Deborah Petrisko

From: jacqueline espinosa [danjacluis@yahoo.com]
Sent: Wednesday, January 29, 2014 9:40 AM
To: publiccomments@njcleanenergy.com
Subject: solar energy storage project

how will this impact the SREC current pricing? With more supply the pricing will go down? What about the residential homes that have invested in solar energy? How can they protect themselves during an outage? Residential homes may have the potential to provide energy during an outage.

Deborah Petrisko

From: joneich@aol.com
Sent: Sunday, February 23, 2014 7:18 PM
To: publiccomments@njcleanenergy.com
Subject: Comment on STRAW PROPOSAL Fiscal Year 2014 Energy Storage Program

The last paragraph on Page 4 of the document states:

For purposes of load shifting or emergency backup, the storage system must be capable of providing the host facility's full electric demand for a minimum of one hour and a maximum of four hours. Stakeholders are encouraged to offer comments on the maximum time threshold and whether a longer threshold should apply to facilities that are defined as "public and critical".
One to four hours seems like a small window, but perhaps that is what is currently "proven and commercially available".

Ideally, the maximum should dovetail with standard emergency management doctrine for people to "shelter in place" for three days (72 hours) following a disaster, when possible.

Incorporating systems that allow structurally-sound homes to provide shelter while "off-grid" reduces the demand on emergency responders and shelters, allowing them to focus on individuals who need to be rescued. Ideally the storage system will support heating, cooling, refrigeration, cooking, and lighting systems. An adjustment to storage capacity for recharge seems appropriate, but a timeframe of less than a day would seem to threaten the ability of the structure to meet shelter-in-place requirements.

Businesses may benefit from a longer window as well. Having gasoline pumps that can operate off grid would support shelter-in-place efforts for many homeowners. Having grocery stores with cash registers and refrigeration/freezer units that operate would reduce the threat of food shortages.

Jon Eich, AICP
930 Hart Circle
State College, PA 16801
(p) 814-876-2264
(f) 814-237-1081
(e) JonEich@aol.com

Deborah Petrisko

From: Todd Olinsky-Paul [Todd@cleanegroup.org]
Sent: Monday, February 24, 2014 2:25 PM
To: publiccomments@njcleanenergy.com
Subject: energy storage straw proposal comments
Attachments: Strawman-New Jersey ESS RFP-Gmarkup.docx

Please find attached your energy storage straw proposal with comments from our energy storage consulting engineer.

As you will see he feels New Jersey should be taking a microgrids approach. However, setting that aside, he does identify a number of limitations of the straw proposal, that may be useful in revising the document.

If you have questions about his comments, I will be happy to arrange a conference call with him so that he can provide answers or clarification about his comments. We remain committed to supporting New Jersey's energy storage initiative and will be happy to provide more information on the attached as needed.

Thank you,
Todd

Todd Olinsky-Paul
Project Director
Clean Energy States Alliance
50 State Street, Suite 1
Montpelier, VT 05602
Phone: 802-223-2554 x207
Mobile: 845-625-8807
Fax: 802-223-4967
Email: Todd@cleanegroup.org

Please visit our websites at www.cleanegroup.org and www.cleanenergystates.org

STRAW PROPOSAL

Fiscal Year 2014 Energy Storage Program
January 28, 2014

Background and Context

In August 2012, the New Jersey Board of Public Utilities (NJBPU) released a study it had commissioned from Navigant Consulting, Inc. titled "Market Assessment Services to Characterize the Opportunities for Renewable Energy". In the study, Navigant identified two potential opportunities for energy storage in the near term based on the amount of intermittent renewable energy (RE) installed or anticipated to be installed in New Jersey:

- Shifting renewable generation to more optimal times of the day; and
- Providing some of the additional frequency regulation that may be required with higher levels of intermittent RE

Comment [G1]: Very disappointed that this is all Navigant could come up with in their evaluation of Energy Storage.

Comment [G2]: I think that Navigant is coming up short on what NJ should be addressing with storage and microgrids. A microgrid with storage can generate revenues far beyond that for frequency regulation as the battery can be supporting other applications and remain in reserve for an islanding situation. It appears to me that Navigant is very short sited in evaluating the potential of Energy Storage.

Navigant estimated that the current technical potential[1] for storage associated with load shifting for solar PV is 500 megawatts (MW), with an additional 45 MW of storage representing the current technical potential for frequency regulation[2].

Two months after the release of the Navigant study, a third important motivation emerged in support of energy storage market development. With Superstorm Sandy knocking out power to millions of New Jersey residents and businesses – and thousands of critical facilities – energy storage is seen as a way of hardening the state's electric infrastructure and allowing essential services to continue operating during grid outages.

NJBPU Staff recommended through the Comprehensive Resource Analysis[3] (CRA) that $2.5 million be allocated for energy storage incentives in the FY2014 New Jersey Clean Energy

[1] The current technical potential for storage is defined as the amount of storage that is technically feasible to install based on the opportunities generated by the total installed amount of intermittent RE in New Jersey through 2016.

[2] The Navigant study examined the potential for energy storage in both solar PV and offshore wind development. For purposes of this solicitation, however, the offshore wind numbers have been deducted from the totals, leaving only the solar PV amounts.

[3] Adopted in the Board Order dated June 21, 2013 In the Matter of the Comprehensive Energy Efficiency and Renewable Energy Resource Analysis for Fiscal Years 2014-2017 Clean Energy Program, Docket No. EO11050324V. The CRA is a statutorily defined method for the NJBPU to establish clean energy program funding levels via ratepayer contribution through the Societal Benefits Charge.

Program budget. In its FY2014 Compliance Filing[4], the Honeywell Market Manager Team proposed the following to establish an incentive program for energy storage:

> *During the 3rd quarter of 2013, Board Staff and the Market Manager will hold discussions with interested stakeholders to develop program guidelines, incentive structure and target market. The findings of these stakeholder meetings will provide valuable input which will be utilized to develop a competitive solicitation process…The proposed solicitation design, incentive levels and schedule that are developed through the stakeholder process will be presented to the Board for its review and approval at one of the regularly scheduled Board Agenda meetings.*

To that end, NJBPU Staff and the Market Manager Team convened the inaugural meeting of the Energy Storage Working Group on July 23, 2013 to obtain stakeholder input into the design, timing, process, incentive structure and eligibility criteria for the competitive solicitation. Written comments were requested by August 5, 2013. A second Working Group meeting was held on September 20, 2013 to review the five written comments submitted[5] and further discuss the elements of the solicitation.

This straw proposal is the result of the ideas and recommendations expressed at those meetings and in the comments. In keeping with the transparent and inclusive nature of NJCEP program development, public comments on this straw proposal will be welcomed and considered. Based upon that input, a final version of the competitive solicitation will be presented to the NJBPU for its review and approval at one of its regularly scheduled agenda meetings. It is the intent of the Market Manager Team to issue the first round solicitation in the second quarter of 2014. The schedule below highlights specific dates in the timeline for issuing the solicitation:

- Jan. 28, 2014: Market Manager issues straw proposal for solicitation concepts; public comment period begins
- Week ending 1/31/14: Market Manager posts a Request for Information (RFI) survey on the NJCEP website with an announcement to the Energy Storage distribution list
- Feb. TBD, 2014: Energy Storage Working Group meeting
- Feb. 27, 2014: Comments due from stakeholders on the straw proposal (Send to publiccomments@njcleanenergy.com)
- Mar. 21, 2014: Market Manager submits solicitation document to NJBPU for approval
- Apr. 23, 2014: NJBPU agenda meeting; Board will vote on final program proposal
- May 2014: Roll-out of first solicitation.

[4] Adopted in the Board Order dated June 21, 2013 In the Matter of the Clean Energy Programs and Budgets for the Fiscal Year 2014, Docket No. EO13050376V.

[5] Comments may be viewed at: http://www.njcleanenergy.com/files/file/public comments/PublicCommentsSubmittedResponseto72313ESWGmeeting.pdf

The RFI survey step is intended to provide input on anticipated demand for incentives to the NJBPU Staff in the CRA development process that will begin in early 2014 for Fiscal Years 2015 through 2017, as well as into the development of the Solicitation itself. Project developers will be asked to provide information on the type of projects they are proposing, and how those projects meet the evaluation criteria.

Program Goals

- Focus on energy storage projects integrated with existing or proposed behind-the-meter Class I renewable energy resources that can be completed as expeditiously as possible.
- Establish maximum incentive amounts which will allow the limited amount of funds to be committed to a broader number of projects.
- Prioritize facilities that are defined as "public and critical" with the goal of keeping critical public functions operational during power outages.[6]
- Promote the future integration of energy storage technology into renewable energy systems.
- Prioritize energy storage projects which offer the greatest benefit to the New Jersey ratepayer.
- Demonstrate energy storage technology benefits and revenue streams toward developing markets that can be sustained without further ratepayer contribution.

Program Eligibility

The energy storage incentive is funded through the NJCEP's Renewable Energy Incentive Program (REIP) and thus requires Applicants to meet eligibility standards that are common to that Program regardless of the technology involved. These common standards include:

- The underlying renewable energy system to which the energy storage project is integrated must be interconnected to the New Jersey electric distribution system pursuant to N.J.A.C. 14:8-2.9, and must be a behind-the-meter, net metered project

[6] NJBPU Staff is in the process of finalizing a definition for public and critical facilities for purposes of developing incentives for CHP and other distributed generation. For the purpose of this solicitation, the following definition will be used which may be subject to change in subsequent proceedings or the next solicitation round: "Critical facilities" means public facilities, including federal, state, county or municipal facilities, non-profit and/or private facilities, including hospitals and communication centers determined to be Tier I or critical infrastructure facilities by the Office of Emergency Management and/or Office of Homeland Security and Preparedness.

sized to produce no more than 100% of the host facility's historic annual electric consumption. (Note: The energy storage system may either be integrated with an existing renewable energy installation or with a yet-to-be-installed renewable energy system that has been approved under either the SRP or REIP.)

- The customer must contribute to the Societal Benefit Charge (SBC) through their utility bills, i.e., as a customer of an Electric Distribution Company (EDC) or Local Gas Distribution Company (LDC) regulated by the Board of Public Utilities.

- The energy storage project provides the greatest benefit to the New Jersey ratepayer.

- NJCEP incentives are contingent upon the Applicant meeting all other program requirements, including but not limited to compliance with the host Electric Distribution Company's interconnection requirements and compliance with all applicable local state and federal laws, permit requirements and regulations.

- Applicant must supply cost information that is accurate and based upon the actual as-built installation cost. Eligible installed system cost includes all key system components, installation, and applicable interconnection costs before *New Jersey's Clean Energy Program* incentive, less any other direct incentives.

- Applicant must provide the source of funds and amount of any other direct incentives received for the project. Staff may recommend that the Board continue the practice of deducting other direct incentives from total installed cost in the calculation of final incentive amounts.

Technology Eligibility

- Storage system must be capable of charging and discharging electricity only. Thermal storage systems (i.e., those that store energy in the form of ice or hot water) are ineligible.

- Electricity placed into storage must be generated by the renewable energy system to which the storage is integrated. The storage device may not be charged by electricity imported from the distribution system or generated by other on-site fossil fueled generators.

- For purposes of load shifting or emergency backup, the storage system must be capable of providing the host facility's full electric demand for a minimum of one hour and a maximum of four hours. Stakeholders are encouraged to offer comments on the maximum time threshold and whether a longer threshold should apply to facilities that are defined as "public and critical".

Comment [G3]: They should address the islanding requirement here along with the minimum time the island must be sustained during an outage. This will imply that RE and energy storage sizing is important and perhaps suggest that fossil fueled generators may be required to maintain the island when PV is low during cloudy daytime periods.

Comment [G4]: •This restriction will not allow the ESS to be used in its most efficient and cost effective way, buy cheap, sell high, charge at night, discharge during the day. It will also limit the feasibility of using the system in island mode. This truly inhibits the ideal way to operate the system when in an islanding mode in which storage optimizes renewables and fossil fueled sources. It also inhibits time shifting energy for peak shaving in time of use environments in which cheap energy is stored in the early morning and dispatched in the peak load periods.
.

Comment [G5]: This paragraph implies that islanding will not be an option. A 4 hour discharge is totally inadequate for an islanding function. In my opinion, the island should be sustained at least 7 days and components sized accordingly.

- Storage systems must utilize proven and commercially available technology. Although the program is technology agnostic, Applicants must provide proof that the energy storage system being proposed will be able to operate for at least 10 years.

- Applicant must be able to demonstrate that the energy storage project submitted under this solicitation can be replicated at other sites; is scalable and can be added to if necessary; and can be able to support different types of renewable energy systems (i.e., solar, wind or biopower); and may provide opportunities for future applications.

Comment [G6]: This will probably restrict the bidders to lead-acid as there is little current evidence that any of the new technologies will last 10 years without a maintenance clause that allows the replacement of energy storage components during the 10-yr period.

Incentive Structure and Maximums

Incentives are a representation of the energy, environmental and societal benefits a project brings to the ratepayers who are funding it and, in essence, place a dollar value on those benefits. At the same time, if properly structured, incentives should provide only the incremental amount required to motivate investment, the tipping point at which a project becomes economically feasible without creating a ratepayer-financed windfall for the developer or end-user.

Creating an optimal incentive structure is a challenging task, particularly when it involves a technology like energy storage that is new to the NJCEP and for which few other state incentive programs exist. An administratively determined incentive in a fixed structure provides some Applicants with more incentive than required and many with too little. Thus, Board Staff proposes to conduct this program as a competitive solicitation, placing the onus on the Applicant to specify the incentive amount necessary to make the project economically viable while recognizing that they are contending with other Applicants for a limited amount of funds.

The limited funding compels Board Staff to establish maximum incentive amounts in order to ensure the widest and most equitable distribution of funds while encouraging Applicants to request only the minimum incentive required for their projects. Applicants may request incentive payments no greater than $500,000 per project or 30% of the project's total installed cost after deducting any other incentives, whichever is less. Although an entity may submit more than one project, the total incentive request for each NJCEP fiscal year is limited to $750,000 per entity. For purposes of the per-entity maximum, an entity is defined as the business, institution or public agency that is the site host for the energy storage project(s). The per-entity maximum does not apply to project developers. It will remain in effect for all solicitation rounds within a single fiscal year. Projects that are granted incentive commitments in one solicitation round of a fiscal year may not reapply in the following round, although they are eligible to reapply in a round thereafter.

Although the program does not feature a structured, administratively set, capacity-based rebate, Applicants will propose a fixed incentive amount for their projects. This proposed

incentive amount will be used to adjust their actual incentive in the event that a project is ultimately sized below the capacity level stated in the initial application. For example, an Applicant requesting a $100,000 incentive for a 100 kW storage system is effectively establishing a $1.00 per watt incentive for their project. If the system that is eventually installed is only 90 kW, the incentive would be calculated at $1.00 per Watt times 90,000 Watts = $90,000.

Applicants will be required to submit a list of additional incentives they anticipate applying for, may have applied for or have received. These additional incentives will be considered in calculating the final REIP incentive for which the project may be eligible.

To encourage the completion of projects as expeditiously as possible, storage systems must be installed within the 12-month approval period to qualify for 100% of the approved incentive amount. Applicants may request one six-month extension beyond the initial approval period due to unforeseen or extenuating circumstances, but will forfeit 10% of the approved incentive amount if project completion exceeds 12 months.

Comment [G7]: This limitation may result in the exclusive bidding of lead-acid and Li Ion technologies, neither of which will provide the 10 year life stipulated in previous specifications. I recommend at least 18 months to 24 months which will allow the emerging energy storage technologies to be bid. There are no off-the-shelf energy storage systems in the market today that will support this application. That will change this year as several ESS developers are nearing commercialization with new technologies.

Solicitation Structure and Timing

Based on the program design, approval and implementation schedule proposed on Page 2 of this proposal, there will be only one solicitation round for energy storage in Fiscal Year 2014. Therefore, the entire $2.5 million budget will be available for that round. In the event the budget is not fully committed, the Market Manager will recommend that the Board carry over any uncommitted funds to the Fiscal Year 2015 solicitation.

The solicitation process will last approximately 60 days. The timeline for each round will be structured as follows:

Day 1: Posting of solicitation document on NJCEP website and email distribution through energy storage listserv. Written question submittal period opens.

Day 5: Written question submittal period closes.

Day 10: Market Manager distributes answers to previously submitted questions to Energy Storage listserv and posts them on NJCEP website.

Day 30: Deadline for submitting completed applications to Market Manager.

Days 31-40: Market Manager conducts preliminary review of applications for completeness; identifies incomplete applications as such prior to forwarding all applications to the Solicitation Evaluation Committee[7].

Days 41-58: Solicitation Evaluation Committee meets to review all applications; determining whether incomplete applications should be included in the evaluation process, ranking all applications on the basis of evaluation criteria and recommending incentive awards.

Day 58+ (TBD): NJBPU Staff presents Evaluation Committee recommendations to the NJBPU Board Commissioners for approval at the next regularly scheduled agenda meeting.

Within one week of NJBPU Agenda meeting: All Applicants are notified in writing as to whether their applications have been approved, and if approved, at what funding level.

Application Process and Evaluation Criteria

The Market Manager intends to revise the existing REIP forms – the Application Checklist, Application Form and Technical Worksheet – to reflect the nature of energy storage technology and the fact that the program is a competitive solicitation. A complete list of the application packet components will be included in the solicitation announcement.

Since the energy storage program is a competitive solicitation, the Market Manager will not be able to offer individual assistance to potential Applicants in terms of walking them through the process on the phone or scheduling pre-application meetings to ensure that all the paperwork requirements are met. Instead, the Market Manager will use its mailbox at njreinfo@njcleanenergy.com to receive written questions on the solicitation; those questions, along with the Market Manager's answers, will be distributed to the Energy Storage listserv and posted on the NJCEP website on the 10th day of the Solicitation so that all potential Applicants can benefit from the exchange. Individual consultation with Applicants will be permitted following the issuance of incentive commitments.

Copies of applications deemed both complete and incomplete by the Market Manager will be distributed to all members of the Solicitation Evaluation Committee for their review. It will be at the discretion of the Committee to either evaluate or reject the incomplete applications. The Committee will evaluate the applications based on four criteria related to the program's goals.

[7] The Solicitation Evaluation Committee shall be comprised of representatives from the OCE, Market Manager, Program Coordinator and such other State agencies as may be appropriate (i.e., DEP). Evaluation criteria will be discussed in the following section.

Economic: The Committee will evaluate the cost-effectiveness of projects on the basis of the following:

- Incentive per kW of storage system's capacity (based on the system's full rated capacity) and per kWh of projected annual discharge
- Projected cost savings produced, demand response or ancillary service revenues generated by load shifting or other PJM market participation
- Other incentives for which the project may be eligible

Project Readiness: The Committee will evaluate projects on the basis of their readiness to be installed expeditiously, including:

- Projected completion date with realistic schedule and milestones
- Identifying and obtaining all necessary permits and interconnection approvals including, but not limited to, local permits, land use, CAFRA, National Fire Protection Agency safety requirements, etc.
- Providing examples of successful projects with similar energy storage technologies at existing sites with which the Applicant was involved

Technical: The Committee will evaluate projects based on:

- System efficiency (amount of power lost between charging and discharging)
- Maturity and proven success of the technology
- Commercial availability and "track record" of equipment
- Performance and reliability of the proposed energy storage system relative to cost

Resiliency: The Committee will evaluate projects based on whether:

- The host site is defined as a "public and critical facility"
- The system incorporates islanding capability
- The project benefits a large number of people as opposed to a single customer (end-user)
- The underlying renewable energy system and the facility itself are secure in the event of an emergency

Comment [G8]: This statement is almost impossible to satisfy except for lead-acid or Li Ion technologies, and they will have to stretch to show that they can operate successfully in a cycling energy environment, lead acid cannot do cycling, Li Ion cannot do 4 hour energy delivery at a reasonable cost. Suggest that wording be changed to reflect the maturity of the ESS proposed rather than requiring that projects are already functioning with the ESS.

Comment [G9]: This statement and the one following may discourage proposals with emerging energy storage technologies. I implies that these items will carry a lot of weight in the proposal evalustion. I suggest that the bidders be allowed to project success and track-record based on the prior development activity that shows the performance of the ESS storage component.

Comment [G10]: With the spec as written, islanding will not be possible unless a 4-hour island is adequate for the critical load being supported. It should be stated here again that islanding will be necessary for periods up to 7 days.

Based upon a discussion at the September 20 Energy Storage Working Group meeting, this straw proposal contains Staff's preliminary recommendation on the evaluation scoring system that will be applied to the solicitation responses. These scoring values are subject to change prior to approval by the NJBPU and are provided at this time to solicit stakeholder comments. The final evaluation scoring system will not be published in the solicitation but will be established by the evaluation committee prior to the release of the solicitation.

The Evaluation Committee shall review applications on the basis of the four criteria categories below. The categories will be weighted, with the weighting based on a possible total of 40

points that can be awarded to any one project. Funds are expected to be committed to the Applicants who are determined to rank highest on the point scoring system. The NJBPU reserves the right to reject all applications for any reason and to terminate this Solicitation round.

The proposed weighting for each category is as follows:

Category	**Weight as % of Total**	**Maximum Point Total**
Economic	30%	12
Project Readiness	25%	10
Technical	20%	8
Resiliency	25%	10
Total	**100%**	**40**

Each category will include criteria that are specific to that category. The evaluation of each of those criteria will determine the total score for the category.

The Committee will conduct its evaluation even if only one application is submitted in a solicitation round, or if multiple applications submitted in a solicitation round have a total requested incentive that is less than the funds available in that round. The lack of competition or the availability of funds does not mean that projects will be funded by default. In all cases, the Committee must make a determination that a project has met a minimum score in the evaluation process in order to receive a recommendation from the Committee to the NJBPU for an incentive payment.

###

Deborah Petrisko

From: Neal Zislin [nzislin@renuenergy.com]
Sent: Wednesday, February 26, 2014 10:30 AM
To: publiccomments@njcleanenergy.com
Subject: FW: Comments on Energy Storage Solicitation Straw Proposal

Scott:

This email has my signatory information at the bottom.

Regards,

Neal

From: Neal Zislin [mailto:nzislin@renuenergy.com]
Sent: Wednesday, February 26, 2014 10:28 AM
To: 'publiccomments@njcleanenergy.com'
Subject: Comments on Energy Storage Solicitation Straw Proposal

Mr. Scott Hunter
Office of Clean Energy
New Jersey Board of Public Utilities
44 South Clinton Avenue
Trenton, NJ 08625

RE: Comments – Energy Storage Solicitation Straw Proposal

Dear Scott:

Thank you for extending to stakeholders the opportunity to provide input on the Energy Storage Solicitation Straw Proposal. Renu Energy is pleased to offer these comments and recommendations to the Office of Clean Energy on the subject of the Energy Storage Solicitation Straw Proposal.

The Office of Clean Energy has underscored that the fundamental objective of this initial energy storage solicitation is for facilities providing critical services to the public to have access to emergency power in the event of a grid shutdown. There are opportunities to utilize electricity from the battery system to generate additional revenues or to avoid expensive, time-of-use power from the grid during the day. In crafting the solicitation, recognition of potentially competing interests for revenue generation and reliance on non-grid emergency power may exist. Further clarification is provided in the following.

Length of Battery Storage Power

- Length of battery storage system power output as stipulated from 1-4 hours is fine for time-shifted demand but is inadequate to provide sustained emergency power resources in the event of a weather-induced calamitous power interruption event. It is recognized that the energy storage system may be used more frequently for the purpose of time-shifted demand from the grid (see bullet #2 under Economic Impacts). Critical facilities will most likely need access to power for at least 24 hours and preferably 48 hours to span after-effects from a weather-induced calamitous power interruption given that normal restoration of sunlight might not occur the day after the event. It is worthwhile to consider imposing the condition for this first solicitation that the battery storage system at sites providing critical services to the public be fully charged and operational at all times.

Energy Storage Technology

- Proven commercially available energy storage technology advises a deep-cycle battery as being a suitable design for this application. The recommended operating mode is to deplete energy to no more than 80% designed storage capacity for lithium ion batteries and no more than 50% designed storage capacity for lead acid batteries before recharging in order to extend longevity of the battery. Lithium ion batteries will retain 80% of their original power output

after 2,000 cycles with 80% depth-of-discharge. Lead acid batteries will retain 60% original power output after 500 cycles with 50% depth of discharge. Unlike solar modules, a capital investment in excess energy capacity is required to provide a reasonable longevity of this battery storage system type.

Economic Impacts

- Our understanding is that the kilowatt-hours generated by the solar system and directed to the battery storage system must be released from the battery storage system to flow through the inverter and a production meter in order to register SREC credits. Over time, when operated in a reserve status, the battery system's energy storage level will slowly diminish due to leakage thus requiring some excess energy from the solar system to trickle charge the battery system. Power generated from the solar system would yield more electricity to be monetized if it is exported into the grid without a stepped-up transformer (and may even apply with a stepped-up transformer) than is used to charge a battery storage system. Both routes incur energy losses in conversion from DC to AC mode through the inverter while battery recharging incurs additional losses. These lost electrons diminish the potential revenue from the solar system-generated electricity (vs. export to the grid) because they do not produce SRECs.

- Ratepayers who currently pay for electricity based on time-of-use and have net-metered kilowatt-hour credits or pay a fixed rate would receive full retail credit for kilowatt-hours consumed during late afternoon and early evening and would not be inclined to draw power from the battery system. Ratepayers who currently pay for electricity based on time-of-use and don't have net-metered kilowatt-hour credits or who receive a demand-management incentive to not consume off the grid during this period would prefer to use the power from the battery storage system. Depleting the battery storage system during late afternoon and early evening under normal operating conditions may contribute to having insufficient energy capacity during an emergency (see next bullet). Operating the battery storage system in this mode will essentially minimize the number of kilowatt-hours being utilized from this system and constrain opportunities to generate other revenue streams. That leaves the battery storage system serving primarily as insurance in the event of a prolonged downtime of the grid.

- The solicitation may need to consider discouraging reliance on the battery storage system to provide power to the site or the grid under normal conditions. This constraint would specifically apply to the export of power into the grid to provide improved frequency control for the distribution network. The battery storage system will become partially or totally depleted until the next day or days when sufficient sunlight enables the solar system to deliver electricity in excess of the site's immediate demands to recharge the battery storage system. Operating the battery storage system during normal conditions may create a site vulnerability in which the battery system may not be able to deliver its designed available capacity during a crisis.

Regards,

Neal

Neal Zislin
VP Engineering
Renu Energy
www.renuenergy.com
nzislin@renuenergy.com
908-371-0014 (Office)
908-425-0089 (Cell)

Dear NJBPU Staff,

SolarCity appreciates the opportunity to provide feedback on the New Jersey Board of Public Utilities (NJBPU) straw proposal to inform the Board's anticipated solicitation to support the deployment of storage systems. SolarCity wholeheartedly agrees with the basic premise underlying the straw proposal, namely that energy storage, paired with renewables can play an invaluable role in achieving a multiplicity of objectives, including improving grid resiliency and emergency services in times of crisis, integrating and enhancing the value of renewable deployments, shifting load to reduce peak demand impacts, and providing grid services like frequency regulation. Realizing these benefits requires careful solicitation design to ensure that the eligibility criteria and evaluative framework used in the solicitation process work to effectively attract and identify projects that most effectively achieve the intended aims of this effort. With that in mind, SolarCity offers the following feedback on the staff straw proposal, by section.

Technology Eligibility:

- One of the conditions of eligibility is that the storage device be charged exclusively by the renewable energy system and not be charged by electricity imported from the distribution system or other on-site fueled generators (pg. 4). To ensure that this requirement does not reduce the opportunity to fully leverage the potential of storage systems to provide various services, foreclose on the possibility of providing ancillary services[1], or create unnecessary engineering complexity we recommend that this requirement be defined on a net annual basis. In other words, the total amount of energy discharged from the storage device in a calendar or energy year should be less than that provided by the renewable energy system in the same year.

- The straw proposal indicates that for purposes of load-shifting or emergency backup, the storage system must be capable of providing the host facility's full electric demand for a minimum of one hour and a maximum of four hours (pg. 4). SolarCity agrees that the desired window of discharge during a critical load event should be clearly stated in the straw proposal, as this defines the relationship between instantaneous power

[1] For instance, a storage device providing frequency regulation service would charge and discharge more or less continuously, and could require direct grid interface

capacity and total energy capacity, which is a major design factor affecting the nature and cost of storage solutions. However, for both emergency back-up and load-shifting, the requirement that the storage system be capable of meeting the host facility's full electric demand appears unnecessary.

- With respect to emergency back-up, the focus should be on critical loads, for example core loads associated with lighting, refrigeration, and heating and cooling needs that are necessary to provide basic services. SolarCity has significant experience deploying systems for emergency back-up, and in those cases, the systems are configured to serve loads that are identified as critical rather than all loads, some of which are more appropriately considered discretionary, for example pool pumps, loads associated with the use of consumer electronics, etc. We feel that this requirement may become especially salient when "multiple use" facilities (e.g. schools which serve as community extreme weather shelters) are considered

- Regarding load shifting capabilities, it is problematic to define the value of load shifting relative to the total load of the host site. For example, a large building that has a much greater peak demand than a smaller building should not be penalized in the solicitation process by virtue of its greater size, if the proposed storage system is capable of reducing the same amount of gross demand as a storage system on the smaller building. To the degree a project is capable of reducing more load served by the utility over a greater period of time, all else equal, that should result in that project being ascribed greater value in the evaluative process.

- Regular and active use of storage equipment for load-shifting can limit the system's ability to offset critical loads, as the system may be at any state of charge when a disaster occurs. SolarCity recommends that the evaluators specify whether any percentage of the equipment's capacity should be dedicated exclusively to critical load backup and left fully charged at all times.

Application Process and Evaluation Criteria:

- On page 7 of the draft straw proposal indicates that, "The Market Manager intends to revise the existing REIP forms – the Application Checklist, Application Form and Technical Worksheet – to reflect the nature of energy storage technology and the fact that the program is a competitive solicitation. A complete list of the application packet components will be included in the solicitation announcement." Recognizing the importance of these documents in the solicitation process, SolarCity requests that draft versions of these materials be made available and subject to comment prior to final adoption and issuance of the solicitation.

- The straw proposal identifies cost-effectiveness as one of the elements that will be taken into consideration and as part of that evaluation, that "projected cost savings produced, demand response or ancillary service revenues generated by load shifting or other PJM market participation" will be included (pg. 8) SolarCity agrees that cost-effectiveness is a critical element in the evaluation, but the straw proposal should clarify that any projections of value associated with system performance will be assessed using a standardized set of assumptions regarding the value of these various services provided rather than relying on applicants' individualized projections of those various potential value streams, which could result in applications being evaluated favorably based simply on more aggressive projections, as opposed to superior cost sharing in reality.

- SolarCity notes that consideration of developer experience is subsumed within the "project readiness" criterion (pg. 8). SolarCity submits that this should be a stand-alone category given that developer experience is a key factor in assessing the likelihood that a proposed project will actually come to fruition. Project development, particularly when combining multiple technologies within a complex regulatory environment demands that applicants have substantial experience and wherewithal to bring a project to completion. While clearly successful completion of similar projects is an important element, we also encourage the NJBPU to consider the totality of an applicant's capabilities and resources that can be brought to bear to ensure successful projects. The importance of developer experience should also be reflected by either elevating this to a stand-alone category, or increasing the weighting of the "project readiness" criterion, and developer experience within it, in the evaluative process.

- Under the technical attributes that will be considered, SolarCity notes that the inclusion of "system efficiency" appears unnecessary to the extent system efficiency should be factored into the economics of the project, and thus factored into any assessment of the value and anticipated costs of a project under the economic evaluation (pg. 8).

- In discussing resiliency, the straw proposal indicates that projects will be evaluated on, among other aspects, whether they are located at "critical and public" facilities as well as the extent to which the renewable systems and the facility itself are secure in the event of an emergency (pg. 8).

    - Regarding the "critical and public" nature of the facilities, SolarCity supports the intent of this element but recommends a more expansive definition that provides some additional flexibility than what may be provided in the definition included in footnote 6 of the straw proposal. For example, the state of Connecticut defines "critical facility" as "any hospital, police station, fire station, water treatment plant, sewage treatment plant, public shelter, or correctional facility any commercial area of a municipality, a municipal center as identified by the chief elected official of any municipality, or any other facility or area identified by the Department of Energy and Environmental Protection as

critical.[2] Similarly, the Maryland Energy Administration's "Fuel Up" program seeks to place storage devices at gas stations along emergency evacuation routes[3] , partially in response to the observation that a significant amount of the civil disruption experienced after extreme weather events comes from the inability to fuel private vehicles. SolarCity believes a similar approach should be taken here, with NJBPU being afforded some discretion to assess whether a proposed facility should be deemed critical.

- With respect to the security of the facility itself as well as of the renewable energy and storage system, again, SolarCity agrees with the inclusion of this element, but to facilitate project identification and development efforts, greater detail around how this will be assessed should be provided.

Respectfully Submitted on February 25, 2014

Andy Schwartz
Deputy Director of Policy and Electricity Markets
SolarCity

Email: aschwartz@solarcity.com
Telephone: 650.963.3879

[2] See http://www.cga.ct.gov/2012/ACT/Pa/pdf/2012PA-00148-R00SB-00023-PA.pdf
[3] See http://energy.maryland.gov/Business/fuelupmd/

Deborah Petrisko

From: Amar Pradhan [amar@10sixenergy.com]
Sent: Wednesday, February 26, 2014 4:41 PM
To: publiccomments@njcleanenergy.com
Subject: Re: Energy Storage Straw Proposal

I have previously opened and operated a energy technology business in New Jersey, Fluitec Wind (hiring 12 people in NJ), and have worked with both the NJEDA and NJBPU.

In regards to the Energy Storage Straw Proposal dated January 28, 2014, I have the following comments:

- There should be a reference and allowance for "Consumer Scale Energy Storage" to contribute to the overall demand. This means Energy storage that is <100kWh in capacity. Such Consumer Scale Energy Storage may require an aggregator to contribute to grid services. If the proposal is worded to only benefit grid-scale players, then ultimately households and small businesses will not be able to adopt energy storage in a significant way. Without such adoption, a significant opportunity to "democratize" energy usage will be lost.
- There should be reference to the fact that there will be multiple use cases for a given storage assets. Specifically, at certain times a given storage asset may be used for load shifting, back up power, solar storage, or frequency regulation. Moreover, that NJ should promote mechanism that allow for full utilization of the storage asset. Energy storage via batteries is a "use it or lose it" asset: most battery chemistries lose energy capacity every minute. Therefore the goal should be 100% utilization.
- The majority of energy storage devices have ideal working conditions that do not comply with load shifting; therefore I suggest that the Straw Proposal specify battery chemistries amenable to the use cases listed. As an example, Lithium ion batteries do not prefer to have deep charge and discharge cycles as is required by load shifting. Such batteries prefer small depth of discharges, such cycling is possible when providing Frequency Regulation. Deep cycling is better handled by flow batteries.
- There should be reference to the opportunity to aggregate Electric Vehicles, back up power / UPS, and similar to contribute to the end goals listed. Regardless of the primary use case of a battery, it can contribute to the needs of NJ as a secondary use case (e.g. when an EV is parked). This is important both to increase the ROI for the primary use case (i.e. get more EVs on the road), and help the grid.

Please contact me if you have any questions or thoughts on the above.

I am very interested to help in this process.

Thank you,

Amar Pradhan
CEO
10SIX
646-705-4585
amar@10SixEnergy.com

On Tue, Jan 28, 2014 at 5:29 PM, Garrison, Charlie J (NJ10) <charlie.j.garrison@honeywell.com> wrote:

Attached please find the Energy Storage Straw Proposal dated January 28, 2014. Please email comments to publiccomments@njcleanenergy.com by February 27,2014. The next meeting of the Energy Storage working group will be announced shortly.

Also attached please find the Energy Storage Working Group Meeting Notes from the meeting held on 9/20/13.

The schedule below highlights tentative dates in the timeline for issuing the solicitation:

- Jan. 28, 2014: Market Manager issues straw proposal for solicitation concepts; public comment period begins
- Week ending 1/31/14: Market Manager posts a Request for Information (RFI) survey on the NJCEP website with an announcement to the Energy Storage distribution list
- Feb. TBD, 2014: Energy Storage Working Group meeting
- Feb. 27, 2014: Comments due from stakeholders on the straw proposal (Send to publiccomments@njcleanenergy.com)
- Mar. 21, 2014: Market Manager submits solicitation document to NJBPU for approval
- Apr. 23, 2014: NJBPU agenda meeting; Board will vote on final program proposal
- May 2014: Roll-out of first solicitation.

Regards,

Charlie

Charlie Garrison
New Jersey's Clean Energy Program™
c/o Honeywell, Inc
145 Route 46 West
Wayne, NJ 07470

www.njcleanenergy.com

EnergyStorage mailing list

EnergyStorage@njcleanenergy.com
To make changes to your subscription preferences, be removed or request someone else be subscribed to this listserv please contact webmaster@njcleanenergy.com with your request or visit:
http://mail.njcleanenergy.com/mailman/listinfo/energystorage

RUTGERS UNIVERSITY

Dept. of Materials Science and Engineering
McLaren Center for Ceramic Research, 129
Rutgers, The State University of New Jersey
607 Taylor Road
Piscataway, NJ 08854-8065

www.mse.rutgers.edu
dunbar.birnie@rutgers.edu
Phone: 848-445-5605
Fax: 732-445-5595

26 February 2014

NJ Clean Energy Program
Energy Storage Working Group
Submitted electronically to: publiccomments@njcleanenergy.com

RE: Comments on the 012814 Straw Proposal on Energy Storage

Dear Colleagues,

I'm writing to provide comments on the Straw Proposal on Energy Storage that was circulated for public comment in January. It is excellent that the NJCEP will be encouraging the implementation of energy storage systems – and that they will be sited at renewable generation, which will provide the best chance that these storage units can also provide storm resiliency value.

First let me comment on the renewable generation intermittency and seasonal variation and the role of electricity storage should have. Presently, for solar installations to qualify for connection to the grid and operate with net-metering, they must be sized small enough that they generate no more than historical annual electrical need. Because our seasonal light-level variations are so large then this typically means that there could be significant generation beyond the local need during the summer, but the winter generation quantities are typically very low. And, certainly there are the night/day variations in generation and usage – though in some regards since the demand for electricity *system-wide* is substantially larger in the daytime, then solar generation is, at least mostly, aligned with the demand and should be used immediately rather than being saved for nighttime usage. So, following this reasoning it can be seen that behind-the-meter storage that reduces solar feed into the grid during summer daytimes (when the electricity value and demand is highest) and reduces nighttime grid demand (when the electricity value is lowest) is putting substantial extra financial *cost* on the system ratepayers instead of lowering the costs overall. While the battery might be used on-site as a load-shifting unit, there is an equal and opposite effect on the external grid for any load shifting that is operating locally. And, as an added problem the battery round-trip-efficiency might be smaller than 100%, essentially adding an energy tax that reduces the internal load-shifting gain that might be possible.

Instead, it would be much better to have the battery system operator freely able to perform energy arbitrage day and night according to rate schedules that incentivize a net leveling of the entire system demand. In this regard it would likely draw energy from the grid in times of low energy value and feed back to the grid when most needed by the majority of users and thereby lowering the amount of very expensive peaking generation that the utilities must provide in these times. This would be a major saving for the ratepayers and the electricity rate signals would then provide financial benefit to the battery operator to partly offset the cost of installation and O&M.

RUTGERS UNIVERSITY

Dept. of Materials Science and Engineering
McLaren Center for Ceramic Research, 129
Rutgers, The State University of New Jersey
607 Taylor Road
Piscataway, NJ 08854-8065

www.mse.rutgers.edu
dunbar.birnie@rutgers.edu

Phone: 848-445-5605
Fax: 732-445-5595

In addition to the energy value of the battery systems, they can provide ancillary services to the grid and should be allowed to earn fair-market value for the those services. One slight concern I have about the ancillary service value is that usually there is a lower-limit of power load that would be allowed to buy into participation in a sensible way – however since we are steering the storage to be in distributed smaller solar generation locations it is very possible that the battery sizes needed at these locations may be too small to count as ancillary service markets. For these sites then it might be possible to solicit aggregators or methods that would systematically utilize this distributed ancillary service load. Some allowances in how the ancillary service market is operated might be warranted.

A further value to the battery+solar installations is the possibility of operating in island mode when grid outages occur. During these times within the island it is natural that the sunlight would be captured during daytime and fed back during the night or for providing continuing power for a known duration (1 to 4 hours was suggested in the straw proposal) after the outage. Again, the size of many of the distributed generation sources is very small and the likely ability to provide full power for the location to have a steady-state fully-functional island mode is unlikely.

It is a relatively simple matter to operate the battery separately from the renewable generation in "normal mode" and essentially have the battery and the solar on separate meters. The solar would always feed the local need and continue to operate via net-metering. Simultaneously, the battery could perform both provide load-shifting and ancillary services tasks, which will give the battery operators the best chance of recouping their cost in the long run. Further, in situations of grid interruption then the battery can be switched immediately to connect with the local solar generation and operate in island mode storing solar for local use. This dual configuration has the best chance of generating the most revenue for the battery owner, and as a result will allow any subsidy to be minimized or spread thinner (and therefore benefitting the ratepayers the most).

For the storm resiliency question: in order to provide the most power/energy in times of storm for a selected building or installation then it would be most valuable to have the batteries sized to accept the maximum summer daily generation rather than smaller amounts. This implies a battery size that is quite a bit larger than would be needed for the local behind-the-meter needs of a building. However, even in times of storm outage it would be likely that only certain emergency circuits would be powered in island mode – but this could still be in buildings where public gathering and sheltering might be needed (fire houses, libraries, community centers, grocery stores(?), etc). So, it would be important to build in the financial incentives to support the larger batteries at these locations – and this would most sensibly be reached by allowing both energy arbitrage and ancillary services earning potential by the storage unit operator.

Finally, on the topic of battery technology maturity, the straw proposal is very restrictive about the extent of track record required for a battery technology to qualify. In my opinion there are many excellent battery technologies that are well demonstrated but may have rather less large-scale field experience, but ones that are increasing in maturity at a rapid pace. As with other programs that the BPU has sponsored in the past it would be sensible to encourage New Jersey

RUTGERS UNIVERSITY

Dept. of Materials Science and Engineering
McLaren Center for Ceramic Research, 129
Rutgers, The State University of New Jersey
607 Taylor Road
Piscataway, NJ 08854-8065

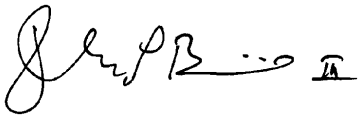
www.mse.rutgers.edu
dunbar.birnie@rutgers.edu

Phone: 848-445-5605
Fax: 732-445-5595

businesses and small companies that might be fielding such technologies. This certainly adds some risk that would be shouldered by the ratepayers, but at the same time it provides an avenue for local-grown economic development. And, if the pilot testing gives proof of lower cost and longer lifetime this could substantially benefit the ratepayers. Probably it would be wrong to *only* sponsor the newest technologies, but there should be room for exploration of new systems; this is the only way they will ever get the long-term field testing that your straw proposal is requiring.

In summary, I think the program would benefit from simplification and by adding the possibility of energy arbitrage. The simplification will make the program practical for a wider range of situations, and the energy trading will add another revenue stream and ultimately benefit the ratepayers. Together, these changes are likely to increase the interest that solar site operators may have for this program.

Sincerely,



Dunbar P. Birnie, III
Corning/Saint-Gobain • Malcolm G. McLaren Distinguished Professor

State of New Jersey
DIVISION OF RATE COUNSEL
140 EAST FRONT STREET, 4TH FL
P. O. BOX 003
TRENTON, NEW JERSEY 08625

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

STEFANIE A. BRAND
Director

February 27, 2014

Via Hand Delivery and Electronic Mail
Honorable Kristi Izzo, Secretary
New Jersey Board of Public Utilities
44 South Clinton Avenue, 9th Floor
P.O. Box 350
Trenton, New Jersey 08625-0350

Re: Comments of the New Jersey Division of Rate Counsel
Fiscal Year 2014 Energy Storage Program Straw Proposal Issued January 28, 2014

Dear Secretary Izzo:

Enclosed please find an original and ten copies of the Comments submitted on behalf of the New Jersey Division of Rate Counsel ("Rate Counsel") in connection with the above-captioned matter. Copies of the comments are being provided to all parties on the e-service list by electronic mail and hard copies will be provided upon request to our office.

We are enclosing one additional copy of the comments. Please stamp and date the extra copy as "filed" and return it in our self-addressed stamped envelope.

Thank you for your consideration and assistance.

Respectfully submitted,

STEFANIE A. BRAND
Director, Division of Rate Counsel

By: Sarah H. Steindel
Sarah H. Steindel, Esq.
Assistant Deputy Rate Counsel

c: OCE@bpu.state.nj.us
publiccomments@njcleanenergy.com
Elizabeth Ackerman, BPU
B. Scott Hunter, BPU
Jerome May, BPU
Tricia Caliguire, Esq., BPU
Rachel Boylan, Esq., BPU
Marisa Slaten, DAG

Comments of the New Jersey Division of Rate Counsel
Re: Fiscal Year 2014 Energy Storage Program Straw Proposal
February 27, 2014

The Division of Rate Counsel ("Rate Counsel") would like to thank the Board of Public Utilities ("Board") Office of Clean Energy ("OCE" or "Staff") for the opportunity to present comments in response to the Energy Storage Straw Proposal issued January 28, 2014.

Background

Under the FY2014 New Jersey Clean Energy Program ("NJCEP") Compliance filing, adopted in the Board's June 21, 2013 Order in Docket No. EO12050376V, Staff proposed to establish an incentive program for energy storage. The Compliance Program, as approved allocates $2.5 million in funding, to be awarded through a competitive solicitation process.[1] Staff subsequently convened an Energy Storage Working Group to obtain stakeholder input into various aspects of and eligibility criteria for a competitive solicitation.[2] Based on the input from the Working Group, Staff developed an Energy Storage Straw Proposal which was circulated to stakeholders on September January 28, 2014.

Staff proposes six goals which will drive the overall solicitation: (1) focusing on projects that are integrated with existing or proposed behind-the-meter Class I renewable energy resources and that can be completed as expeditiously as possible; (2) establishing caps on incentive amounts; (3) prioritizing projects at "public and critical" facilities; (4) promoting the future integration of energy storage technology into renewable energy systems; (5) prioritizing projects that offer the greatest benefits to ratepayers, and (6) demonstrating the benefits and

[1] Straw Proposal, pp. 1-2.
[2] Straw Proposal, p.2.

revenue streams that flow from energy storage technology, with the objective of developing markets that operate without ratepayer subsidies.[3]

In addition to the basic eligibility standards from the existing Renewable Energy Incentive Program ("REIP"), Staff is proposing several limitations on types of technologies and systems that would be eligible for subsidies: (1) energy must be stored in the form of electricity; (2) the stored electricity must be generated by the renewable energy system, not imported from the distribution system or generated by on-site fossil generation; (3) the system must be capable of providing the host facility's full electric demand for a minimum of one hour and a maximum of four hours for purposes of both load shifting and emergency backup; (4) the technology must be proven and commercially available, and able to operate for at least ten years; and (5) the project must be replicable at other sites, scalable, expandable, able to support different types of renewable energy systems, and it must have the potential to provide opportunities for future applications.[4]

The program would be conducted as a competitive solicitation, with applicants proposing the incentive amounts they are requesting. Incentive amounts would be capped at $500,000 per project or 30 percent of the project's total installed costs less any other incentives. Furthermore, no one end-use entity could request more than $750,000 in total.[5] Finally, to encourage completion of projects in as short a time frame as possible, OCE proposed that projects not completed within a 12-month period forfeit 10 percent of the approved incentive.

---

[3] Straw Proposal, p. 3.
[4] Straw Proposal, pp. 4-5.
[5] Straw Proposal, p. 5.

Comments of Rate Counsel

Rate Counsel appreciates the OCE's desire to move from fixed incentives to incentives determined though a competitive solicitation. Rate Counsel also supports Staff's proposal to continue the eligibility standards from the existing REIP. Rate Counsel further supports OCE's goals of maximizing ratepayer benefits and encouraging the development of markets that can sustain themselves without ratepayer subsidies.

Rate Counsel does note, however, that the results of this initial solicitation are difficult to predict. As noted in the Straw Proposal, the proposed Energy Storage incentive program is a new one. The level of interest in this program, and the incentive amounts applicants will request, are unknown. It will be important to carefully re-evaluate this program based on the results of the initial solicitation. Depending on the response to this initial solicitation, it may be appropriate to re-evaluate parameters such as the technology restrictions, the per-project and per-entity incentive caps, and the incentive structure. The results of the initial solicitation should allow OCE to evaluate whether energy storage technologies are sufficiently mature and cost-effective to be capable of become self-sustaining with a reasonable investment of ratepayer dollars.

Rate Counsel also has concerns about Staff's proposal to require all projects to have the ability provide the host facility's full electric demand for a one- to four-hour period both for purposes of load shifting and to provide emergency backup. This proposed requirement results in a program that combines two distinct goals (1) encouraging development of energy storage technologies, and (2) promoting "islanding" capability. Before introducing such a requirement, OCE should first consider, analyze and present for stakeholder feedback the benefits and costs that are likely to result from pursuing both goals in a single program. There may be some overlap between facilities where energy storage is cost-effective and those that are most important for

storm resiliency. However, facilities that can cost-effectively integrate energy storage with existing or planned renewable energy systems may not be the same facilities that will create public benefits by remaining operational following a storm event. [6]

An "islanding" requirement applicable to all projects is likely to result in higher requested and granted subsidy levels, and the exclusion of many, possibly more cost-effective, projects from the solicitation process. The result could well be higher ratepayer-funded subsidies to provide resiliency benefits to facilities that do not necessarily provide essential services following a storm or other event resulting in widespread outages.

In lieu of an absolute requirement, Rate Counsel recommends that the Board recognize the public benefits of "islanding" capability for critical and public facilities as part of the criteria for ranking applications. In other words, the ranking criteria could assign a value to "islanding" capability for projects serving public and critical facilities. However, no recognition should be given for "islanding" capability for host sites that do not provide public benefits. All applications could then be screened for cost-effectiveness, without excluding all projects lacking "islanding" capability.

Conclusion

Rate Counsel does not object to the proposed Energy Storage solicitation. However, this program should be carefully re-evaluated based on the results of the solicitation. Additionally, in lieu or requiring "islanding" capability for all projects, the Board should reflect the benefits "islanding" capability for projects located at public and critical facilities as part of its criteria for ranking applications.

---

[6] Rate Counsel raised similar concerns at page 5 of Rate Counsel's comments filed July 19, 2013 in connection with the Board's Combined Heat and Power/Fuel Cell Working Group.

February 27, 2014

VIA ELECTRONIC MAIL

Mr. Scott Hunter
Renewable Energy Program Administrator
New Jersey Office of Clean Energy
New Jersey Board of Public Utilities
44 South Clinton Avenue
Post Office Box 350
Trenton, NJ 08625-0350

Re: Fiscal year 2014 Energy Storage Program, Straw Proposal Comments

Dear Mr. Hunter:

The Environmental Defense Fund ("EDF") thanks New Jersey's Office of Clean Energy ("OCE") and Board of Public Utilities ("BPU") for this opportunity to comment on the January 28, 2014 Energy Storage Program Straw Proposal ("Straw Proposal"). EDF is a national non-profit membership organization engaged in linking science, economics and law to create innovative, equitable and cost-effective solutions to society's most urgent environmental problems. EDF has more than 750,000 members nationwide and over 32,000 in New Jersey. As an organization, EDF has been active in New Jersey on environmental issues since the 1970's, most recently submitting comments on the combined head and power/fuel cell program (2013), proposed by the New Jersey Clean Energy Program.

EDF strongly agrees with the OCE's determination that energy storage, tied to renewable generation, can serve as an important resource in shifting renewable generation, providing additional frequency regulation, and increasing energy resiliency.[1] Clean energy, including storage, is receiving significant consideration in various contexts within New Jersey, such as the 2011 New Jersey Energy Master Plan ("NJ EMP"), OCE Comprehensive Resource Analysis

[1] OCE Straw Proposal, Fiscal Year 2014 Energy Storage Program (January 28, 2014) at 1.

(FY14-FY17) ("CRA"), and the recently released New Jersey Community Development Block Grant Action Plan Amendment ("NJ Action Plan Amendment" or the "Amendment").[2]

The NJ EMP, filed over two years ago, set forth a "strategic vision for the use, management, and development of energy in New Jersey over the next decade."[3] It provided foundational goals, including reducing peak demand, capitalizing on emerging technologies, and promoting a diversity of clean, in-State generation. It explicitly noted the role that energy storage could play in furthering these goals, stating that "[e]nergy storage has a promising future, especially when coupled with intermittent resources like solar and wind."[4] Specifically, the NJ EMP asserted that "large-scale energy storage is used to provide electricity during periods of peak demand, and thus serves as a source of peaking generation. On a smaller scale, energy storage is used to reduce demand, and acts as a substitute for peaking generation. Either way, energy storage tends to flatten the load curve, and can lower costs for all customers by reducing the need for peaking generation sources."[5]

The CRA, filed in early 2013, affirmed the State's commitment to increasing energy storage throughout New Jersey, with renewable energy and energy storage included as a major budget category.[6] As stated in the CRA, "energy storage holds much promise as a tool that can address problems and opportunities associated with the intermittent nature of many renewable energy systems, including wind and solar."[7] The CRA also noted that energy storage can provide additional benefits as a "means of ensuring the operation of critical facilities during power outages."[8] Lastly, the CRA allocated funding to the program contemplated in the Straw Proposal.

More recently, the NJ Action Plan Amendment states that "[d]istributed generation technologies - technologies such as combined heat and power, fuel cells, and solar with storage - proved extremely resilient following Superstorm Sandy and can offer critical facilities across New Jersey a path for building energy resilience."[9] The Amendment proposes one tool to advance these technologies – an "energy resilience bank" that "will provide the resources New Jersey's critical facilities need to invest in fuel cells, combined heat and power, solar with storage, and other technology that will better prepare water and wastewater facilities, schools

---

[2] 2011 New Jersey Energy Master Plan (December 6, 2011); OCE, Revised CRA Straw Proposal, Proposed Funding Levels FY14-FY17 (March 28, 2013); The State of New Jersey Community Development Block Grant-Disaster Recover Partial Action Plan Amendment Number 7, Substantial Amendment for the Second Allocation of CDBG-DR Funds per the Disaster Relief Appropriations Act of 2013 (Public Law 113-2, January 29, 2013), available at http://www.nj.gov/dca/divisions/sandyrecovery/pdf/NJ%20Action%20Plan%20Substantial%20Amendment%202%202%20final.pdf.
[3] NJ EMP at 1.
[4] *Id.* at 10.
[5] *Id.* at 123.
[6] CRA at 46.
[7] *Id.* at 52.
[8] *Id.* at 57.
[9] NJ Action Plan Amendment at 3-26.

and hospitals, police and fire stations, and other key community infrastructure for future extreme weather events."[10]

Like the NJ EMP, CRA, and NJ Action Plan Amendment, this Straw Proposal provides a tool to advance New Jersey's broader storage, clean energy, and resiliency goals. EDF is supportive of aspects of the contemplated program design, but believes the opportunity exists to strengthen it by: 1) adding a monitoring and reporting component; 2) modifying included technology and technical criteria; and 3) ensuring that technology is not only island-ready, but built to forward-thinking resilient standards. Adoption of these recommendations would not only provide for a stronger program design, but better match the program's structure to its stated and intended goals. EDF addresses each recommendation in turn below.

1. Monitoring and Reporting

Effective monitoring and reporting can ensure that positive steps accomplished by this program are not lost or isolated. Given that the State is engaged in a number of clean and resilient energy initiatives, a monitoring and reporting component could be critical in communicating program benefits, challenges, and design features to the public, interested parties, and other State agencies.

A monitoring and reporting component may already be contemplated by the OCE, as the CRA, which allocates funding for this energy storage program, also allocates funding for general program evaluation. EDF requests information as to the extent that monitoring and reporting is already being considered, and urges the OCE to ensure that any monitoring and reporting that does occur is transparently provided to the public. We additionally recommend adding an express monitoring and reporting component to the Straw Proposal's program design, as it is currently unclear whether and how such monitoring and reporting is contemplated.

The OCE should consider how to shape a monitoring and reporting component. Other States have engaged in efforts to encourage storage, such as California's recent storage procurement framework and design program, and could provide helpful benchmarks in designing this component.[11] EDF recommends that at a minimum, the degree to which storage is able to shift renewable generation, supply frequency regulation, and allow for reliability of electric service should be monitored and reported. Challenges and benefits in reaching stated goals should also be assessed and shared, so that successful implementation can be replicated and possibly brought to scale.

Monitoring and reporting requirements should be incumbent on both program participants and the OCE. One possible option would be to require participants to provide identified information to the OCE, which in turn could form a report to be distributed publicly.

---

[10] *Id*. at 3-15.

[11] California's Storage Procurement Framework and Design Program establishes a target of 1,325 MW of energy storage to be procured by the California utilities by 2020 (California Public Utilities Commission, Docket R. 10-12-007).

2. Technology and Technical Requirements

The Straw Proposal contains a number of beneficial technology and technical requirements and criteria. However, EDF seeks clarification in regard to the project design's 1) maximum storage requirement[12] and 2) technical criteria.[13]

First, the Straw Proposal states that "[f]or purposes of load shifting or emergency backup, the storage system must be capable of providing the host facility's full electric demand for a minimum of one hour and a maximum of four hours."[14] While a minimum hour requirement is beneficial in furthering the stated goals of resiliency, energy shifting, and frequency regulation, it is unclear why a maximum requirement is necessary or helpful. If a project is able to provide additional hours of energy, while still meeting the Straw Proposal's criteria and other requirements, it would go further to meeting the Straw Proposal's stated goals. If the project is unable to economically provide energy storage beyond four hours, other eligibility requirements and criteria would be sufficient in ensuring other, more beneficial, cost-effective projects are selected.[15] Any maximum will limit the resiliency benefits of the energy storage, undermining the Straw Proposal's stated purpose of "keeping critical public functions operational during power outages."[16] The electric grid can experience extended failures, far exceeding the proposed four hour maximum. For example, the NJ Action Plan Amendment notes that "roughly 80 percent of all energy failures experienced during Superstorm Sandy required at least one week for repair. Almost 30 percent of the shutdowns required two or more weeks to restore power."[17] Ensuring that power remains on in critical facilities is a foundational resiliency target in this Straw Proposal, and would be hindered by capping the length of time for which a facility could run on the stored energy.

In addition, the benefits of storage, including demand response, frequency regulation, and shifting renewable generation, could be limited by this maximum. Thus, the proposed maximum could impair the cost-effectiveness of energy storage, in effect hampering participation in the program.

Second, EDF seeks greater information regarding three of the Straw Proposal's stated technical criteria: 1) "maturity and proven success of the technology," 2) "commercial availability and 'track record' of equipment," and 3) "performance and reliability of the proposed energy storage system relative to cost." How would the necessary information be gathered, analyzed, and determined? The data source and set – be it supplied as part of the customer application or other point – necessarily creates the baseline judgment for these criteria. EDF thus seeks clarification as to how such a baseline will be established, and recommends that this analysis be transparent to all parties involved.

---

[12] Straw Proposal at 4.
[13] *Id.* at 8.
[14] *Id.* at 4.
[15] *See, e.g.* Straw Proposal requirements at 4 ("the energy storage project provides the greatest benefit to the New Jersey ratepayer") and criteria at 8 ("projected cost savings produced"; "performance and reliability of the proposed energy storage system relative to cost").
[16] Straw Proposal at 3.
[17] NJ Action Plan Amendment at 3-28.

3. Island-Ready and Resilient Storage

EDF fully supports the resiliency criteria provided in the Straw Proposal, particularly the requirement of "islanding capability."[18] The Proposal likewise includes as a criterion that "the underlying renewable energy system and the facility itself [be] secure in the event of an emergency."[19] This criterion is critical, and should be understood to encompass the storage device itself. Without a hardened system, the resiliency provided by storage will be unavailable during an extreme weather event. Protection of the underlying asset is thus a necessary foundation to all other resiliency benefits the system can provide.

To the extent that it is not already encompassed in the criterion noted above, the OCE should additionally require that the renewable energy system and storage device be hardened to appropriate levels in vulnerable areas. Absent such an express requirement, systems that are otherwise sound in design, fully automated, and with excellent economics, may fail during the very emergencies when they are needed, due to inundation or other storm effects. The National Oceanic and Atmospheric Administration (NOAA) has prepared a report estimating global sea level rise by 2050, which could be helpful in determining the level of hardening to require. This report, "Global Sea Level Rise Scenarios for the United States National Climate Assessment" (NOAA Assessment") is noted and referenced in NJ Action Plan Amendment, and could be used to provide guidance in creating this requirement.[20] Utilizing the NOAA Assessment would help to ensure the resiliency of the underlying asset and its availability in the event of an extreme weather event.

Conclusion

EDF thanks the OCE for the opportunity to submit the foregoing comments. In light of Superstorm Sandy, it is clear that clean energy storage is one tool the State can use to advance energy resiliency. However, as the Straw Proposal indicates, distributed clean energy resources, including storage, can provide a myriad of benefits if designed properly. For example, clean energy storage, as designed in the Straw Proposal, can not only allow for energy resiliency, but also provide frequency regulation and shifting of renewable generation. EDF encourages the OCE to continue using a forward thinking and market-based approach to identify ways in which distributed clean energy resources can provide a number of benefits. Doing so will ensure that multiple State objectives can be met through clean energy projects and designs.

---

[18] Straw Proposal at 8.
[19] *Id*.
[20] *See also* NJ Action Plan Amendment: "In prioritizing and selecting energy resilience projects for Bank support, the State will review design options that ensure that energy technology will be appropriately elevated, walled, or otherwise resilient to potential future flooding and storm surge." P. 3-34.

Respectfully signed and submitted on February 27, 2014

ENVIRONMENTAL DEFENSE FUND

/s/ Mary Barber

Mary Barber
Director, Smart Power Initiatives
Environmental Defense Fund
257 Park Avenue South, 17th Floor
New York, NY 10010
Phone – (212) 616-1351
mbarber@edf.org

/s/ Michael Panfil

Michael Panfil
Attorney
Environmental Defense Fund
257 Park Avenue South, 17th Floor
New York, NY 10010
Phone – (212) 616-1217
mpanfil@edf.org

/s/ Elizabeth Stein

Elizabeth Stein
Attorney
Environmental Defense Fund
257 Park Avenue South, 17th Floor
New York, NY 10010
Phone – (212) 616-1327
estein@edf.org

viridityenergy
power economics redefined

1801 Market Street ■ Suite 2701 ■ Philadelphia, PA 19103 ■ phone: 484-534-2222 ■ fax: 215-564-3842 ■ www.viridityenergy.com

February 27, 2014

Via email to publiccomments@njcleanenergy.com

New Jersey Board of Public Utilities
44 South Clinton Avenue
Post Office Box 350
Trenton, NJ 08625-0350
Attention: Charlie J. Garrison

Re: Straw Proposal, Fiscal Year 2014 Energy Storage Program

Dear Mr. Garrison:

Viridity Energy, Inc. ("Viridity") appreciates the opportunity to comment on the New Jersey Clean Energy Program's straw proposal for the Fiscal Year 2014 Energy Storage Program. Viridity's comments focus on aspects of the straw proposal that, without clarification, may pose serious obstacles to the success of funded projects.

1. *Source of electricity placed into storage*.

Viridity understands the proposed requirement that electricity placed into storage must be generated by the renewable energy system with which the storage device is integrated. Allowing a storage device to be charged from the grid during hours when energy prices are low, and then discharged when prices are higher, does not advance the integration of storage with on-site renewable generation.

However, the proposed requirement should be clarified to reflect an understanding of the regulation service that the storage device can provide to the grid. Failure to clarify the straw proposal would eliminate the opportunity to provide frequency regulation via a renewables/storage combination.

PJM has explained how it directs the charging and discharging of a storage device following the dynamic regulation ("RegD") signal:[1]

[1] PJM Interconnection, L.L.C., Order No. 755 Compliance Filing, March 5, 2012, p. 8.

• In response to sudden Area Control Error ("ACE") movements, PJM first uses flexible, fast-ramping resources following the RegD signal to counteract those sudden movements.

• Next, PJM directs slower-responding resources to take over the response.

• As the slower-responding resources take over, PJM adjusts the RegD signal so that it slowly resets the fast-ramping resources to a midpoint – where they are ready to correct the next ACE movement.

That frequent resetting of the RegD resources to the midpoint means that those resources are repeatedly brought back to what is essentially a zero net charge or discharge. The grid operator sends the storage device a "regulation down" signal to direct the storage device to absorb energy from the grid, and sends a "regulation up" signal to direct the device to release the stored energy back to the grid; but the cumulative effect of the varying signals is to repeatedly bring the storage device back to the state of charge where it started.

Unless the straw proposal is clarified to confirm that this zero net charge/discharge is an allowable use of the storage device, projects funded under the solicitation would be prohibited from providing regulation service. This would contradict the straw proposal's intention to demonstrate energy storage technology benefits and revenue streams toward developing markets that can be sustained without further ratepayer contribution.

2. *Providing host facility's full electric demand for 1-4 hours*.

The straw proposal notes that energy storage can help support resilience, by supporting the continuation of essential services during outages on the grid. Viridity understands that the high priority on resilience is reflected in the requirement for a storage system to be capable of providing the host facility's full electric demand for at least one hour.[2]

However, Viridity suggests that the need to satisfy the host facility's electric demand should be met more holistically, using all of the assets at the host facility – not just the storage device – to meet electric demand. Both electric generating assets (such as the on-site renewable energy facility) and electricity-consuming assets should be included in the plan to satisfy the facility's electric demand. With respect to electricity consuming assets, the plan to satisfy the facility's electric demand should include strategic curtailments of portions of the facility's load. For example, if the facility normally maintains a temperature of 70 degrees during warm weather, raising the temperature setpoint to 78 degrees would make more effective use of the limited

[2] Viridity has no objection to the four-hour cap in the straw proposal.

amount of stored electricity. Similarly, not all of the host facility's lighting needs to burn brightly during an entire outage; neither do all elevators necessarily have to be in service.

Viridity therefore recommends that the straw proposal be revised, in the "Technology Eligibility" section on page 4, so that the first sentence of the third bullet is deleted and replaced by the following:

> For purposes of load shifting or emergency backup, the storage system (in combination with on-site generation and flexible demand) must be capable of providing the host facility's full electric demand for a minimum of one hour. The capability of the storage system to provide the host facility's full electric demand shall not exceed four hours.

3. *Incentive structure*.

The straw proposal states that properly structured incentives "should provide only the incremental amount required to motivate investment, the tipping point at which a project becomes economically feasible without creating a ratepayer-financed windfall for the developer or end-user."

Viridity recognizes the need to stretch ratepayer dollars as far as possible. At the same time, the incentive structure should not discourage innovative strategies to operate project assets in a way that maximizes revenues and creates cost savings for the host facility. Consider two separate projects, each using the same size and types of assets. One project is operated to provide maximum economic benefits to the host facility, while the other project delivers lesser benefits. The project with the lesser benefits should not receive a greater incentive in order to reach the "tipping point"; the project that delivers greater benefits should not have its incentive reduced. Viridity respectfully suggests that the incentive structure should be designed to encourage the use of operational strategies that can be demonstrated as best practices to enhance the economic sustainability of each project.

Thank you for your consideration of these comments.

Very truly yours,

Allen Freifeld

Allen Freifeld
Senior Vice President
Law, Public Policy, and Operations

Comments of Solar Grid Storage
To the BPU Energy Storage Straw Proposal

February 27, 2014

Solar Grid Storage LLC, a company of long-time solar veterans dedicated to the widespread deployment of solar and clean energy, appreciates the opportunity to provide these comments to the Office of Clean Energy.

We believe the Straw is well written and mostly well conceived but has **two fatal flaws** that will prevent meaningful and cost-effective deployment of storage with solar and unnecessarily lose the extraordinary opportunity to have entities **outside of NJ pay for** most, of additional storage investments. -- that is, the federal government with it's 30% Investment Tax Credit and Accelerated Depreciation, and PJM with its Ancillary Services markets. The Straw as currently written will **eliminate** this opportunity and put the entire burden of this program on the NJ ratepayer – and in our opinion, reduce the amount of storage connected to renewables to a pittance.

Fatal Flaw 1 - Page 4 under Technology Eligibility, second bullet, second sentence: "The storage device may not be charged by electricity imported from the distribution system or generated by other on-site fossil fueled generators." This provision as written will ***eliminate*** the opportunity for PV projects to use its equipment to provided ancillary services to the grid operator for grid balancing and other power quality issues. This is directly ***counter*** to stated goals of the program including in the Economic criteria on page 8 that specifically values the "ancillary service revenues generated by load shifting or other PJM market participation."

When using PV + storage systems for ancillary services, PJM sends a signal for either rapid charging or discharging of a certain amount of power from a PV + storage system to help them most efficiently balance power on the grid. Rules of PJM have the charging and discharging netting to zero every hour, so even at night when PV is not generating power, the net energy imported from distribution system is zero. This issue has been much discussed in both the net metering and energy storage working groups conducted by the BPU, and should be put behind us -- or ratepayers in NJ will be denied an opportunity to most cost-effectively increase grid system resiliency and provide critical load power to hosts of solar power during power outages.

We want to make it very clear that without an appropriate fix to this provision there will be no new meaningful storage in New Jersey.

Proposed fix - change the offending sentence to the following with changes in ***bold red italics:***

"The storage device may not be charged by electricity ***generated by on-site fossil-fueled electricity or*** imported from the distribution system, ***except for short-term charging and discharging that enables ancillary services with no material nighttime net import or export from the grid."***

Fatal Flaw 2 – Technology Eligibility, third bullet, first sentence: "For purposes of load shifting and emergency backup, the storage system must be capable of providing the host's facility full electric demand for a minimum of one hour and a maximum of four hours."

This is an error of understanding of the current costs of battery storage, how it works and/or the typical PV system size relative to the load of the residence or building. Rarely will the PV system size, and therefore the battery size, provide enough power for the full demand of a home or building. In most cases a storage system would have to be oversized (and overly expensive) to meet the requirement as written, and just in practical terms, a one hour battery is a good goal but simply too expensive at this time, and unnecessary if you design for critical loads. A slight change to the language would correct this and open up the opportunity for a more near-term and meaningful number of PV + storage systems to be installed to much wider and cost-effective applications. Focusing on publicly available emergency centers such as schools, firehouses, and municipal buildings makes sense.

Proposed fix - "For purposes of load shifting and emergency backup, the storage system must be capable of providing the host's facility full electric demand for a minimum of one-***half-***hour ***or powering critical loads for eight*** hours."

Again, we want to thank the BPU for proposing this program and compliment the BPU staff for a mostly well-conceived and appropriately competitive structure of the program. If revised as we proposed, New Jersey will have the most practical and cost-effective storage incentive program in the country, quickly providing New Jersey ratepayers with meaningful levels of storage and added levels of resiliency for both individual PV + storage customers and the ratepayer paid distribution system in general.

We are happy to respond to any additional questions or comments.

Respectfully submitted,

Thomas Leyden
CEO
Solar Grid Storage LLC
tleyden@solargridstorage.com
609-498-6479 office

A.F. Mensah, Inc.
New Jersey Board of Public Utilities Energy Storage Straw Proposal Comments

A.F. Mensah, Inc. (AFM) is happy to submit our response regarding the New Jersey Board Public Utilities Energy Storage Straw Proposal. While drafting this response, we solicited comments from our end use customers who vary in application, location, and load criticality. Collectively, our main points below summarize the need to have a technically efficient design yielding maximum sustainability and reliability during grid disturbances.

The first response to the NJBPU addresses the technical requirement, ***"Electricity placed into storage must be generated by the renewable energy system to which the storage is integrated. The storage device may not be charged by electricity imported from the distribution system or generated by other on-site fossil fueled generators. (Page 4)"***

This requirement, as written, may be misleading and may unintentionally exclude certain key applications and certain system configurations, which may offer greater benefits for reliability. Requiring that the storage device does not charge from the distribution system will prevent the battery from providing frequency regulation to the grid. The frequency regulation application was one of the battery applications that were encouraged in the straw proposal. Requiring that the storage device does not charge from the distribution system will also prevent AC coupled configurations, which may otherwise offer technical, revenue settlement, and other business benefits for certain systems.

As such, AFM would recommend the following set of requirements:

1. Storage device must be co-located with the renewable energy asset behind the same customer account meter
2. Storage device must be sized to provide at least half-hour at rated renewable output. This means that for each 1W of renewable installed, the storage device should be rated at 1W, with a minimum rated capacity of 0.5Wh.
3. Storage device and renewable system must be configured to work together in order to provide power to the host facility during a power outage.

AFM's last comment is regarding, ***"For purposes of load shifting or emergency backup, the storage system must be capable of providing the host facility's full electric demand for a minimum of one hour and a maximum of four hours. Stakeholders are encouraged to offer comments on the maximum time threshold and whether a longer threshold should apply to facilities that are defined as "public and critical" (page 4).***

Sizing based on full electrical demand may in certain cases lead to a cost prohibitive battery storage size. It is recommended that sizing be based on the full rating of the renewable energy system, with a minimum storage capacity of 30 min. i.e. for every 1W of renewable energy installed, the storage asset should be 1W with at least a 0.5Wh rated capacity. Adopting this criteria with an optimal battery capacity sizing approach, a system can be sized and configured to support most critical loads for extended periods of time, especially when this configuration takes advantage of the renewable generation during grid outages.

We thank the New Jersey Board of Public Utilities for considering our comments and look forward to further discussions.

Climate Change Mitigation Technologies LLC
1009 Park Avenue, New York, NY 10009
Telephone: 212-472-1860
rkenard@ntea.info

92 Park Street, Montclair, NJ 07042
Telephone: 973-622-5672
Jsherman2001@gmail.com

To: New Jersey Board of Public Utilities
New Jersey Clean Energy Program
Scott Hunter

From: Climate Change Mitigation Technologies LLC

Date: February 27, 2014

Re: CCMT Comments on NJBPU Battery Storage Straw Proposal

Climate Change Mitigation Technologies, LLC, a New Jersey limited liability company (CCMT), is pleased to submit the following comments on the Board of Public Utilities' Battery Storage "straw proposal" dated January 28, 2014. The purpose of this comment is to identify a potential battery energy storage project that CCMT and Montclair State University (MSU) are discussing that would be located on the MSU campus in Montclair, NJ.

The major elements of the project under discussion are as follows: A battery pack of sufficient size / storage capacity would be installed on the MSU campus and connected to MSU's existing 300 kW solar PV panel. The power from the existing solar PV panel would then be stored in the battery pack and fed into five (5) MSU campus shuttle buses retrofitted to be full battery electric buses. The buses would be charged using the WAVE wireless inductive charging technology (www.waveipt.com). This would create a 100% green and resilient energy pathway for MSU's shuttle bus fleet which would operate on the campus and in the community.

In addition to storing and fueling the wirelessly-charged battery electric buses, the battery would be used to time-shift energy, shave peak loads, and earn frequency regulation service revenue from PJM during normal conditions. During emergency conditions the battery and inverter would also be able to supply a source of back-up emergency power to the Dining Hall at Heights dormitory complex, turning it into a place of refuge for MSU students and staff during emergency events.

Potential Project partners are: Montclair State University, Climate Change Mitigation Technologies, Princeton Power Systems, and Viridity Energy.

Respectfully Submitted,

Climate Change Mitigation Technologies LLC

Raymond J. Kenard, Managing Member

BEFORE THE NEW JERSEY BOARD OF PUBLIC UTILITIES

FY2014 Energy Storage Straw Proposal

COMMENTS

DOCKET NO. NOI-2014-0001

COMMENTS OF THE ENERGY STORAGE ASSOCIATION

Pursuant to the FY2014 Energy Storage Straw Proposal ("Proposal"), the Energy Storage Association ("ESA") appreciates the opportunity to submit the following comments and information for the Board's consideration.

I. ABOUT THE ENERGY STORAGE ASSOCIATION

The ESA is an international trade association that was established over 20 years ago to foster development and commercialization of energy storage technologies. Since then its mission has been the promotion, development and commercialization of competitive and reliable energy storage delivery systems for use by electricity suppliers and their customers.

ESA members represent a diverse group of entities, including electric utilities, energy service companies, independent power producers, technology developers involved with advanced batteries, flywheels, compressed air energy storage, pumped hydro, supercapacitors and component suppliers, such as power conversion systems. ESA's members also include researchers who are committed to advancing the state-of-the-art in energy storage solutions. See Attachment 1 for a full list of ESA members.

The ESA engages in regulatory, legislative and policy efforts and includes among its membership leaders in the energy storage marketplace. Member companies have firsthand knowledge of the regulatory challenges that need to be overcome to finance and operate commercial-scale energy storage facilities and are working to promote the development and commercialization of competitive and reliable electricity storage systems within the United States. The ESA is looking forward to serving as a resource to the Board of Public Utilities for New Jersey.

II. THE BENEFITS OF ENERGY STORAGE

ESA believes that energy storage technologies and applications enable all generation sources on the grid to operate more efficiently, flexibly, and resiliently; facilitate integration of renewable energy resources on the grid; reduce greenhouse gas emissions; and lower costs for consumers. Energy storage resources are currently operating on the nation's grid and are used in a variety of applications to balance generation and load in an efficient and cost-effective manner. Energy storage technologies are ideally suited to assist with grid resiliency and increased reliability. Energy storage can reduce greenhouse gas emissions. A study by Carnegie Mellon in October 2008 estimated that 20% of the CO2 emission reduction and up to 100% of the NOX emission reduction expected from introducing wind and solar power will be lost because of the additional ramping requirements these resources impose on traditional generation.[1] Storage provides the flexibility to integrate renewables into the electric grid without consuming additional fossil fuels needed to meet the ramping requirements of renewable energy generation resources.

[1] Katzenstein, W., and Jay Apt. Air Emissions Due To Wind And Solar Power. *Environmental Science & Technology*. 2009, 43, 253-258. http://pubs.acs.org/doi/pdf/10.1021/es801437t

Many energy storage facilities are in operations or under construction, providing a rich operating history across a range of applications and use cases. The table below lists over 200 MW of advanced energy storage projects in operation or under construction; most of these projects are by ESA companies who are developers/owners, storage suppliers, inverter suppliers or integrators. This is simply a sample of the multiple energy storage projects under development.

Facility (Location)	Developer/Owner	Technology	COD	MW
Beacon Tyngsboro (MA)	Beacon Power	Flywheel – Beacon	2008	Up to 3
Stephentown Spindle (NY)	Beacon Power	Flywheel – Beacon	2011	20
Laurel Mountain	AES	Battery – A123	2011	32
Hazle Spindle (PA)	Beacon Power	Flywheel - Beacon	2013	20
Kahuku (HI)	First Wind	Battery – Xtreme	2011	15
Various U.S. Projects	AEP	Battery – NGK	2006-10	13
Auwahi (HI)	Sempra Generation	Battery – A123	2012	11
East Penn (PA)	East Penn/Ecoult	Battery – Ecoult	2012	3
Notrees (TX)	Duke	Battery – Xtreme	2013	36
San Jose (CA)	PG&E	Battery – NGK	2013	4
Westminster (CA)	Southern Ca. Edison	Battery – A123	2011	4
Vaca Dixon (CA)	PG&E	Battery – NGK	2013	2
Borrego Springs (CA)	SDG&E	Battery – Dow Kokam	2013	1
Catalina Island (CA)	Southern Ca. Edison	Battery – NGK	2011	1
Borrego Springs (CA)	California Utility	Battery – Saft	2012	0.5
San Diego (CA)	California Utility	Battery – Saft	2012	0.07
Philadelphia (PA)	SEPTA	Battery – Saft	2012	1.5
Kona (HI)	HELCO	Battery – Saft	2012	0.2
New York City (NY)	Con Edison	Battery – Saft	2012	1
Wailea (HI)	MECO	Battery – A123	2013	1
Tait (OH)	AES	Battery	2013	20
Angamos (Chile)	AES	Battery	2011	20
Los Andes (Chile)	AES	Battery	2009	12

III. COMMENTS ON THE PROPOSAL

ESA is pleased that the New Jersey BPU has undertaken this effort and understands that the program will focus on applications behind the meter; limit incentive amounts to allow for a greater number of projects; prioritize facilities based on critical needs; facilitate integration with renewable energy systems; ensure benefits accrue to the New Jersey taxpayer; and demonstrate energy storage value streams with a sustainable future market. We also understand that a key driver of this program is the need to increase resilience and flexibility on the distribution system serving New Jersey residents. We believe energy storage is well suited to meeting this need and that these technologies and applications can fulfill the goals of this initiative.

1). Develop resilience metrics. ESA recommends, with these goals and drivers in mind, that the Board develop metrics that will build resilience into the cost-benefit analyses when evaluating projects considered for funding by this program. In areas of extreme weather events where the grid has been compromised, the health and well being of citizens can be at risk. Energy security has a value and that should be included in calculating the benefits of energy storage.

2.) Allow combinations of technologies and durations. ESA believes that the duration requirements of the program as well as the need to provide full back-up power are arbitrary and will overlook technologies that would otherwise be considered useful for consumers. We recommend that projects that combine energy storage technologies to meet any duration requirements be considered eligible for the program. Allowing for aggregation of technologies will build in redundancy and allow for more flexible use of the energy storage equipment. We also recommend that the energy storage system not be required to provide full power to the

facility but instead cover critical loads on dedicated circuits.

3.) Permit energy storage to serve multiple functions. ESA recommends that energy storage facilities in this program be available when appropriate to provide services to the grid when not providing back-up power to the customer in the case of outage. Energy storage resources can provide numerous solutions for challenges to the electric grid—from generation services like arbitrage, ancillary services and renewables firming, to transmission and distribution services such as reducing circuit and line overload, enabling grid resiliency, and voltage support. Because of the ability to provide the grid a variety of services, this program should allow the capturing, valuation, and monetizing of the multiple benefit streams that energy storage applications provide as stand-alone resources. We believe this would ensure that these projects are as cost-effective as possible for the New Jersey consumer.

4). Recognize difficulty of limiting charging from renewables. We understand that this program is a companion to the New Jersey Clean Energy Renewables Program and appreciate the goal to ensure that these renewables resources are available to continue service to the consumers able to continue to serve consumers after states is closely tied to the renewable energy goals of the state. Outside of this program, ESA believes that limiting the charging to a dedicated renewable resource will be limiting to both the cost-effectiveness and the flexibility of these applications. Energy storage technologies can take a charge from any resource on the grid, then deployed when most cost-effective and most useful.

IV. CONCLUSION

ESA appreciates the opportunity to offer recommendations to this FY2014 Energy Storage Straw Proposal and looks forward to continuing to work with the Board and its stakeholders by offering additional comments; providing case studies and operational information; and testifying before the Board as this policy is more fully developed and implemented in New Jersey.

Respectfully submitted.

ENERGY STORAGE ASSOCIATION

By its Policy Director,

Katherine Hamilton
ESA Policy Director
1155 15th Street, NW, Suite 500
Washington, DC 20005
k.hamilton@energystorage.org
202-524-8832

Attachment 1

MEMBERS OF ENERGY STORAGE ASSOCIATION

(as of January 3, 2014)

Corporate Members (96)

- 1Energy Systems, Inc.
- 24M Technologies, Inc.
- A123 Energy Solutions
- ABB, Inc.
- AES Energy Storage
- Ambri
- American Vanadium
- Aquion Energy
- Aartha USA
- Argonne National Laboratory
- Axion Power International, Inc.
- Beacon Power LLC.
- Beckett Energy Systems
- Black &Veatch Corporation
- Brown Rudnick LLP.
- BYD America
- California ISO
- Cellstrom GmbH
- CODA Energy, LLC.
- Customized Energy Solutions
- DNV GL Energy
- Duke Energy
- Dynapower Company LLC
- EaglePicher Technologies, LLC.
- East Penn Manufacturing Co., Inc.
- Electrovaya
- ENBALA Power Networks
- Energy and Environmental Economics, Inc.
- EnerDel
- EnerSys
- EnerVault Corporation
- EnStorage Israel Ltd.
- Eos Energy Storage
- EPRI
- Exelon Generation
- Fairfield Energy Partners, LLC
- FIAMM
- FirstEnergy Service Company
- GE Energy Storage
- Global Energy Pvt. Ltd.
- Greensmith Energy Management Systems
- HDR Engineering, Inc.
- Highview Power Storage
- Hitachi Chemical Co. America
- Hydrogenics Corporation
- Ice Energy
- Imergy Power Systems
- INABENSA
- INGETEAM INC.
- Innovation Core SEI, Inc.
- Landis+Gyr
- LG Chem Power
- MCV Energy Systems, Inc.
- Microvast*
- Mitsubishi Electric Power Products, Inc.
- National Electric Contractors Association (NECA)
- Nation-E
- Navigant Consulting
- NextEra Energy Resources, LLC.
- NGK Insulators, LTD.
- Oncor
- Pacific Northwest National Laboratory
- Panasonic
- Parker Hannifin – Energy Grid Tie Division
- PJM Interconnection, LLC
- Premium Power
- Primus Power Corp.
- Prudent Energy Corporation
- Public Service Co. of New Mexico
- RedFlow Limited
- RES Americas
- S&C Electric Company
- Safe Hydrogen, LLC.
- Saft America, Inc.
- Samsung SDI America Inc.
- San Diego Gas & Electric
- Sandia National Laboratories
- Saskatchewan Research Council
- SkyPower Services
- Southern Company
- Southwest Research Institute
- Steffes Corporation
- Strategen Consulting, LLC
- Sun Catalytix Corporation
- SunEdison, Inc.
- SustainX
- Sutherland Asbill & Brennan LLP
- TAS Energy
- Temporal Power Ltd.
- Townsend Capital, LLC.
- TRA International
- UniEnergy Technologies
- Viridity Energy
- Woodward, Inc.
- Xtreme Power
- ZBB Energy Corporation

Individual Members (20)

- Abbas Akhil, Renewable Energy Ventures, LLC
- Richard Baxter, Mustang Prairie, LLC
- John Boyes, John Boyes Consulting
- James M. Eyer, E&I Consulting
- Pete Hamilton, Better Energies, LLC
- William V. Hassenzahl, Advanced Energy Analysis

- Darrell Hayslip, Narrow Gate Energy, LLC
- Udi Helman
- Michael Kepros, Kepros Battery Consulting
- Matt Lazarewicz, Energy Storage Solutions, LLC.
- Robert Lockhart, Acuity Power Group
- Kenneth J. Lutz, AMR Strategies
- Jeff Pierson, Bethesda Capital LLC
- Anthony Price, Swanbarton Limited
- Charles Ricker, Ricker Strategic Advisors
- William Riley, Aquifer Based Hydroelectric Systems
- Susan Schoenung, Longitude 122 West, Inc.
- Zach Taylor
- H. Chandler Williamson, HCW Consulting

Deborah Petrisko

From: Govi Rao [grao@noveda.com]
Sent: Saturday, March 01, 2014 9:05 AM
To: publiccomments@njcleanenergy.com
Cc: Garrison, Charlie J (NJ10)
Subject: Comments on the Categories and Criteria for evaluating energy storage proposals

My apologies for the delayed response to the working committee draft on the categories/criteria for evaluating energy storage proposals. Considering the evolving remediation work that is being undertaken world-wide from using technologies without evaluating downstream implications, I believe we should ensure that all proposals are evaluated on environmental and human health related impact. While resiliency of the technology is critical, so also is the impact on the environment and human health. Being proactive about this is extremely critical and it will irresponsible of us not to have such criteria as part of the primary evaluation. Thanks.

Govi Rao
President and CEO
c: 610.745.9590 |w: 908.685.6448 |f: 908.458.9190
3434 Rt. 22 W| Suite 110 | Branchburg | NJ 08876

www.noveda.com |www.makemesustainable.com|

Comments Relative to BPU Straw Proposal

The straw proposal issued by the NJ BPU on 28 January specifies that the FY 2014 Energy Storage Program's objectives are:

- Shifting renewable generation to more optimal times of day, and
- Providing some of the additional frequency regulation that may be required with higher levels of intermittent renewable energy.
- A subsidiary objective is to provide emergency power during grid outages during which the storage system is to provide a minimum of 1 hour and a maximum of 4 hours of maximum load.
- The storage system is to be recharged only by solar energy, not energy from the grid.

While commending the BPU for taking NJ into the future with Distributed Energy Resources that complement a very significant national leadership for Solar PV deployment Partnerships One are hereby submitting comments which we believe will improve the BPU straw proposal prior to release as an RFP

We believe that the above requirements are too restrictive, and unnecessarily complicate the design of battery storage systems. Furthermore, these restrictions directly contradict two of the broad goals for the selection criteria; yielding highest economic return for investment funding, and moving quickly to an unsubsidized market commercial adoption.

- The systems will require lithium-ion batteries and are therefore expensive..
- Restricting the storage exclusively to PV generated electricity diminishes the utility of the storage as a grid interacting "buffer" asset and thus lowers its effective ROI. It also complicates the design of the storage power electronics and increases its cost.
- Storage of grid-generated off-peak power can provide meaningful demand management and support to the grid during stressful periods on-peak.
- The inclusion of electric vehicle batteries, either while in the vehicles or after their end-of-life removal, together with extending operation of underutilized solar inverters to provide overnight power conversion can improve the economics of storage investments, as shown in Appendix A with technical validation shown in Appendix B and a specific example described in Appendix C.
- Electric power storage for demand management, frequency regulation and emergency power is equally if not more important to microgrids as it is to the grid itself. A specific example is described in Appendix D

RECOMMENDATIONS

- **The FY 2014 Energy Storage Solicitation should allow for the storage and subsequent discharge of grid-generated electricity to produce meaningful revenue and support for the grid. This can be limited to a maximum allowable net energy transfer (to satisfy utility concerns), but must permit net metering within this limit.**

- **The FY 2014 Energy Storage Solicitation should allow for the explicit inclusion of Electric Vehicle batteries as storage media together with bidirectional inverter-chargers, either within the vehicle or as secondary battery reuse after their removal.**

- **Future Energy Storage Solicitations should include preferential language (ie weighting criteria) to encourage the application of battery storage for frequency regulation requirements of microgrids. A very limited number of Vehicles/batteries can play a major role in maintaining the resilience and reliability of a micro grid.**

APPENDICES:

A	Comparative Economics of Current-Requirement Driven Solutions
B	The NSF Sponsored Vehicle Solar Grid (VSG) Program
C	Aberdeen Township – Vehicle-Solar Municipal Solution
D	Madison, NJ Microgrid Demonstration

Appendix A

Comparative Economics of Current-Requirement Solutions

Shifting energy to more optimal times of day implies many deep discharge cycles during a year. Providing frequency regulation implies that the batteries will be operated below a state of full charge. Both of these conditions rule out the use of inexpensive lead acid batteries, which are otherwise ideal for uninterruptible power. A reliable, long-lived battery storage system will require lithium-ion batteries at a cost of approximately $0.50 to $1.00 per Watt-hour of storage capacity. The inverter/chargers to charge the batteries from the solar PV array and discharge them as AC power to local loads and to the grid will add another $0.50 to $1.00 per Watt of power capacity. Thus at a discharge rate of 1C (one amp output per amp hour of battery capacity) the major equipment amounts to $1.00 to $2.00 per Watt of solar capacity. Engineering, permitting, balance of plant and installation will add another $0.50 to $1.00, for a total of $1.50 to $3.00 per solar Watt, approximately equal to the cost of the solar installation. Thus the addition of storage to a solar plant doubles its cost. The same is true of residential systems.

The revenue from frequency regulation will amount to approximately $40 per megawatt hour connected and successfully bid (assumed to be 50% of the time), or $0.175 per Watt on an investment of as much as $3.00, a 5.8% return. The value of capacity shifting of PV energy will be minimal because the PV output matches closely the demand on the grid. In fact limiting the storage to PV energy will increase the cost of the storage system because the storage battery will have to be DC connected to the PV array, a technology that will add complexity and cost more than the common AC connection.

The value of an emergency power source is roughly equivalent to a natural gas fired emergency generator at $0.50 per Watt, which increases the return to 6.8% on the balance. This is barely enough to meet the interest payments without massive incentives. With a 30 % NJ subsidy and the 30% Federal tax credit (if it applies) the return increases to 18%, or a 7-year payback with interest at 5%.

The value of shifting off peak grid generated power into the daytime hours is significant, and the solicitation should be modified to allow this to happen. This will provide a valuable demand management tool to PJM and the utilities, and lower cost power to the user.

Partnerships One, LLC, a New Jersey-based technology company which has been involved in electric vehicle propulsion technology since 2006 has pioneered the concept of Vehicle-Solar-Grid integration to create a more favorable utilization of assets. Vehicles with their expensive lithium-ion batteries are parked for much of the time and certainly at night. PV systems with their expensive inverters and net metering connections are also inactive at night. VSG offers a means to tie these underutilized assets together to provide ancillary services to the grid for revenue and to keep the PV array functioning to provide emergency power in case of power outages.

The physical means to do this are expected to cost approximately $0.60 per Watt in quantities up to 1000 and significantly less at larger quantities. This is just about offset by its value as an emergency power source. The vehicle batteries are paid for, as are the solar inverters and balance of plant. The return, even assuming no operation in the daytime, is $0.0875 on a very small net investment, much more attractive than a stand-alone storage system.

The automobile companies are actively pursuing the use of vehicle batteries for electric storage. Nissan, in addition to being the market leader in battery electric vehicle sales, has pioneered the Leaf-to-Home system in Japan for emergency power during outages. The technology exists to make this connection.

The VSG concept has been technically validated in a Phase I Small Business Innovation Research project funded by the National Science Foundation and described in Appendix B. The technology can be implemented in the near term with hardware supplied by Princeton Power Systems, another New Jersey-based technology company.

The solicitation should encourage the inclusion of electric vehicles and their batteries as storage media.

Appendix B

The NSF Sponsored Vehicle Solar Grid (VSG) Program

Vehicle-Solar-Grid Integration Test at GridSTAR

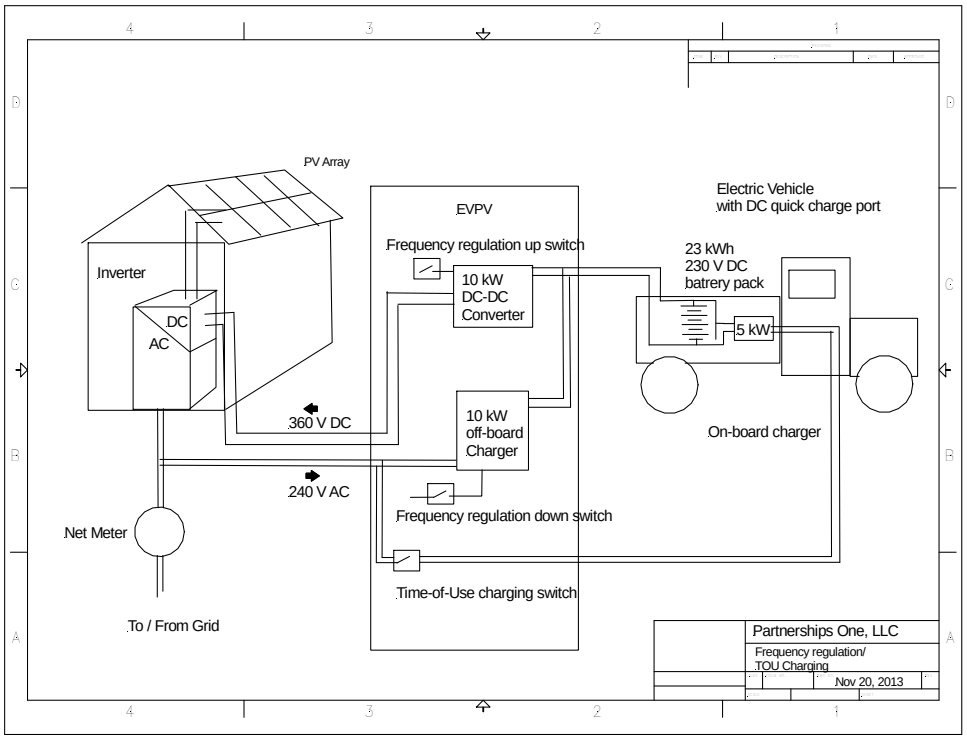
*(From an article in Current Events **46** (1) p 1,10-11 January, 2014, By Paul H. Kydd)*

Vehicle-Solar-Grid (VSG) integration is a new vehicle-to-grid concept that is being tested at the recently built GridSTAR facility at the Philadelphia Navy Yard.

The advent of large numbers of electric vehicles will soon provide a major resource of distributed electric storage capacity in the U.S. Typically a single vehicle will have a 20 kWh capacity battery and as few as 1000 vehicles represents 20 megawatt hours of electric storage. Typically also these vehicles are in use only a few hours a day and can be plugged in to the grid the rest of the time.

Similarly there is an increasing number of solar photovoltaic installations with grid-tied inverters which are idle during the night time hours. VSG seeks to provide the key linking technology to combine these under utilized assets to provide distributed, dispatchable electric storage capability to the grid, as shown in the schematic diagram. This capability can be valuable enough to provide an incentive to the owners of PV systems and EVs.

Schematic Diagram



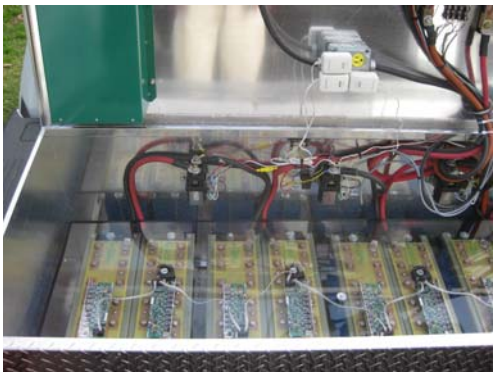
The schematic diagram shows VSG interface equipment, which we call an EVPV, linking an electric vehicle to an existing grid-tied solar inverter. The prototype has been built under a

National Science Foundation Small Business Innovation Research Phase I project by Partnerships One, LLC, with subcontracts to Penn State and Customized Energy Solutions.

There are two connections to the vehicle. One is a standard J1772 AC connection to the 5 kW on-board charger to charge the battery after use. It is equipped with a Time-of-Use switch to perform charging when power is cheapest if desired.

The other connection is a quick charge DC connection to the battery pack. This could be a ChadeMO conector as used by the LEAF and other Japanese vehicles. It provides a high power path to take power from the grid or give it back in response to requests from your friendly electric utility grid Independent System Operator (ISO), who is responsible for keeping the grid frequency synchronized and power flowing to everyone.

The ISOs solicit bids daily for ancillary services, typically hour by hour for the following day, and accept enough bids to satisfy their need, typically about 1% of system capacity. Winners get paid the bid price, assuming they actually deliver what they promised. There are many other details, but broadly this is the source of the revenue we are seeking to realize with the VSG technology.



23 kWh battery pack with Manzanita 5 kW on board charger.

The EV is a 2004 Ford F-150 converted by Partnerships One, LLC, with a 23 kWh battery and a 5 kW onboard charger shown here. It is linked to the grid via the Electric Vehicle-PhotoVoltaic (EVPV) unit containing a 10 kW off board charger for down regulation and a 10 kW DC-DC converter for up regulation, and appropriate switches and data acquisition equipment to perform regulation service and earn revenue.

The EVPV installed at the Penn State University GridSTAR facility at the Philadelphia Navy Yard is shown next, along with the team putting together the hardware and software to accomplish VSG.

The Phase I project concluded in December, 2013, with tests of the system at GridSTAR to demonstrate frequency regulation and the interaction between the demands of VSG and normal operation of the vehicle.

EVPV installed next to net zero energy GridSTAR house at Philadelphia Navy Yard.

A Phase II proposal has been prepared for 2014-2016 to extend the system to users distributed over Eastern Pennsylvania, New Jersey, Delaware and elsewhere in the PJM service territory to demonstrate aggregation of a number of vehicles into a meaningful supply of stored energy and perhaps earn revenue for the participants. To learn more about our project visit our web site chargedupcar.com, and if you are interested, fill out a participant form to be considered for inclusion in Phase II

Acknowledgements: This project has been supported by the National Science foundation under SBIR Phase I Grant No. IIP 1314675. Our host at GridSTAR is Prof. David Riley of Penn State University.

Appendix C

Aberdeen Township – Vehicle-Solar Municipal Solution

Taking as an example the 200 kW solar system at Aberdeen, NJ, which serves the municipal offices and the police department. Six 30 kW inverters handle this power

To accomplish the goal of integrating PV generation and battery storage the Princeton Power Systems 30 kW GTIB (Grid-Tied Inverter-Battery) inverter/battery charger has been configured to charge vehicles. To do this the units are derated to 15 kW, so a total of 13 units is needed to accept the maximum power from the solar array at a cost of $600,000. The balance of plant will cost approximately $100,000 for a total of $700,000. (Future engineering development will allow operation at full power, cutting the cost per kW in half).

These units are configured to charge Nissan Leaf electric vehicles and eventually can be extended to other EVs. Partnerships One has been in discussions with Nissan since 2012 to develop this type of grid integration using their batteries. Initially thirteen 24 kWh Leaf battery packs will be purchased, giving a total storage capacity of 312 kWh and a maximum power output of 195 kW limited by the inverters. Later upgrade to double the power output is possible. As electric vehicles come on board to provide storage, the Leaf batteries can be withdrawn to other projects for credit. The 312 kWh of storage provides for an hour and a half of emergency power at the full rating of the PV system. The cost of the packs is estimated at $130,000.

The total cost of the installation is thus $830,000.

The cost saving from capacity shifting PV energy only is likely to be small, perhaps zero. Solar energy offsets the afternoon peak demand for air conditioning thereby providing near optimal time of use support to the grid. Capacity shifting from off peak power at night to the daytime peak might provide $8000 of revenue per year.

The revenue from frequency regulation will be 200 kW x $40/1000 x approximately 4000 hours per year successfully bid, or $32,000.

The alternative of a 200 kW natural gas emergency generator would cost something like $100,000.

With a 30 % Federal tax credit and a 30% NJ storage incentive the net investment by the township will be: $830K – 250K (tax credit) = 580 – 175K (NJ incentive) = $405K.

The frequency regulation revenue will return 8%, (10% with capacity shifting at night).
With municipal bond interest at 5%, the investment will amortize in 15 years with off peak power shifting. With advanced technology inverter chargers the amortization shrinks to 8 years.

The risk is that the frequency regulation revenue may not be as high as forecast, (though it may be higher and there may be other revenue opportunities associated with storage). . The risk is offset by the advantage of having emergency power from the batteries and from keeping the solar array functioning during an outage.

In future years with more electric vehicle batteries available and with further upgraded inverters,

the investment in a 200 kW system could be as little as $150,000, and the incentive could be withdrawn.

Appendix D

Madison, NJ – Vehicle-Solar Municipal Solution (2015+)

Madison NJ is the Municipal Power provider to its 16,000 residents and multiple businesses, schools, and government facilities housed within a 4 square mile footprint. It is also situated on a main track line for NJ Transit carrying the Midtown Direct commuter line. The borough electric department has instituted net metering policies that make this available to all electric service customers. There are currently 10 residences that have installed solar panels and inverters and are presently connected through Net Metering.

Madison offers the ideal setting for the "crucible" evaluation the Vehicle-Solar-Grid concept from two distinct perspectives;

- Iimplementing a near term residential electric vehicle aggregation and control pilot for local commuters that can inform a broader program template for the state, and
- Incorporating vehicle-based storage (or secondary use EV battery systems) as a stabilizing element within a planned future Microgrid supporting critical municipal resilience needs.

These programs could begin as individual segment solutions and over time allow demonstration of very *tightly* ***integrated*** *and* ***collaborative*** public-private clean energy based resilience programs. Further concept description is provided below, and is intended to highlight the flexibility that can be obtained from a broader definition of qualified storage solutions..

RESIDENTIAL PROGRAM

A minimum of (5) residents from Madison who currently have solar panels, and (5) residents without panels, will be recruited into the trial program that will connect owned or leased electric vehicles during the overnight hours into the PJM Ancillary Services market. The vehicles will be subsidized through the 2015+ Energy Storage program funding. If sufficient funds are available, an additional facility will be placed at the Madison train station parking facility to evaluate extending daytime participation for these services.

The objective of the program will be as follows:

- Demonstrate the potential for earned revenue from EV batteries to significantly offset the procurement price for the vehicle (stimulating future EV adoption)
- Profile and compare the energy consumption patterns and resulting carbon footprint for all participants, and compare between the two subgroups.
- Obtain data for possible implementation of a generally available rate class offer for all electric service customers.
- OPTIONAL: Evaluate the operation of a "workplace charging" scenario for commuter vehicles parked at the Madison train station.

MUNI/PUBLIC PROGAM

As part of a move toward incorporating local distributed generation as a resilience improvement strategy, Madison is considering implementing advanced microgrid control systems that could enable extended islanded operation in the event of a catastrophic event. This will include additional Distributed Energy Resources (DER) such as batteries and intelligent energy management systems. In order to achieve the ROI that ratepayers expect, the net system cost must be minimized (which is also true for the larger regulated EDCs). This will be achieved through the normal operation of the assets in a revenue generating capacity through the PJM markets.

The microgrid will evolve over time, but will center on allowing islanded operation for several public accessed operations. Below is the priority list for these:

- Downtown Public Safety and Boro Hall
- Drew University
- Town Well Water Pumps
- Sewage Treatment plant
- Large Corporate facilities
- Municipal School buildings

Because the islanded microgrid requires continual and precise load balancing and local fast regulation, the use of batteries will be critical. As described in Appendix A, the economics of dedicated storage tilt strongly toward utilizing storage from assets that have multiple economic utilization. A small fleet of municipal-owned electric vehicles would be ideal to serve in this capacity as an integrated frequency regulation resource for the periodic microgrid balancing operation, and would operate similarly to the residential EVs overnight to participate in PJM markets during normal grid connected operation.

This concept can be explored further under this program, or under other advanced Clean Energy pilot programs that the BPU is driving forward. It should be noted that although Madison Municipal Electric does not participate in the societal benefit charge, the value of learning through this small “crucible” utility would greatly benefit **all** NJ ratepayers by informing a cohesive energy policy governing the transition of the regulated EDCs toward the inevitable Distributed Energy Resource environment.