives to solve electric grid reliability constraints that would otherwise require construction of new power lines and/or other distribution and transmission system upgrades. *CENTRAL MAINE POWER Request for Approval of Non-Transmission Alternative (NTA) Pilot Project for the Mid-Coast and Portland Areas*, Docket No. 2011-138, Order Approving Stipulation (April 30, 2012) (hereinafter as "*Order*"). The Pilot sought to test the ability of NTAs to reliability reduce load by 2 MW in the Boothbay sub-region of CMP's electric grid in order to avoid the need for an estimated $18 million rebuild of the 34.5 kV electric line from Newcastle to Boothbay Harbor.[2]

In addition, the Pilot Project was also designed and approved to advance the goals and policies of the Maine Smart Grid Policy Act, 35-A M.R.S.A. § 3143, and to help answer four more general questions:

[2] The 2 MW load reduction target is not a static figure; rather it represents CMP's estimate of the amount of load reduction (or in-region generation) that would be necessary to avoid voltage or thermal violations in the Boothbay sub-region at a system-wide peak load level of 2,000 MW.

a. Whether and what type of NTAs can be acquired at reasonable cost to meet grid reliability requirements;

b. Whether and the best means by which the new Advanced Metering systems being deployed by CMP can provide the information and communications requirements to support NTA solutions to grid reliability issues

c. Whether NTAs are capable of responding in the manner necessary to provide grid reliability service to CMP;

d. Whether the results of this Pilot Project can be scaled to meet the grid reliability requirements of other regions of the CMP and BHE networks in Maine.

Order at 9.

The Commission designated GridSolar as the Pilot Project Coordinator and directed GridSolar to solicit NTA proposals using a competitive bidding process. Consistent with § 3143 and the Pilot project purposes, the *Order* required GridSolar to select and recommend contracts for Commission approval based upon a balancing of the cost, reliability and diversity of NTA resources. To the extent feasible, GridSolar was directed to include a minimum of 250 kW of NTA resources in each of the following categories: energy efficiency, demand response, renewable distributed generation (at least half of which should be photovoltaic solar energy) and non-renewable distributed generation (with preference given to resources with no net emissions of greenhouse gasses).

Upon approval of the submitted NTA contracts by the Commission, the Order directed GridSolar to operate the project in a manner consistent with the *NTA Pilot Project for Boothbay Sub-Region of Mid-Coast Region, Operating Plan, Budget and Schedule* (*NTA Pilot Plan*) submitted jointly by GridSolar and CMP. The *NTA Pilot Plan* separated the three-year phase one of the project into three concurrent and overlapping tasks: (1) the competitive bidding and NTA contracting process, (2) development and implementation of the GridSolar communications and dispatch center, and (3) measurement, verification and reporting. The Order also directed GridSolar and CMP to pre-file a Measurement and Verification Plan (*M&V Plan*) defining how GridSolar and CMP will measure and verify the successes and failures of the Pilot plan in meeting objectives.[3]

Consistent with the *NTA Pilot Plan* and the revised *M&V Plan*, this report provides an interim summary and progress report on each of these tasks through January 31, 2014.

[3] The M&V Plan (and underlying process), as revised, has been submitted to and accepted by the Commission. *See GridSolar – Boothbay Smart Grid Reliability Pilot Project Measurement and Verification Plan* (Sept. 20, 2013), Docket No. 2011-138.

III. TASK ONE: COMPETITIVE BIDDING AND NTA CONTRACTING.

Task One involved several preparatory steps, including modification and approval of the GridSolar/CMP contract to provide for GridSolar's role as the Pilot Project Coordinator, filing of the *M&V Plan*, and development of the RFP packet. At the same time, working together with CMP, GridSolar delineated the project location for geographic eligibility, which includes grid-tied NTA resources located on circuits supplied by CMP Line 23, a 34.5 kV feed that originates in Edgecomb and terminates in Boothbay. This includes all of the towns of Boothbay Harbor and Southport, and about two thirds of the town of Boothbay. *See* Figure 1.

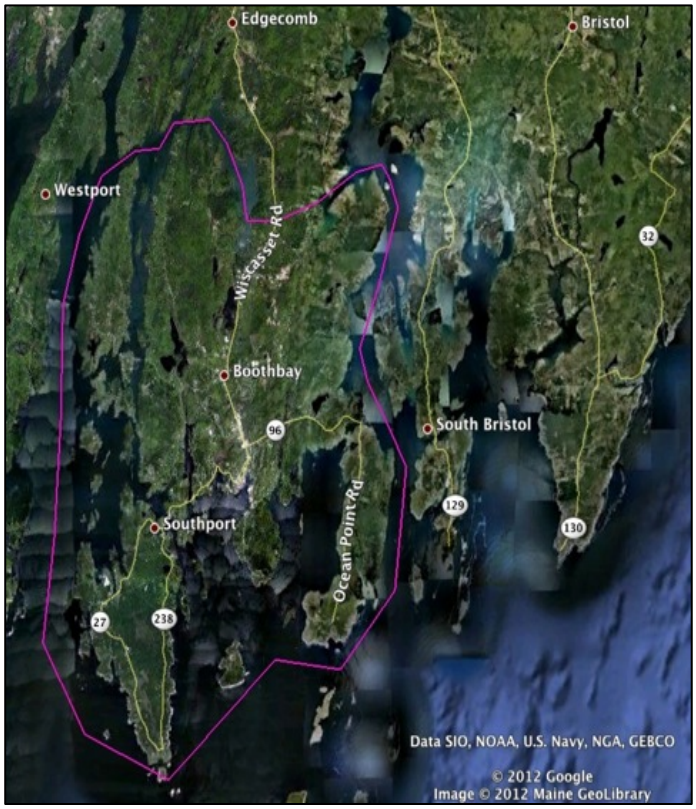


Figure 1: Map of Boothbay Smart Grid Pilot Project Area.

The RFP packet, which was circulated for review and comment by the Parties and the Commission during the summer of 2012, included the following:

- Operations, performance, communications and M&V protocols for NTA providers;
- Draft RFP;
- Draft NTA contract and terms;
- RFP selection criteria and timeline; and
- An RFP outreach plan.

To ensure adequate participation in the RFP, prior to issuance GridSolar worked with the Efficiency Maine Trust and others to develop and contact a list of potential NTA providers in Maine, including all known PV solar installers, energy efficiency companies and auditors, companies that sell and service electrical generators, battery storage providers, and other potential participants. Information about the project was posted on the GridSolar website and released to both the national industry press and to statewide and local media outlets – most of which covered the story. GridSolar placed paid advertisements with the Boothbay newspaper (print and online editions) and, working in coordination with the Boothbay Chamber of Commerce, sent notices about the project to all chamber members (approximately 330 local businesses), and held a well-advertised public information session in Boothbay.

A. The Market Response to the Requests for NTA Proposals.

The Pilot project area – the towns of Boothbay, Boothbay Harbor and Southport – consists primarily of small commercial seasonal businesses, residential and vacation communities, with minimal industrial activity and virtually no commercial office space. Moreover, the Pilot is the first of its kind in Maine and the NTA energy services industry is still just emerging in our state. Yet, despite these obstacles and limited opportunities, the response to the RFP was vigorous. GridSolar issued the RFP in two rounds. Each solicited in response more than double the total NTA Resources needed to meet the grid reliability requirements established by CMP's needs assessment, and each time the full suite of resources targeted by the Pilot design for testing were represented.

RFP I, issued in September, 2012, received a total of 12 bids from 6 separate NTA resource providers totaling almost 4.5 MWs in five NTA resource categories, including Solar PV, Efficiency, Demand Response, Battery Storage and Back-Up Generation. (Ex. 1.) After GridSolar's recommended bid selection was finalized, the 1 MW Maine Micro Grid offer was withdrawn due to its inability to secure financing support.[4] To provide adequate interim reliability, the Commission directed GridSolar to install a temporary 500 kW back up diesel generator and to issue a second RFP. *CENTRAL MAINE POWER Request for Approval of Non-Transmission Alternative (NTA) Pilot Project for the Mid-Coast and Portland Areas*, Docket No. 2011-138, Order Approving RFP I (May 28, 2013).

RFP II, issued in May 2013, received a total of 22 bids from 10 separate NTA resource providers totaling just over 4 MWs in five NTA resources categories: Solar PV, Efficiency, Demand Response, Battery Storage, and Back-Up Generation. (Ex. 2.) In addition, the property owner hosting the 500 kW temporary BUG submitted a bid to take over operation of the BUG for the duration of the Pilot.

The RFPs have provided valuable new and detailed information regarding the availability and cost of NTAs in Maine. All bids submitted for both RFPs met the established eligibility criteria and, individually and in the aggregate, and were more cost effective than the transmission solution. (*See* Ex. 3., summarizing results for each RFP by NTA resource category, including prices for each phase of the project (Years 1-3, Years 4-10) and the levelized 10 to 20 year costs.)

Notably, in the response to the second RFP, the number of bids received and NTA resource providers went up, while the price for all NTA resources went down except energy efficiency – which was expected, since the lowest cost efficiency opportunities (lighting) were developed first. Yet even energy efficiency is continuing to improve and diversify as an NTA resource. Efficiency Maine Trust reports continuing demand for additional lighting retrofits at the RFP I price, and the second level efficiency resource (heat pump air conditioning) is still the lowest cost of all the RFP II NTA resources. (Figure 2.)

[4] Main Micro Grid subsequently explained that the offered 3 year NTA contract (with option to extend to 10 years if approved by the Commission) could not provide investors with certainty that the required 6-year holding period for the federal Investment Tax Credit incentive would be satisfied.

The NTA resources bid into each of the RFPs are all scalable and could be easily expanded were the reliability target larger. The BUG and Battery Storage resources are single unit facilities that, for the same price, could be duplicated multiple times within the Pilot project region with relatively little additional effort. So also could the Ice Bear demand response units (which average 6-8 kW per unit). Similarly, Efficiency Maine Trust ("EMT"), which bid and provided the energy efficiency NTAs under RFP I, has indicated to GridSolar that it could easily have secured much more efficiency had the design of the RFP permitted a more flexible bid response and longer duration commitment. For Solar PV systems, the amount bid represents a small fraction (well below 1%) of the total rooftop area in the region, and this does not include solar PV that could be developed on brown-field or green-field sites. Overall, none of the NTAs resources bid into either RFP I or RFP II are limited to development in the Boothbay region; nor are they uniquely specific to the reliability issues on CMP's distribution system in that region. Rather, the scale and scope of all of the NTAs are expandable to virtually any level of required capacity, and are applicable to other regions of the Maine electric grid.

These results answer the first question posed by the pilot and demonstrate that a wide range of NTA resources categories are available in the marketplace in Maine at a reasonable cost to meet grid reliability requirements.

10 year Levelized Cost	RFP I			RFP II			Price Difference	Net Price
	Bids	Capacity	$/kW Month	Bids	Capacity	$/kW Month		
Efficiency	2	156	$8.14	5	235	$16.60	104%	$13.22
PV Solar*	7	489	$24.86	8	456	$21.57	-13%	$23.28
BUG	1	100	$130.00	2	600	$44.95	-65%	$57.10
DR	1	250	$66.50	1	250	$57.65	-13%	$62.07
Battery**	5	3500	$76.18	6	2500	$72.83	-4%	$74.78
Total Available	**16**	**4496**	**$68.89**	**22**	**4041**	**$58.69**	**-15%**	**$64.06**

* Levelized Cost of Solar 20 years, 8% Discount Rate used for all resources

** Only the largest battery bid by each provider is included

Figure 2: Price Comparison of All Bids Received, RFP I & II.

B. Evaluation and Selection of NTAs.

Following each RFP, GridSolar submitted for review by the Parties and the Commission an evaluation of each bid together with GridSolar's recommendation of which NTA resources to accept, balancing cost, reliability (performance), diversity and emissions, while, in keeping with the Pilot purposes, ensuring a minimum of 250 kw each of conservation and efficiency, demand response, renewable distributed generation, and back up generation. Each criterion is explained below.

1. Cost. Because the Pilot project's initial duration is substantially shorter than the useful life of the NTA resources, GridSolar measured costs in two ways: (1) on an annual revenue requirement basis, and (2) on an expected life levelized equivalent cost per kW-month for the full 10 year extended Pilot term. The first computes the revenue requirement for each NTA resource as the Capacity Rating multiplied by the bid price each year. The second computes the

net present value of the annual bid prices over the expected 10-year project life (20 for solar) at an 8% discount rate and calculated the amount per kW-month, which, if held constant over the expected life, would result in the same net present value.[5]

2. Reliability. To evaluate reliability, GridSolar has developed initial capacity ratings for each NTA resource category applicable to Maine conditions, and provided a methodology for adjustments based on periodic inspections and performance audits. *See* GridSolar, *Boothbay Smart Grid Reliability Pilot Project Measurement and Verification Plan*. (revised Sept. 20, 2013). In addition, for RFP II, GridSolar adjusted downward the expected total capacity of those PV Solar bids without firm development contracts.

3. Diversity. In terms of diversity of resources, GridSolar found that batteries were almost four times more expensive than fossil fuel fired generators and provided no significant reliability advantage. Nevertheless, GridSolar recommended inclusion of the least cost battery option so as to meet the Pilot Project purposes of demonstrating each technology under actual conditions.

4. GHG Emissions. The GHG emission criterion for fossil fuel fired generators has not yet been invoked, since only diesel fueled non-renewable BUGs have been bid[6] (no unbundled propane-fired BUGs were proposed). To the extent this criterion is also relevant to storage NTAs, GridSolar has not yet been able to establish a verifiable reduction in GHG emissions from the battery NTAs as compared to the diesel BUG. Rather, it is likely that there is little difference, if any, in the emissions related to daily battery cycling (equal to emissions at ISO-NE off-peak marginal emission rate from charging events, including line losses, minus avoided emissions at on-peak rates), as compared to potential emissions that would occur from less frequent operation of the new EPA tier-4 emissions compliant diesel BUG.[7] Regardless, in keeping with the diversity criterion, GridSolar selected one each of the smallest Battery and BUG proposals submitted.

After eliminating the high bids, the net results are as shown in in Figure 3. Additionally, copies of GridSolar's complete recommendations for each RFP are provided in Exhibits 1 & 2 .

[5] Each RFP had one bundled bid for multiple technologies, but because the bundled bid was withdrawn in the first RFP and because it was the excluded high bid in the second RFP, it was never necessary to try to unbundle the cost of each component.

[6] The 500 kW diesel BUG was added to the project at the Commission's directive after the Maine Micro Grid proposal, which did include a 100 kW propane-fired BUG as part of a bundled BUG-Solar-Battery-Demand Response bid, was withdrawn.

[7] The Cat-5 diesel BUG engine is the same as that in a typical back-hoe, front end loader or dump truck used in excavation and construction. Thus, is highly likely that, just comparing hourly emissions, use of the diesel BUG for the extended life of the Boothbay Pilot would be substantially less that the total emissions from just the construction phase of a new power line – without even accounting for the emissions rate associated with generation of electricity transmitted on the new line.

Recommended NTA Resources, by Capacity (kW) and Price ($/kW Month)						Weighted 3 Year Price	Weighted 10 Yr. (Levelized) Price
	RFP I*	RFP II	Totals	Pct.	Units		
Efficiency	237.00	111.25	348.25	19%	7	$23.51	$10.47
Solar	168.83	106.77	275.60	15%	14	$46.05	$13.19
BUG (same)	500.00	500.00	500.00	27%	1	$17.42	$20.63
Demand Response	0.00	250.00	250.00	13%	1	$110.00	$57.65
Battery	0.00	500.00	500.00	27%	1	$163.70	$75.99
Total	905.83	1468.02	1873.85		24		

* RFP I excludes Maine Micro Grid project; Efficiency increased to reflect EMT contract option.

Figure 3: Combined RFP I & II Selected NTA Resources.

C. Contracting and Implementation.

For each RFP, review of GridSolar's recommendations by the Parties, staff and the Commission did not result in any changes to the selection methodology or selections. Accordingly, after this review, GridSolar began the process of negotiating final contracts with each NTA resource and submitting those contracts for Commission approval.

For RFP I, all contracts have been approved by the Commission or staff. Due to the popularity of its commercial lighting program, EMT exercised a contractual option and its installed capacity has exceeded bid targets by approximately 32% (75 kW, to date). For PV Solar, all but one Solar PV NTA (40 kW) are installed and fully operational. Regardless, because a portion of the withdrawn Maine Micro Grid proposal allocated to the Town of Boothbay (approx. 76 kW), was revived as a stand alone project,[8] PV Solar also outperformed initial targets. Only the temporary back up generator is still pending. The BUG was permitted and installed early last fall and is currently undergoing the interconnection approval process with CMP. (See further discussion in Section IV.C, below.)

For RFP II, the contract negotiation process is ongoing, with 3 contracts for 755 kW of recommended NTA resources approved to date. As the remaining contracts are finalized, they will be provided for Commission review and approval. GridSolar expects contracts for all of the non-PV Solar NTA resources to be finalized and that construction will be completed and each NTA will be brought online by the June 1, 2014 deadline. For the PV Solar NTAs, we expect that most but not all of the projected RFP II capacity will be contracted, built and online by the deadline. This reflects the fact that the NTA price for the PV Solar resources is likely at or just under the tipping point needed by solar providers to spur investment by consumers – particularly for the small seasonal businesses typical of the Boothbay peninsula. Since the total capacity across the remaining PV Solar bidders is small, any reduction in PV Solar NTA capacity will either be made up by increases in efficiency capacity (or PV Solar resources from RFP I) or will be small enough so as not to create any future reliability issues for the grid.

[8] Approved by Order dated July 25, 2013.

The contract and construction status of each NTA is provided in the Boothbay Reliability Smart Grid Pilot project digital inventory attached as Exhibit 4. A summary by NTA resource category and status is provided in Figure 4, below.

NTA Resource Status – 2/5/14	RFP I			RFP II		
	Units	Nameplate (kW)	Capacity (kW)	Units	Nameplate (kW)	Capacity (kW)
Efficiency						
Recommended				5	218.64	94.94
Contracted						
Operational	1	220	232.78			
Efficiency Totals	**1**	**220**	**232.78**	**5**	**218.64**	**94.94**
PV Solar						
Recommended				6	280.1	102.6
Contracted	1	39.84	39.84			
Operational	6	238.35	170.41	1	5	3.79
PV Solar Totals	**7**	**278.19**	**210.25**	**7**	**285.1**	**106.39**
BUG						
Recommended		(see RFP – II)		1	500	500
BUG Totals				**1**	**500**	**500**
DR						
Contracted				1	250	250
DR Totals				**1**	**250**	**250**
Battery						
Contracted				1	500	500
Battery Totals				**1**	**500**	**500**
Recommended Totals	**0**	**0**	**0**	**12**	**998.74**	**697.54**
Contracted Totals	**1**	**39.84**	**39.84**	**2**	**750**	**750**
Operational Totals	**7**	**458.35**	**403.19**	**1**	**5**	**3.79**
Totals	**8**	**498.19**	**443.03**	**15**	**1753.74**	**1451.33**

Figure 4: Current Status, by NTA Resource Category.

IV. TASK TWO: DEPLOYMENT OF THE GRIDSOLAR SMART GRID OPERATIONS CENTER

A. Background

GridSolar has worked closely with CMP to develop the communications requirements and protocols needed to enable the NTA resources participating in the Boothbay Pilot project to fully meet all applicable grid reliability performance criteria. Certain of the NTA resources are "passive" in nature and will operate based on conditions specific to their circumstances. These include energy efficiency measures and solar PV systems. These NTA resources are always in the "on" position and will deliver grid reliability benefits to the extent that they are operating during the time of need. These passive NTA resources do not require communications for dispatch purposes, but only for measurement and verification.

Other types of NTA resources are "active" and need to be turned "on" when dispatched in order to provide grid reliability benefits. These include battery storage, BUGs and demand response resources. Each of these units must accommodate two-way communications between GridSolar and the NTA resource to permit GridSolar to send dispatch instructions (or to remotely control the NTA resource) and to monitor compliance with and performance in response to those instructions. As a general matter, two-way communications capability is integrated into most active NTA resources. BUGs and battery storage systems are usually designed to enable remote dispatch and monitoring by third-parties, and where they do not have this capability, they can be easily retrofitted. The BUG and battery storage installations under the Boothbay Pilot will have such capabilities.

Demand response resources represent a much broader array of NTA resource types, ranging from devices that shift loads to off-peak periods, to devices that cycle loads on and off, to actions that simply curtail electricity usage. The demand response industry, represented by firms such as EnerNOC, has demonstrated that these resources can be utilized to respond to grid reliability conditions and with a very high degree of reliability. In certain cases control over the resources is given to a third-party (e.g.., EnerNOC, Comverge)[9], which dispatches the NTA based on directions from the system operator. In other cases, control remains with the demand response resource and that owner responds to commands from the third-party. Ice Energy's Ice Bear units that are being deployed for the Boothbay Pilot project are equipped with internet-based communication systems that permit remote control, operation and monitoring by both Ice Energy and GridSolar.

In addition to the ability of GridSolar to communicate with the NTA resources, GridSolar and CMP must be able to communicate directly with each other so that CMP (i) knows at any time how much active NTA resource capacity is available to be dispatched against loads in the Boothbay Pilot region, (ii) can direct GridSolar to dispatch a specified amount of NTA resource capacity for a specified period, and (iii) can verify whether or not such capacity is actually dispatched and operating to reduce loads in the Boothbay Pilot region.

B. GridSolar Operations, Monitoring and Dispatch Network

To meet the above requirements, GridSolar has built a secure and dedicated wide area SCADA (supervisory control and data acquisition) communications network. SCADA systems are in widespread use throughout the electric grid in Maine and elsewhere, and increasingly are being used as the backbone of smart grid applications throughout the country. GridSolar's SCADA network will transmit real-time information, two-way communications, and operational commands between the GridSolar operations center in Portland and each active NTA resource participating in the Boothbay Pilot. For the BUG, the system includes both a wired port-to-port static IP connection between the GridSolar Operations Center and the generator, and a wireless (cellular) VPN backup connection. Onsite, the BUG

[9] See http://www.enernoc.com and http://www.comverge.com.

has electronic remote control capabilities that are fully compliant with CMP interconnection requirements, and which include real-time monitoring, remote on/off switching, five minute delayed start (per CMP interconnection requirements), instantaneous off in the event of grid failure, and system protection (anti-islanding). The battery and demand response NTAs have comparable systems, which use the NTA providers' proprietary network, controls, command interface software and data logging and reporting architecture.

To operate the network, GridSolar has developed a Command Interface system using the model view control software design pattern, which at this stage divides the NTA command environment by region, substation, and circuit. This design is both scalable and modular, meaning that the system can be expanded to include additional regions, counties or utility service territories and, at the same time, can be operated so that any given module (e.g. a specific circuit) can be precisely deployed to meet that circuit's specific real-time reliability needs. Command decision making is structured so that a CMP employee can log-in remotely and input either scheduled or emergency NTA parameters, including date, time, load, duration and location(s). The system will notify via alarm the GridSolar 24x7 employee and meanwhile, using GridSolar-programmed algorithms, it will define a dispatch order for needed NTA resources (including units, load, and duration) and provide an automated signal to each assigned NTA resource. The system will also provide for failsafe backup calls to each resource (via email and telephone). GridSolar will conduct and record real-time monitoring of NTA status throughout each test or reliability event.

All actions and results will be logged and recorded, so that GridSolar and CMP can debug and debrief after each event. System monitoring and verification will also include real-time monitoring of passive PV Solar NTA resources over 25kW and after-the-fact verification (via monthly reports) for smaller PV Solar resources and efficiency resources. Additionally, pursuant to the Commission's May 28, 2012 Order, GridSolar has requested that CMP provide 2012 peak load levels on the critical buses in the region as a baseline, and then for each test or reliability event, provide voltage levels on each of these buses during the event and for two hours pre- and post-deployment of NTA resources, as well as thermal measurements/calculation for Section 23.

System security is achieved through "unified threat management", a combination of high tech routers, anti-virus software, client to site tunnels and firewalls. The security restricts communication between recognized devices, restricts the type of data permitted, supplies encryption and provides 24/7 remote support. The System includes authentication and permission-based user account functions. Each Operator will be assigned a user name and password that must be used to be granted access to System services. User accounts are stored by the System, but user passwords are not stored in the GridSolar databases as plain text. The System stores only a "hashed" form of the plain text password. When a user types in a password, the password handling application runs through a cryptographic hash algorithm, and if the hash value generated from the user's entry matches the hash stored in the password database, the user is permitted access. The hash value is created by applying a cryptographic hash function to a string consisting of the submitted password and another value known as a "salt". The salt prevents attackers from easily building a list of hash values for common passwords and prevents

password cracking efforts from scaling across all users. Additional security provisions will be added as smart grid best practices are developed.

C. GridSolar Operations, Monitoring and Dispatch Network

After delays due to the December ice storms, GridSolar and CMP recently began a training and testing process for the full Command Interface system. In its initial phases, the testing will run paper scenarios utilizing a variety of different NTA resources, and then in later phases will include test runs involving each active NTA resource. After each phase of testing, GridSolar will submit to CMP log, data and audit records and make upgrades as appropriate. CMP and GridSolar will conduct iterative rounds of testing as appropriate. The current round of testing involves three development environments; production, primary development and hot fix development. The two development environments are setup for high priority bug updates that require immediate attention and longer term product updates that are rolled out on a scheduled and versioned basis.

Currently, the only active NTA resource that is fully installed and ready to operate is the 500 kW diesel BUG. GridSolar has built version 1.0 of the Command Interface and has fully deployed all of the above described hardware and software components linking the BUG into GridSolar's SCADA system located in its Portland operations center. Although the BUG has been ready for operation since last fall, CMP has not yet finalized its review of the interconnection between the BUG and the grid. In the meantime, GridSolar has brought in load banks and other equipment to perform an internal (off-grid) test of the entire system. Those initial tests met initial interconnection requirements (CMP subsequently asked for additional testing) and also demonstrated that the Command Interface operating system and primary wired network is operating as designed. Once the interconnection is complete, a second round of internal and then a round of live testing of the BUG operations will be done.

As with the BUG, the Convergent battery storage unit will have essentially identical equipment and operating parameters and will be capable of virtually instantaneous remote start-up (with the CMP-required 5 minute delay). Command and control systems will be provided by Lockheed Martin, which has extensive experience serving utility networks, including distributed energy storage smart grid demonstration projects for the Department of Defense and San Diego Gas & Electric. The Convergent battery system is expected to be deployed and ready for testing this spring.

The Ice Bear units are also designed for quick-start but, per the bid offering, the NTA resource owner will have up to 30 minutes to start-up each unit after receiving notice of dispatch. As described below, phase one of the Ice Bear installation (217 kW of 250 kW) is projected to be complete by March 1, 2014, with the balance to follow in April and testing in April and May. Ice Energy has a proprietary digital communications and operations system, which has previously been successfully demonstrated in smart grid applications by several other utilities in the U.S. and Canada (see detailed description below).

In sum, while the GridSolar SCADA network is still in development, this is a proven technology that is already in widespread application in the electric grid in Maine and elsewhere, and is being used as the backbone of smart grid applications throughout the country. There has been no indication to date of

any significant flaws in the GridSolar system or any other factor that would make the network not work as intended.

V. TASK THREE: MEASUREMENT AND VERIFICATION

In addition to the above information summarizing the RFP process and development of the GridSolar Operations Center,[10] the NTA Plan and revised M&V Plan require GridSolar to provide an annual report regarding each of the following items:

A. NTA Inventory, including Capacity, Energy Savings, Emissions Reductions, & Fuel Usage.[11]

To track data on capacity, energy savings, emissions reductions, & fuel usage, GridSolar has created an interactive, searchable digital inventory, which is attached as Exhibit 4. This worksheet includes detailed information on each NTA and NTA resources category, together with individual, aggregate and total data on capacity, energy savings/generation, emissions, costs and reductions in fossil fuel consumption. Source data for inventory calculations is provided in Ex. 5.

A summary of results, by NTA bucket and by current operational status, is provided in Figure 5.

[10] See NTA Plan, Task Three, Annual Report Items 5, 11.

[11] See NTA Plan, Task Three, Annual Report Items 2, 3.

NTA Resource	Nameplate (kW)	Capacity (kW)	Capacity Price $/kW/Month	Total Costs ($)	Energy (kWh)	Total Nox (lb/MWh)	Total SO2 (lb/MWh)	Total CO2 (lb/MWh)	Total Gas (mmBTu)	Total Oil (Gal)
Efficiency										
Recommended	218.64	94.94	$32.00							
Operational	220.00	232.78	$21.20	$38,665.48	507,486.00	-71.05	-15.22	-456,229.91	-3,825.83	-2,152.18
Efficiency Total	**438.64**	**327.72**	**$28.91**	**$38,665.48**	**507,486.00**	**-71.05**	**-15.22**	**-456,229.91**	**-3,825.83**	**-2,152.18**
Solar PV										
Recommended	280.10	102.60	$43.83							
Contracted	39.84	39.84	$50.40							
Operational	243.35	175.41	$50.29	$17,059.25	35,474.00	-5.51	-1.42	-31,713.76	-279.05	-78.98
PV Solar Total	**563.29**	**317.85**	**$48.53**	**$17,059.25**	**35,474.00**	**-5.51**	**-1.42**	**-31,713.76**	**-279.05**	**-78.98**
Backup Generator										
Recommended	500.00	500.00	$17.42	$188,054.19		35.72	0.06	12,751.68	0.00	175.00
BUG Total	**500.00**	**500.00**	**$17.42**	**$188,054.19**		**35.72**	**0.06**	**12,751.68**	**0.00**	**175.00**
Demand Resp.										
Contracted	250.00	250.00	$110.00							
DR Total	**250.00**	**250.00**	**$110.00**							
Energy Storage										
Contracted	500.00	500.00	$168.70							
Storage Total	**500.00**	**500.00**	**$168.70**							
Grand Total	**2,251.93**	**1,895.57**	**$61.16**	**$243,778.92**	**542,960.00**	**-40.83**	**-16.58**	**-475,191.99**	**-4,104.88**	**-2,056.16**
NTAs by Status										
Recommended	998.74	697.54	$36.70	$188,054.19		35.72	0.06	12,751.68		175.00
Contracted	789.84	789.84	$109.92							
Operational	463.35	408.19	$46.86	$55,724.73	542,960.00	-76.56	-16.64	-487,943.67	-4,104.88	-2,231.16

Figure 5: NTA Inventory, Summary of Capacity, Cost, Energy, Emissions and Fuel Use/Savings by Resource Category and Operational Status.

B. Use of Battery Storage, Peak Reduction and Interactive Consumer Devices and Technologies.[12]

The Pilot will include the first ever advanced battery storage application used for grid reliability purposes in Maine, as well as 250 kW of demand response NTAs using interactive "Ice Bear" units located behind the meter that can be dispatched remotely to reduce peak air conditioning loads. Each of these applications is described below.

Battery NTA. Convergent Energy + Power ("Convergent") will install a 500 kW advanced lead acid battery storage NTA, pursuant to a recently approved contract from RFP II. The Convergent battery can go from zero to 100% state of charge ("SOC") in 8 hours during off-peak periods, and can discharge at full nameplate capacity for to six hours if called to support the grid during a peak or shoulder (maintenance) period reliability event. Because Convergent's lead acid battery was capable of providing its full nameplate NTA capacity during the full six-hour peak period when a reliability event would be most likely, it was preferred over competing and comparably (or higher) priced proposals for a Sodium Nickel Chloride battery (500 kW, 2 hours discharge time) and a Lithium Ion battery (500 kw, 2.5 hr discharge time). On the downside, the cells in Convergent's lead acid battery have a projected lifespan of 4 to 5 years, and due to concerns about obsolescence, the NTA contract provides that Convergent is not obligated to maintain battery operations after that time if, through no fault of its own, it is unable to obtain replacement cells. To date, the only wrinkle in development of the battery NTA occurred when the location in the Boothbay Industrial Park subjected the battery NTA to potential interference from regular gravel quarry blasting. This issue was resolved through using an upgraded installation design. As with the BUG, the battery will be capable of fully automated remote operations, including 10 second ramp up start (with 5 minute delay) if called for a reliability event.

The battery demonstration, while valuable to the Pilot project purposes, is a much more expensive resource than other resources. This 500 kW NTA alone represents 27% of the total Pilot capacity requirement, and comes at quadruple the cost of PV Solar, five times the cost of efficiency (AC replacement), and more than eight times the cost of the BUG or lighting efficiency.

Finally, although the battery NTA will result in reduced local emissions and fossil fuel use, GridSolar expects the net emissions and fuel effects to be small. To determine net emissions, GridSolar will take the product of ISO-NE's published off-peak emission rate (charge time, by kWh) minus avoided on-peak emissions (discharge time, by kWh), times the number of charge/discharge events for reliability purposes, including charging necessary to maintain a complete SOC.[13] The formula to determine battery impacts on fossil fuel consumption uses the same approach, but is be based on ISO-NE's marginal heat rate and resource mix.

---

[12] See NTA Plan, Task Three, Annual Report Items 4, 8.

[13] See *2012 ISO New England Electric Generator Air Emissions Report*, ISO New England, Inc., System Planning, (Jan. 2014), available at http://www.iso-ne.com/genrtion_resrcs/reports/emission/2012_emissions_report_final_v2.pdf (Feb. 28, 2014), attached as Ex. 5.

Demand Response. Thermal Energy Storage of Maine ("TESM") and Ice Energy are installing 250 kW of demand response NTAs using the patented Ice Bear distributed energy storage system. Ice Bear units work in conjunction with commercial direct-expansion (DX) air-conditioning systems, specifically the refrigerant-based, 4-20-ton packaged rooftop systems common to most small to mid-sized commercial buildings. The Ice Bear makes ice using power delivered from the grid during off-peak hours and delivers cool, 55 degree air to the building's plenum for up to six hours per day.[14] While the electric load of any given AC unit will vary depending on its age and size, the "peak relief credit" for a given Ice Bear installation in Boothbay will be in the range of 6 to 8 kW.

TESM and Ice Energy are currently almost finished with the installation of phase one of their project, which includes 27 Ice Bear units at 8 locations in the Pilot area for a total of 217 kw. In April, the team plans to complete 5 more units comprising the remaining 33 kW of capacity. A typical location for Ice Bear units is a commercial building such as a bank, a large hotel, or a "big box" store (the "Host"), with more than one five-ton or larger commercial "package" air conditioning units on its roof. The NTA Capacity Rating of each Ice Bear unit is equal to the sum of the ratings of each existing AC unit that is equipped to be cycled off when called upon by GridSolar. If Ice Energy replaces an existing AC unit when the Ice Bear unit is installed, the rating is that of the replaced AC unit.

The ratings for existing AC units are determined by the table shown in Figure 6:

kW Site Values	Size of Package Unit or Targeted Stage															
Age of Package Unit	**1 Tons**	**1.5 Tons**	**2 Tons**	**3 Tons**	**4 Tons**	**5 Tons**	**6 Tons**	**7 Tons**	**7.5 Tons**	**8 Tons**	**8.5 Tons**	**9 Tons**	**10 Tons**	**12.5 Tons**	**15 Tons**	**20 Tons**
Pre 1984	1.632	2.448	3.264	4.895	6.527	8.159	9.791	11.423	12.239	13.054	13.870	14.686	16.318	20.398	24.477	32.636
1984-1991	1.458	2.187	2.916	4.373	5.831	7.289	8.747	10.205	10.934	11.662	12.391	13.120	14.578	18.223	21.867	29.156
1992-1998	1.432	2.149	2.865	4.297	5.730	7.162	8.594	10.027	10.743	11.459	12.175	12.892	14.324	17.905	21.486	28.648
1999-2005	1.325	1.987	2.649	3.974	5.298	6.623	7.948	9.272	9.935	10.597	11.259	11.921	13.246	16.558	19.869	26.492

Figure 6: NTA Capacity ratings for displaced air conditioning units.

For example, consider an Ice Bear unit installed on a rooftop with two 5 ton AC units, one made in 1980, the other 1985. The Ice Bear unit displaces both the 1980 Package Unit (or its replacement), which equals 8.159 kW of peak load reduction, and the 1985 AC unit, which provides 7.289 kW of peak load reduction, for a total of 15.448 kW of peak load reduction. Upon completion of each installation, GridSolar will inspect and audit unit performance; dynamic capacity rating adjustments if necessary will be calculated pursuant to the approved M&V Plan.

Ice Energy is providing remote access to each Ice Bear unit via a private wireless 3G network and its CoolData utility network interface, which is used extensively in smart grid applications by many other utilities. The CoolData system consists of a two-way communications network, real-time dashboard display, and advanced smart grid software architecture that controls the Ice Bear system, manages the connected rooftop packaged unit, and serves as an intelligent gateway for managing additional demand and consumption on installed buildings. Ice Energy is installing temperature and current monitoring

[14] For further explanation and diagram of typical installation, see Smart Grid News "Scorecard" for the Ice Bear Energy Storage System, attached as Ex. 6.

sensors, a data logger, configure the Web based control dashboard, and archive all logged data on an OSIsoft PI historian. (Ex. 6.) GridSolar will have access to the asset performance history.

Additionally, the CoolData system is scalable and will provide GridSolar with the ability to intelligently shape peak demand by managing the load profile of a single building, a feeder, a substation, or region in the event that additional Ice Bear units become part of additional NTA projects.

C. *Elimination of barriers to adoption and deployment of Smart Grid functions, and associated infrastructure, technology and applications.*[15]

The Boothbay Pilot has deployed (or is in the process of deploying) almost 70 separate NTA installations[16] in the Boothbay subregion of the CMP electric grid, which will defer or eliminate the need for a new $18 million 34.5 kW transmission line to import power into the region, at substantially reduced cost and with the added benefit of reduced emissions and lower usage of fossil fuels. GridSolar believes the Pilot has helped demonstrate, in particular, the viability of two key pathways to building a smarter electric grid in Maine: (1) the ability to use avoided transmission payments to incent location of passive NTA resources on circuits and in regions where needed to avoid expensive transmission upgrades caused by peak load limitations, and (2) the ability to build active NTA resources, including demand response, storage, and back up generation, to solve transmission restraints at lower cost and with lower environmental impact that construction of new power lines.

First, as described above, the Pilot has resulted in accelerated deployment of traditional passive NTAs (efficiency and PV Solar) that, without the Pilot, simply would not have occurred at this time in this region. For example, prior to the Boothbay Pilot there was only one commercial scale PV Solar project in the Boothbay region – a (donated) 45 kW PV Solar installation at the Maine Coastal Botanical Gardens – and just a few very small residential solar projects. Likewise, EMT reported that extraordinarily few businesses on the Boothbay peninsula had previously participated in its proscriptive or custom efficiency programs – likely due the seasonal nature of their businesses. Both market segments reacted vigorously to the modest incentives provided by the Pilot ($40-50/kW Month for PV Solar, and $15-30/kW Month for Efficiency), demonstrating the viability of what is known as grid-targeted (a.k.a., geo-targeted) efficiency and solar programs.[17] By happenstance, RFP II occurred just after the Maine Solar rebate program expired. The strong participation of PV Solar resources in RFP II indicates that cost savings generated by NTA reliability solutions can help overcome budget limits that are otherwise shrinking Maine's renewable energy programs.

---

[15] See NTA Plan, Task Three, Annual Report Item 10.

[16] This figure does not include the dozens of separate efficiency installations managed by Efficiency Maine Trust.

[17] For an example of Vermont's geo-targeted efficiency program, see http://www.efficiencyvermont.com/About-Us/Energy-Efficiency-Initiatives/Geographic-Targeting.

Second, the Pilot has helped overcome financial barriers to allow the application of new active NTA resources in Maine. Ice Bears, for example, have logged over 10 million operating hours at sites in nine states and one Canadian province. This technology has not proven cost effective in Maine based solely on a customer's projected demand and energy savings. The additional Pilot incentive (avoided transmission costs), has helped overcome the cost barrier. Moreover, were the NTA pilot term longer, GridSolar expects that the monthly incentive payment could be as much as halved. See Ex. 2 (comparing 3 year cost to 10 year levelized cost). Were the Pilot located in a more urban region with greater commercial Demand Response opportunities, we would expect to see many more applications.[18]

The Pilot has also accelerated the deployment of new BUG and Battery applications, as explained above. For BUGs, while there is nothing new about their use for smart grid purposes in Maine (BUGs located at rest areas on the Maine turnpike have participated for years in the ISO-NE Demand Response Program), GridSolar believes that the Boothbay pilot marks the first time a new EPA Tier 4 emission compliant mobile generator has been part of a smart grid project. Additionally, this marks the first time we have seen BUGs proposed both as a stand alone unit and as part of a renewable energy micro grid package. The levelized price of the Boothbay BUG is equivalent to that of PV Solar, which indicates that a PV Solar-BUG package NTA would be competitive in future RFPs.

Finally, it is also worth noting the success of the direct install LED efficient lighting program operated by Efficiency Maine Trust. Lack of information and the initial capital cost of LED lighting is a significant barrier to deployment of LED lighting for many seasonal retail businesses. In Boothbay, EMT solved both problems by having qualified technicians identify and directly install LED lighting in qualified locations (on the same visit) at no cost to the store owner – a program that proved extremely popular and successful. In one example, a gallery owner reported that the new LED lighting improved light quality in his store, lowered lighting energy expense, and reduced the amount of lighting waste heat thereby also lowering his air conditioning energy expense. This lighting program was one of the least cost NTAs. EMT fully subscribed its (expanded) capacity obligation in RFP I and, based on local demand, is available to provide further capacity.

D. Consumer Education[19]

A significant existing barrier to deployment of Smart Grid functions that has been unaffected by the Pilot is the limited capacity of CMP's new smart grid meters and AMI system as installed. Because the residential and small general service meters lack the ability for two way interactive communications or specialized billing, residential demand response and dynamic pricing NTAs are not yet viable. GridSolar expects that these technologies will become available in the future as CMP upgrades its AMI system,

[18] Due to limitations in CMP's AMI system, which were installed without the ability for two way interactive communications or specialized billing involving residential meters, no residential demand response or dynamic pricing NTAs were received.

[19] See NTA Plan, Task Three, Annual Report Item 9.

and will generally be more applicable to more densely developed, non-seasonal residential communities.

In light of this limitation, neither GridSolar nor any NTA provider has had any programmatic basis to provide consumers with timely energy consumption information and control options.

E. Grid Benefits and Technical Data[20]

The use of digital information and control technology is described in Section IV above. To date, the Pilot has deployed over 400 kW of passive NTA resources, which have generated or saved over half a million kilowatt hours of electricity. These passive NTA resources alone exceed the projected grid reliability requirements in the Boothbay subregion of the CMP electric grid for the initial years of the Pilot. Although the remaining NTA assets – about 1.5 MW – will come on line this year, the subregion will not reach the projected critical loads in which the full suite of NTA resources are needed to meet reliability requirements until the out years of the Pilot project. This demonstrates the dynamic and modular nature of NTA solutions, which can be ratcheted up or down year to year, as conditions require – thus lowering net costs and preventing premature or stranded costs due to overbuilding.

It is GridSolar's understanding that CMP is in the process of improving its smart grid platform at the three substations within the project area in order to provide baseline and real-time operational data of grid performance. Pursuant to the Commission's May 28, 2013 Order, GridSolar has requested from CMP the baseline 2012 peak load data at the critical buses in the Boothbay subregion, and pre- and post-deployment voltage readings before during and after each "reliability event" or "test," and pre- and post-deployment thermal measurements/calculations on Section 23.

F. Cost Comparison, Jobs and Economic Benefits.[21]

GridSolar currently projects that the NTA-Transmission hybrid Boothbay Pilot will provide approximately $17.6 million of savings to CMP's ratepayers over the 10-year extended life of the project (through 2023), net of the costs of the hybrid components.

To compute the annual revenue requirement for the Pilot, GridSolar compiled total cost by RFP I (2013 start), RFP II (2014 start)[22] and administrative costs as projected for the extended 10-year life of the

[20] See NTA Plan, Task Three, Annual Report Item 1. See also *CENTRAL MAINE POWER Request for Approval of Non-Transmission Alternative (NTA) Pilot Project for the Mid-Coast and Portland Areas*, Docket No. 2011-138, Order Approving RFP I, at 6 (May 28, 2013).

[21] See NTA Plan, Task Three, Annual Report Items 1, 6, 7.

[22] For simplicity, this assumes that all NTA Resources in RFP II are on-line for the full 2014 calendar year.

Pilot. Where applicable, GridSolar made adjustments for actual and/or expected capacity achieved compared to contracted capacity. The BUG costs include $100,000 as the estimated up-front expense and 2013 lease fees associated with installation and interconnection of the 500 kW diesel BUG. The estimate of GridSolar's administrative costs assume no further NTA projects are pursued in other parts of Maine.

The GridSolar revenue requirement is then compared against the estimated revenue requirements of an $18 million transmission solution less the transmission component of the hybrid NTA solution, which is estimated to be $2 million. The data and graphs displaying the results are shown in Figure 7.

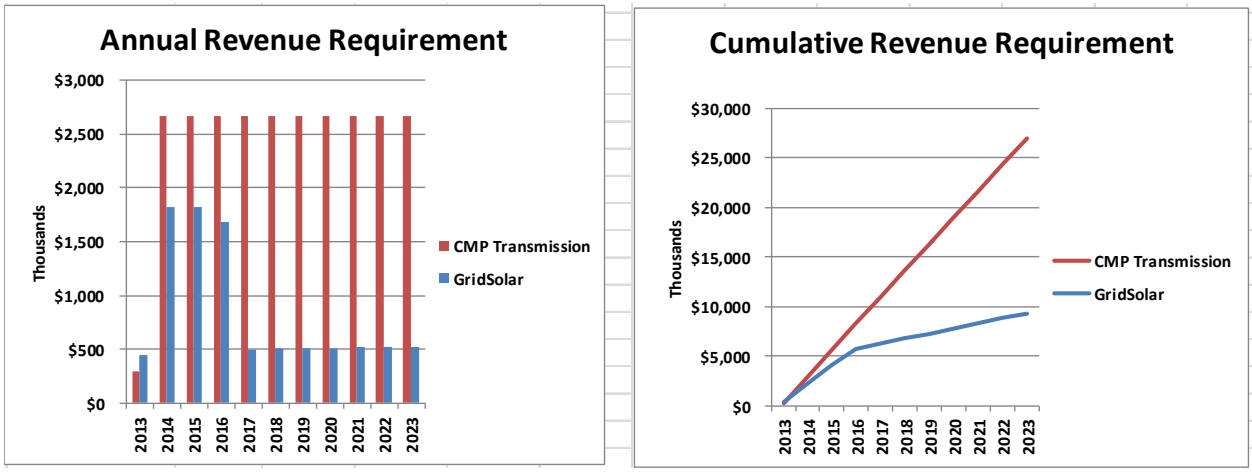


Figure 7: Cost of GridSolar's NTA Solution compared to new transmission to meet 10-year reliability needs in the Boothbay subregion of the CMP electric grid.

The cost comparison analysis demonstrates how cost effective the NTA hybrid solution is compared to the transmission only solution, even with the expensive Battery Storage component representing 27% of the capacity requirement. This comparison addresses only 2 MW of critical load, which is the expected load over the ten-year study period based on the CMP Needs Assessment for this region. The transmission solution can accommodate significant additional load growth at essentially no additional cost; however, over the ten year period under the NTA hybrid solution, there are substantial savings – approximately $17.6 million - that can be used to offset the costs of additional NTA resources should load growth in the Boothbay Region exceed the projections over the initial ten years and continue to grow beyond.[23] This additional $17.6 million can be expected to support higher amounts of NTA options on a dollar per kW basis, as the prices of certain NTA resources such as Solar PV fall over time and the overall NTA resource mix shifts away from higher priced Battery Storage or new battery technologies bring these costs in line with other resources.

[23] The load projection in CMP's most recent rate case indicates flat or declining load on its system under base case assumptions. Given the number of passive NTAs implemented as part of the Pilot, GridSolar anticipates that load in this pocket would be likely to follow the declining path shown for MACE efficiency in the rate case.

GridSolar also evaluated the NTA Resource solution in a "worst case" under which the Commission authorizes the GridSolar model as proposed for three years (through 2016) and then subsequently abandons this approach and constructs the transmission solution. Under this scenario the Commission would spend $5.77 million on contracts with the NTA resources plus GridSolar's O&M costs, but would postpone the transmission investment for three years or longer, since the 600 kW of passive NTA resources (efficiency and solar PV) at a minimum would remain operational. The three years of transmission avoidance would save ratepayers an estimated $8.3 million. If the 600 kW of passive NTA Resources buys an additional three years of transmission avoidance, the savings increase to $16.3 million. In either case, the Pilot Project will provide the Commission an opportunity to revisit the reliability issue within the region three or more years from now. Thus, even under the worst case scenario, CMP's ratepayers are better off under the NTA-Hybrid approach than under the transmission only solution.

GridSolar has not asked its NTA providers to calculate the numbers of jobs created for each project, but based on its lower cost, the Pilot has likely resulted in fewer short term construction jobs than the transmission solution. Unlike construction of new high voltage transmission lines, however, most of the NTA providers are using local companies and contractors – so the jobs that have been created are local and directly benefit the Boothbay area and Maine economy. In at least one sector – PV Solar -- the Boothbay Pilot has potentially saved jobs that might otherwise have been lost. The Pilot went into effect at a time when overall PV Solar construction in Maine was declining due to the expiration of the Solar Rebate program (as of June 2012, Maine became the only state in New England with no state incentive for installation of renewable energy). Providers have told GridSolar that the Boothbay pilot resulted in new orders for PV Solar systems that would not otherwise have been built, thus enabling the state's nascent solar sector to better survive the downturn caused by the loss of the rebate program.

In terms of ongoing operations, the NTA Pilot will provide a number of direct economic benefits, ranging from cost savings for all Maine ratepayers to direct benefits to participating businesses. Unlike building new transmission lines, which creates no permanent jobs or savings, the Pilot project will help lower ongoing energy expenses and increase renewable energy generation at participating area businesses, hotels and restaurants. Based on press reports, the Pilot is also benefitting local businesses in other ways, such as higher quality lighting in galleries and retail stores, improved comfort provided by new high-efficiency air conditioning, and meeting consumer preference for visibly green businesses (i.e. with solar panels on the roof).

VI. ASSESSMENT AND RECOMMENDATIONS.

As noted above, the results of the Boothbay pilot demonstrate that a wide variety of NTA resources are available in Maine at reasonable costs that can meet grid reliability requirements and that these NTAs can be deployed throughout Maine and can be scaled to virtually any size. Passive NTAs are already providing required reliability benefits to the Boothbay subregion of the grid. The active NTAs are still in

deployment and testing, but there is every indication that they too are capable of responding as necessary to provide grid reliability services. Thus, at this stage, the Pilot has answered in the affirmative three of the four questions it was designed to answer. *Order* at 9. The only question where information is lacking is the ability to use the AMI system to support NTA solutions. *Id.* That question must await, however, inclusion of additional infrastructure in the AMI system.

Whether a given suite of NTA solutions will be more cost effective than building new transmission capacity must generally be determined circuit by circuit, and will depend upon the relative scale and cost of the transmission only solution. Nonetheless, based on the sizeable savings demonstrated by the Boothbay Pilot, GridSolar expects that NTA solutions or NTA-Transmission hybrid solutions will be able to play a substantial role in meeting future grid reliability requirements statewide at lower cost – and with less emissions and fossil fuel usage than transmission only solutions.

GridSolar expects that going forward the cost of NTA solutions will further decline (and produce even greater savings) as the distributed energy and efficiency market sectors grow and mature, technologies improve, installed costs drop, and public awareness rises. Additionally, further deployment of NTAs and other smart grid technologies will help meet the goals of the Maine Smart Grid Policy Act and will benefit Maine ratepayers by enhancing consumer choice, lowering costs, improving system efficiency, reducing energy usage and pollution and lowering reliance on fossil fuels. 35-A M.R.S.A. § 3143(3).

Based on the Pilot, GridSolar recommends the Commission expand the NTA program to evaluate NTA opportunities in other regions of the CMP and Emera Maine electric gird. (Indeed, consideration of NTAs as part of each new transmission line or project is now a legal requirement pursuant to recent amendments to Maine's transmission planning standards, 35-A M.R.S.A. §§ 3132, 3132-A.) The 3-year period of the Boothbay Pilot made it more difficult to secure NTA resources at prices reflective of the longer-term operational period of those resources. GridSolar recommends that all future NTA projects not be limited to artificial terms, but be structured on a basis commensurate with the long-term useful lives of transmission alternatives and the NTA resources.

In addition, GridSolar's experience has shown that the most effective energy conservation NTA resources were procured by the Efficiency Maine Trust. However, EMT has advised GridSolar that the RFP process employed by GridSolar to procure NTA resources is inconsistent with how EMT structures its programs and operations, and as a result EMT is not able to participate as efficiently or as effectively as it would like. Accordingly, GridSolar recommends that energy conservation and efficiency NTA resources should be procured in all future projects in partnership with EMT, outside the RFP process used to procure other NTA resources.

The Pilot has also demonstrated that doing so will require organizing entity – a smart grid coordinator, even if that precise name is not used – with the capacity and legal authority to develop and proffer NTA solutions and, more importantly, once the NTA solution is approved, to ensure that it is implemented and operated in a manner that can meet grid reliability mandates.

This task requires an entity that can provide a range of services, from defining NTA alternatives and performance standards, to soliciting and managing competitive bidding, negotiations and contracting, to developing and implementing secure communications and operation protocols to enable the NTA resource to receive, act upon and confirm actions related to dispatch orders from the T&D utilities, to measurement and verification of the performance, to providing payment and settlement services. Based on the Boothbay experience, GridSolar believes that these services and functions will largely be identical on most circuits throughout the state, and that it will be most practical and cost effective to utilize a single coordinator and smart grid SCADA network to provide these functions. Given the grid reliability and fiduciary responsibilities involved, GridSolar further believes that any such coordinator should be subject to the same regulatory oversight as Maine's other public utilities.

VII. LIST OF EXHIBITS.

Exhibit 1. Summary of Responses to RFP I

Exhibit 2. Summary of Responses to RFP II

Exhibit 3. Combined Summary of Responses to RFP I & II

Exhibit 4. Digital Inventory, Boothbay Smart Grid Reliability Pilot Project (Mastertracker.xlsx)

Exhibit 5. Inventory Calculations Emissions and Fuel Usage Source Data.

Derivation of GridSolar Calculations of BBH Pilot Fuel Usage

XQ500 Generator Data Sheet – Emissions and Fuel Useage

2012 ISO New England Electric Generator Air Emissions Report, ISO New England, Inc., System Planning, (Jan. 2014),

Exhibit 6. Ice Bear product information.