

JUSTIN R. BARNES

(919) 825-3342, jbarnes@eq-research.com

EDUCATION

Michigan Technological University

Houghton, Michigan

Master of Science, Environmental Policy, August 2006
Graduate-level work in Energy Policy.

University of Oklahoma

Norman, Oklahoma

Bachelor of Science, Geography, December 2003
Area of concentration in Physical Geography.

RELEVANT EXPERIENCE

Director of Research, July 2015 – present

Senior Analyst & Research Manager, March 2013 – July 2015

EQ Research, LLC and Keyes, Fox & Wiedman, LLP

Cary, North Carolina

- Oversee state legislative, regulatory policy, and general rate case tracking service that covers policies such as net metering, interconnection standards, rate design, renewables portfolio standards, state energy planning, state and utility incentives, tax incentives, and permitting.
- Responsible for service design, formulating improvements based on client needs, and ultimate delivery of reports to clients. Expanded service to cover energy storage.
- Oversee and perform policy research and quantitative or qualitative analysis to fulfill client requests, and for internal and published reports, focused primarily on state solar market drivers such as net metering, rate design, incentives, and renewable portfolio standards.
- Provide expert witness testimony on issues related to overall DG policy, rate design, cost of service, and DG costs and benefits.

Senior Policy Analyst, January 2012 – May 2013;

Policy Analyst, September 2007 – December 2011

North Carolina Solar Center, N.C. State University

Raleigh, North Carolina

- Responsible for researching and maintaining information for the Database of State Incentives for Renewables and Efficiency (DSIRE), the most comprehensive public source of renewables and energy efficiency incentives and policy data in the United States.
- Managed state-level regulatory tracking for private wind and solar companies.
- Coordinated the organization's participation in the SunShot Solar Outreach Partnership, a U.S. Department of Energy project to provide outreach and technical assistance for local governments to develop and transform local solar markets.
- Developed and presented educational workshops, reports, administered grant contracts and associated deliverables, provided support for the SunShot Initiative, and worked with diverse group of project partners on this effort.
- Responsible for maintaining the renewable portfolio standard dataset for the National Renewable Energy Laboratory for use in its electricity modeling and forecasting analysis.
- Authored the *DSIRE RPS Data Updates*, a monthly newsletter providing up-to-date data and historic compliance information on state RPS policies.
- Responded to information requests and provided technical assistance to the general public, government officials, media, and the energy industry on a wide range of subjects, including federal tax incentives, state property taxes, net metering, state renewable portfolios standard policies, and renewable energy credits.



- Extensive experience researching, understanding, and disseminating information on complex issues associated with utility regulation, policy best practices, and emerging issues.

SELECTED ARTICLES and PUBLICATIONS

- EQ Research and Synapse Energy Economics for Delaware Riverkeeper Network. *Envisioning Pennsylvania's Energy Future*. 2016.
- Barnes, J., R. Haynes. *The Great Guessing Game: How Much Net Metering Capacity is Left?*. September 2015. Published by EQ Research, LLC.
- Barnes, J., Kapla, K. *Solar Power Purchase Agreements (PPAs): A Toolkit for Local Governments*. July 2015. For the Interstate Renewable Energy Council, Inc. under the U.S. DOE SunShot Solar Outreach Partnership.
- Barnes, J., C. Barnes. *2013 RPS Legislation: Gauging the Impacts*. December 2013. Article in Solar Today.
- Barnes, J., C. Laurent, J. Uppal, C. Barnes, A. Heinemann. *Property Taxes and Solar PV: Policy, Practices, and Issues*. July 2013. For the U.S. DOE SunShot Solar Outreach Partnership.
- Kooles, K, J. Barnes. *Austin, Texas: What is the Value of Solar; Solar in Small Communities: Gaston County, North Carolina; and Solar in Small Communities: Columbia, Missouri*. 2013. Case Studies for the U.S. DOE SunShot Solar Outreach Partnership.
- Barnes, J., C. Barnes. *The Report of My Death Was An Exaggeration: Renewables Portfolio Standards Live On*. 2013. For Keyes, Fox & Wiedman.
- Barnes, J. *Why Tradable SRECs are Ruining Distributed Solar*. 2012. Guest Post in Greentech Media Solar.
- Barnes, J., multiple co-authors. *State Solar Incentives and Policy Trends*. Annually for five years, 2008-2012. For the Interstate Renewable Energy Council, Inc.
- Barnes, J. *Solar for Everyone?* 2012. Article in Solar Power World On-line.
- Barnes, J., L. Varnado. *Why Bother? Capturing the Value of Net Metering in Competitive Choice Markets*. 2011. American Solar Energy Society Conference Proceedings.
- Barnes, J. *SREC Markets: The Murky Side of Solar*. 2011. Article in State and Local Energy Report.
- Barnes, J., L. Varnado. *The Intersection of Net Metering and Retail Choice: an overview of policy, practice, and issues*. 2010. For the Interstate Renewable Energy Council, Inc.

TESTIMONY

- North Carolina Utilities Commission, Docket No. E-7 Sub 1146. January 2018.
- North Carolina Utilities Commission, Docket No. E-2 Sub 1142. October 2017.
- Public Utility Commission of Texas, Control No. 46831. June 2017.
- Utah Public Service Commission, Docket No. 14-035-114. June 2017.
- Colorado Public Utilities Commission, Proceeding No. 16A-0055E. May 2016.
- Public Utility Commission of Texas, Control No. 44941. December 2015.
- Oklahoma Corporation Commission, Cause No. PUD 201500271. November 2015.
- South Carolina Public Service Commission, Docket No. 2015-54-E. May 2015.
- South Carolina Public Service Commission, Docket No. 2015-53-E. April 2015.
- South Carolina Public Service Commission, Docket No. 2015-55-E. April 2015.
- South Carolina Public Service Commission, Docket No. 2014-246-E. December 2014.

AWARDS, HONORS & AFFILIATIONS

- Solar Power World Magazine, Editorial Advisory Board Member (October 2011 – March 2013)
- Michigan Tech Finalist for the Midwest Association of Graduate Schools Distinguished Master's Thesis Awards (2007)
- Sustainable Futures Institute Graduate Scholar Michigan Tech University (2005-2006)



Concept Bring Your Own Device (“BYOD”) Program Design

Program Overview

Customers participating in the BYOD Pilot (the “Pilot”) will install a compatible battery system. Once installed, they will follow enrollment instructions to enter into the Pilot, individually or through an aggregator. The enrollment will include a verification process that confirms the device can be utilized in the program platform. Once integration into the platform is confirmed, the participating customer or a designated aggregator will begin receiving participation payments in exchange for allowing the utility or the customer’s chosen aggregator, if applicable, shared access to their device to generate value for all customers. For customers not participating through an aggregator, the participation payment could be provided as a bill credit.¹ For customers that enroll with an aggregator, the participation payment will convey as a direct cash payment to the aggregator.

The battery system needs to be available to charge and discharge in accordance with utility instructions, so that the output can be used for peak shaving and other grid services. The battery system can be utilized for other purposes by the customer, including backup power for the customer’s premises, to the extent that those uses will not conflict with its use to serve the objectives of the Pilot. During and beyond this Pilot, the utility will collaborate with participating aggregators to explore options that allow customers to participate on different levels and essentially ‘pay for performance’ when they do provide other outcomes that benefit all customers and the utility system.

Participation Agreements

To be part of this Pilot, customers will sign an agreement allowing shared access to their device to be used by a third party, including the utility or third-party aggregators, for grid services such as peak reduction and other ancillary services. Among the terms that will be identified in the agreement are:

- A “Peak Event” is defined as a period of time in which a utility or aggregator will make adjustments to the device such as charging or discharging a battery at a specific rate.
- The anticipated number and duration of Peak Events in times per month and hours per Peak Event.

¹ The utility may function as an aggregator and operator at the election of the customer. Nothing compels a customer to choose the utility or another third-party as the operator.

- The utility will send “Peak Event” notifications to customers and participating aggregators.
- Customers may be sent notification of a Peak Event from the utility or via their chosen aggregator, via a smart phone app or other electronic method provided by the aggregator or developer, at least 4 hours in advance.
- The utility or a customer’s chosen aggregator will ensure that batteries are available to perform backup power for the customer as quickly after the peak event as possible.
- The utility or a customer’s chosen aggregator will also make adjustments when possible to avoid completely discharging a battery for the purpose of achieving grid benefits during or prior to a pending weather event that could create outages.
- The utility, in coordination with participating aggregators, will continually explore other opportunities to generate value for all customers through mechanisms, such as ancillary market revenues, energy arbitrage, etc., and if feasible, will amend the Pilot to include mechanisms for providing compensation for those benefits.

The participation payment amount will be effective for the duration of the agreement with the utility. The agreement term will be 10 years. Customers will have the option to opt-out of the Pilot at any time and discontinue shared access to their device. Opt-outs must be coordinated with the aggregator, if applicable, and the participation credit or payment, as applicable will also terminate at the time a customer opts-out. Customers are allowed to opt back in, but may be assessed a reconnection fee to do so and can only opt back in once annually. The 10-year term will continue from the date of the original activation.

Participation Payments

The agreement between the utility, the customer, and the aggregator, if applicable, will yield a monthly participation payment to the customer, or to the aggregator if the customer has chosen an aggregator, based on assumed value for each kW of storage capacity contractually available to the utility for the minimum duration determined to be necessary to meet program objectives, at the full capacity rating.

Participation payment amounts will be determined through analysis of forecasted cost savings and a sharing ratio between payment recipients and non-participant customers. This will involve an estimation of total potential cost savings, which will be adjusted for the possibility that systems may not prove to be 100% effective at reducing costs. A sharing ratio will be applied to this value to assign a portion of the expected cost savings to participants and non-participants. The product of the the adjusted cost savings and the

sharing ratio will determine the participation payment amount for battery capacity made available to the program.

For example, if total potential cost savings of \$10 million are forecast for a given amount of storage capacity (e.g., 5 MW), and it is assumed that participating systems will be 75% effective, the total sharable benefits are \$7.5 million. If the benefits sharing ratio is 90% to participants and 10% to non-participants, the payment pool will be \$6.75 million. This amount is then divided by the amount of storage capacity to determine the participation amount. In this instance, the amount would be divided by 10 years and 5 MW, leading to a participation payment of \$200/kW-year or \$16.67/kW-month.²

Participation payments will be subject to the following conditions:

- The utility may omit or reduce the participating customer's or aggregator's monthly payment if the contracted energy storage is not available due to:
 1. Lack of capacity to deliver at contracted output for the applicable duration;
 - or
 2. Lack of communication with the device during a peak event.
- The monthly participation payment amount is effective for a period of 10 years or until the customer opts out or the contract is terminated.
- For customers receiving the bill credit directly from the utility, the monthly credit can be used to offset all charges on the bill.
- A fee may be charged to each customer or aggregator for utility-provided services required for participation in the program to the extent these costs are not recovered through other means.

Performance Rewards

Additional performance awards may be made to participants, including aggregators, and the utility where realized cost savings exceed the amount on which participation payments are based, evaluated on an annual basis. These payments are to be shared at equal percentages between participants, non-participants, and if applicable, the utility.

A utility will be eligible for performance payments if it achieves a peak forecast accuracy higher than the assumed rate underlying the calculation of participation payments. For instance, if the participation payments are based on a successful peak forecast rate of 9 of 12 months, a utility may receive a performance incentive if: (a) its forecasts cause cost reductions during 10 or more months, and (b) actual cost savings produce an excess of

² These monetary amounts are for illustrative purposes only.

savings that can be distributed. In this case, the utility will receive 33.3% of the excess savings.

If excess savings accrue during a year where a utility exceeded the forecast accuracy benchmark, the remaining excess savings will be split among participants and non-participants at 33.3% for each. If excess savings occur during a year where the utility fails to exceed the forecast accuracy benchmark (e.g., future system costs were underestimated), the excess savings would be shared at a 50/50 ratio between participants and non-participants.

Customer Obligations

1. The customer is required to maintain the internet connection with the battery storage system at all times. In the event connectivity with the battery system is lost, the customer and, if applicable, the aggregator, will be notified and will have 30 days to remedy. If not resolved in this time frame, the customer will be removed from the Pilot and no longer receive the credit. If the issue is resolved at a future date, the customer may opt back in with a \$15 reconnection fee. The monthly credit or payment, as applicable, will resume.
2. If a customer is a net-metered customer, the credits generated from the battery storage system will be tracked separately from any solar credits generated. All rules and expiration requirements for solar credits will still apply.
3. For customers receiving the credit directly from the utility, monthly credits will be allowed to accrue, and are able to be used to pay all charges on the utility bill.
4. The utility will measure performance of the system during the peak events. If the battery system fails to perform within 10% of the contracted capacity, the customer or aggregator will have 30 days to resolve the issue. Upon resolution, the customer or aggregator will request the utility to test and verify that performance has been restored. If not resolved within 30 days, the customer may be removed from the Pilot with the agreement voided and the monthly credit, or payment, as applicable, ceased, or the monthly credit or payment amount, as applicable, may be lowered to reflect the new available power and capacity.
5. The utility may only remove a customer from the Pilot for repeated issues of connectivity or non-performance of the system, after opportunity to cure.

Aggregator Obligation

For participating Aggregators, the following provisions will apply.

1. Aggregators will identify new customers and support BYOD customers by deploying energy storage to participating customers, ensuring customers fully understand the provisions of the BYOD program, ensuring customers are able to maintain their participation in the program, ensuring customers understand optimal usage of their energy storage system, and identifying additional value streams for customers.
2. Through a contractual mechanism with the utility, aggregators will receive payments from the utility associated with the 10-year stream of value of the battery capacity they have enrolled.
3. The aggregator is responsible for ensuring that issues such as device connectivity are resolved quickly and effectively, and replacing with new battery capacity any batteries that exit the program.
4. Aggregator contracts with customers will detail how payments from the utility will be shared with the customer, such as through upfront discounts on storage deployment or an ongoing share of revenue.
5. If and when the utility identifies additional value streams, such as distribution investment deferral, renewables hosting capacity expansion, or grid reliability, the aggregator will assist the utility in realizing this value by, for example:
 - a. Targeting deployment to high-value locations for elevated contracted value;
 - b. Supporting battery discharge optimization, as needed, to stack value;
 - c. Co-optimizing more complex battery discharge with future customers needs, such as EV charging or complex tariffs.

Measurement & Verification

Measurement and verification is a key component of this Pilot to test the assumptions made regarding benefits to the grid and savings to all customers – both those participating in the Pilot and those not participating. To that end, the utility will report the available capacity for grid services, monitor which resources and aggregators are sent dispatch signals, and importantly, provide the total capacity and energy of the DERs for each peak event that is called. The energy platform will provide performance information for each system, which will assist in determining that the systems remain in compliance with their requirements. The utility will use this data to determine the overall effectiveness of the Pilot to reducing peak demands.

The utility will also send out a brief survey to each customer and aggregator 6 months into their agreement to gain feedback from Pilot participants. The utility will look to learn

if customers and aggregators are satisfied with their involvement in the Pilot, the notification process, and value of the monthly credit or payment, as applicable.



CRAIG FERREIRA
Innovation Development

Direct Dial Number: (802) 747.6818
Craig.Ferreira@greenmountainpower.com

Electronic and Hand Delivery

February 23, 2018

Mrs. Judith C. Whitney, Clerk
Vermont Public Utility Commission
112 State Street
Montpelier, VT 05620-2701

Re: Green Mountain Power – Bring Your Own Device “BYOD” Innovative Pilot

Dear Mrs. Whitney:

Please accept this as Green Mountain Power’s (“GMP”) notice of the Bring Your Own Device (“BYOD”) Pilot (the “Pilot”). Green Mountain Power plans to start offering customers the opportunity to participate in the Pilot after March 10, 2018.

Executive Summary

Green Mountain Power is focused on a new energy future, that is home-, business-, and community-based and leverages the latest innovations in grid modernization to drive down costs and provide value for all customers. Battery storage is a meaningful part of that energy future. The BYOD Pilot opens GMP’s distributed energy resource (“DER”) platform to customers who purchase and install compatible batteries in their home or business. Customers will have the opportunity to earn a GMP bill credit by allowing GMP shared access to the battery to maximize its value for all GMP customers by reducing costs at “peak” times, and exploring the ability to charge and discharge systems to achieve other forms of wholesale power market value. The BYOD pilot allows customers to find new ways to obtain backup power in a cost-competitive way, while participating in GMP’s grid transformation efforts with their own storage solution and receiving credits for doing so, while also helping to drive down costs for all GMP customers.

Current or likely to be compatible battery systems include the following¹:

1. Sonnen Battery

¹ The official list of currently approved battery systems will be located on GMP’s website.

Mrs. Judith Whitney

Page 2 of 6

February 23, 2018

2. Sunverge Battery
3. Solar Edge StorEdge Compatible Battery Systems
4. PowerWall 2.0

This is the current range of mainstream battery storage market offerings, and thus integrate with GMP's software. We are open to exploring the integration of other battery technologies upon request.

Customers participating in the Pilot will install a compatible battery system. Once installed, they will follow enrollment instructions to enter into the Pilot. The enrollment will include a verification process that enables their device to be utilized within the GMP energy platform². Once integration into the GMP energy platform is confirmed, the participating customer will begin receiving a credit on their electric bill in exchange for allowing GMP shared access to their device to generate value to all GMP customers. This means the battery system needs to be available to charge and discharge in accordance with GMP instructions, so that the output can be used for peak shaving and other grid services. The battery system cannot be utilized for any other controls by the customer, other than providing backup power for the customer's premises. As we look beyond this pilot, we plan to explore options that allow customers to participate on different levels and essentially 'pay for performance' when they do provide outcomes that benefit all customers and the GMP system.

To be part of this pilot and GMP's energy platform, customers will sign an agreement allowing shared access to their device to be used for grid services such as peak reduction and other ancillary services. Some of the details that will be identified in the agreement are:

- A "Peak Event" is defined as a period of time in which GMP will make adjustments to the device such as charging or discharging a battery at a specific rate.
- Peak Events are anticipated to occur an average of 5 to 8 times per month for an average of 3 to 6 hours at a time.
- Customers will be sent notification of a Peak Event, via a smart phone app or other electronic method, at least 4 hours in advance.
- GMP will ensure that batteries are available to perform backup power for the customer as quickly after the peak event as possible.
- GMP will also make adjustments when possible to avoid completely discharging a battery for the purpose of achieving grid benefits during or prior to a pending weather event that could create outages. While we cannot guarantee that the participating customer's battery system will be charged to a minimum level at all times, we will work to minimize these impacts to make sure the customer has back up power.

² The platform is a system that enables GMP to monitor and control the output of many distributed devices such as battery storage systems, for the benefit of GMP's system and customers as a whole.

Mrs. Judith Whitney

Page 3 of 6

February 23, 2018

- GMP will continually explore other value opportunities to generate value for all customers through mechanisms, such as ancillary market revenues, energy arbitrage, etc., and if feasible, we will amend this pilot to include a feature to share those benefits.

The participating customer's bill credit amount will be effective for the duration of the agreement with GMP. The agreement term will not exceed 10 years. Customers will have the option to opt-out of the Pilot at any time and discontinue GMP shared access to their device. The GMP bill credit will also terminate at this time. Customers are allowed to opt back into the Pilot, but will be assessed a \$15 reconnection fee on their next GMP bill and can only opt back in once annually. The 10-year term will continue from the date of the original activation.

Value of Energy Storage Systems

Energy Storage

The agreement between GMP and the customer will yield a monthly bill credit³ based on assumed value for each kW of storage capacity contractually available to GMP for a minimum duration of 3 hours at the full capacity rating. The minimum offer amount must be 2kW or greater with the maximum aggregate offer being 10kW behind an individual meter. If batteries are paired to get a full 10kW/30kWh the bill credit would be two times the 5kW bill credit rate.

Duration (Hours)	Power (kW) Available to GMP	Energy (kWh) Available to GMP	Monthly Bill Credit*
3	2-2.9	6-8.7	\$14.50
	3-3.9	9-11.7	\$22.00
	4-4.9	12-14.7	\$29.00
	5-5.9	15-17.7	\$36.00

* Bill credit based on an assumption that GMP will be able to use participating battery systems to reduce 8 out of 12 monthly Vermont peaks per year for RNS transmission savings, and assumes that the systems will be 75% effective at reducing the annual ISO-NE peak that determines GMP's Forward Capacity Market obligations.

- GMP reserves the right to omit or reduce the participating customer's monthly bill credit if the contracted energy storage is not available due to:
 1. Lack of capacity to deliver a 3-hour discharge at full output; or
 2. Lack of communication with the device during a peak event.
- The monthly bill credit amount is locked in for a period of 10 years or until the customer opts out or the contract is terminated.
- The monthly bill credit can be used to offset all charges on the bill, including those not covered by solar, i.e. 'non-bypassable'.
- An integration and communication fee of \$2.50 per month will be added to each bill to cover the costs of the ongoing communications and software platform fee.

³ Participating customers receive 70% of the estimated value that the battery system will provide to GMP, with remaining 30% of value flowing to non-participating customers through reduced retail rates.

Customer Obligation

1. The customer is required to maintain the internet connection with the battery storage system at all times. In the event GMP loses connectivity with the battery system, the customer will be notified and will have 30 days to remedy. If not resolved in this time frame, the customer will be removed from the Pilot and no longer receive the bill credit. If the issue is resolved at a future date, the customer may opt back in with a \$15 reconnection fee. The monthly bill credit will be resumed in the amount specified at the initial activation.
2. If a customer is a net-metered customer, the credits generated from the battery storage system will be tracked separately from any solar credits generated. All rules and expiration requirements for solar credits will still apply.
3. Monthly bill credits will be allowed to accrue, and are able to be used to pay all charges on the GMP bill. At any time, but no more frequent than once annually, if a customer has excess bill credits, they are able to request an Energy Transformation Rebate in the amount of the excess bill credit with proof of purchase any product that meets the requirements of the Renewable Energy Standard under Tier 3, such as:
 - i. Smart Thermostat
 - ii. Heat Pump
 - iii. Heat Pump Water Heater
 - iv. Qualified Electric Vehicle
4. GMP will measure performance of the system during the peak events. If the battery system fails to perform within 10% of the contracted capacity, the customer will have 30 days to resolve the issue. Upon resolution, the customer will request GMP to test and verify performance has been restored. If not resolved within 30 days, the customer may be removed from the Pilot with the agreement voided and the bill credit ceased, or the monthly bill credit amount may be lowered to reflect the new available power and capacity.
5. GMP may remove a customer from the Pilot for any reason, including, but not limited to repeat issues with connectivity or performance of the system as that is how value is delivered to all customers.

Measurement & Verification

Measurement and verification is a key component of this Pilot to test the assumptions made regarding benefits to the grid and savings to all GMP customers – both those participating in the Pilot and those not participating. To that end, GMP's Energy Platform will report the available capacity for grid services, monitor which resources are sent dispatch signals, and most importantly, provide the total capacity and energy of the DERs for each peak event that is called. The energy platform will provide us with the performance information for each system, which will determine the systems are remaining in compliance with their requirements. GMP will be using data provided by Virtual Peaker to determine the overall effectiveness of the Pilot to reducing GMP peak demands.

Mrs. Judith Whitney

Page 5 of 6

February 23, 2018

GMP will also send out a brief survey to each customer 6 months into their agreement to gain feedback from Pilot participants. GMP will look to learn if customers are satisfied with their involvement in the Pilot, the notification process, and value of the monthly bill credit.

Timing & Scope

Beginning in March the BYOD Pilot will be available to all residential customers and small commercial customers not currently on a Time-Of-Use retail electric rate. The initial Pilot will last for 18 months and will be available to a maximum of up to 2MW/6MWh of battery storage systems.

To reach 2MW/6MWh, GMP is expecting a mix of system sizes will be installed by participating customers. Currently, the most commonly sized system is around 9kWh, and other common sizes range from 6kWh to 15kWh. With this in mind, GMP anticipates the breakdown of 2MW/6MWh will be close to the following:

Battery kW Size	Quantity Installed
2	50
3	550
4	45
5	15

The Pilot Advances State Energy Goals

The BYOD offering will help advance state energy goals. First, the promotion and use of energy storage provides a clean alternative backup power solution for customers that would otherwise rely on a fossil-fuel generator, or not have a backup power source. Second, energy storage can be a tool to manage the grid with the development of distributed energy resources called for under Act 56, the Vermont Renewable Energy Standard (“RES”) enacted in 2015. Specifically, dispatch control of energy storage can be used to help smooth grid impacts caused by a high penetration of distributed solar energy, potentially avoiding more expensive, traditional grid upgrades⁴. Additionally, these resources are anticipated to provide a small amount of value towards the Tier 3 targets under the RES. Finally, these DERs represent innovative, dispatchable resources that can be used during peak periods to help reduce GMP’s power supply costs, lowering costs for customers.

Summary of Projected Costs & Revenues

There is an ongoing software cost to enable this Pilot that is partially offset by the monthly communication fee. This Pilot will provide value to non-participating customers through power supply cost reductions. Based on GMP Power Supply projections, GMP assumes

⁴ The BYOD Pilot will begin by primarily focusing on peak shaving, however GMP will continue to work and build the framework to utilize batteries for this purpose.

a levelized per kW value of approximately \$10.30 per month. Participating customers will receive 70% of this value, while the remaining 30% will benefit all GMP customers. GMP expects a mix of battery sizes to be deployed by participating customers. Table 1 shows the expected benefits to all GMP customers based on an anticipated mix of battery size deployments.

	Year	1	2	3	4	5	6	7	8	9	10
Revenue											
Communication & Integration Fees		\$19,800	\$19,800	\$19,800	\$19,800	\$19,800	\$19,800	\$19,800	\$19,800	\$19,800	\$19,800
Power Supply Benefit		\$150,521	\$251,251	\$316,532	\$325,119	\$334,653	\$350,465	\$372,873	\$397,496	\$423,057	\$449,713
Total Revenue		\$170,321	\$271,051	\$336,332	\$344,919	\$354,453	\$370,265	\$392,673	\$417,296	\$442,857	\$469,513
Costs											
GMP Grid Platform		(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)
Battery Bill Credit		(\$176,040)	(\$176,040)	(\$176,040)	(\$176,040)	(\$176,040)	(\$176,040)	(\$176,040)	(\$176,040)	(\$176,040)	(\$176,040)
Total Costs		(\$206,040)									
Net Benefit to GMP Customers		(\$36,080)	\$65,667	\$131,608	\$140,282	\$149,912	\$165,884	\$188,518	\$213,390	\$239,209	\$266,134

Table 1

Efficiency Vermont Non-Conflict and Collaboration Certification

By this filing, GMP certifies that the BYOD Pilot does not conflict with work being performed by Efficiency Vermont. GMP has discussed the scope and objectives of this pilot with Efficiency Vermont and Efficiency Vermont is supportive of this pilot.

Status Updates

GMP proposes to provide status updates to the Commission regarding the BYOD Pilot’s progress on a six-month basis until the Pilot expires in 18 months. In the event GMP decides to terminate the Pilot prior to the passage of 18 months, we will provide prompt notice to the Commission and the Department.

If you should have any questions, please contact me at 802-747-6818.

Sincerely,



Craig Ferreira

- cc: Stephanie Hoffman, Vermont Department of Public Service
- Karen Glitman, Efficiency Vermont
- Barry Murphy, Vermont Department of Public Service

Liberty Utilities (Granite State Electric) Corp. d/b/a Liberty Utilities

DE 17-189

Petition to Approve Battery Storage Pilot Program

OCA Data Requests - Set 1

Date Request Received: 2/16/18
Request No. OCA 1-37

Date of Response: 3/9/18
Respondent: Heather Tebbetts

REQUEST:

Did the Company consider any other ownership schemes (i.e., joint ownership between customer and utility)? If not, why not? If yes, why this paradigm?

RESPONSE:

No other ownership arrangements were considered. The objective is to make the pilot simple for customers to understand and for the Company to administer.

Liberty Utilities (Granite State Electric) Corp. d/b/a Liberty Utilities

DE 17-189

Petition to Approve Battery Storage Pilot Program

Sunrun Inc. Technical Session Data Requests - Set 1

Date Request Received: 3/16/18
Request No. Sunrun Tech 1-5

Date of Response: 3/23/18
Respondent: Heather Tebbetts

REQUEST:

Liberty's response to OCA 1-37 states that Liberty did not consider any other ownership schemes and that the proposed Pilot will achieve the objective of making the Pilot simple for customers to understand for the Company to administer.

- a. Please describe how Liberty arrived at this determination if Liberty did not compare the proposed Pilot with any other ownership schemes.
- b. Please provide a timeline from when Liberty began developing the proposed Pilot up to when Liberty filed the Petition. Please include milestone dates, such as the issuance of the RFP.

RESPONSE:

- a. The Company arrived at this determination based on the goals of the pilot. Allowing the possibility of different ownership schemes would introduce complexity to the pilot, thus making customer understanding and Company administration more difficult.
- b. The Company began developing the proposed pilot in September 2017. The only milestone date was the filing date of November 30, 2017. Regarding the selection of Alectra as well as the battery manufacturer, please refer to the direct and supplemental testimony of Witness Tebbetts, as well as the data responses to OCA 1-31, OCA 1-35, and Staff 1-15.

Liberty Utilities (Granite State Electric) d/b/a Liberty Utilities

Total Resource Cost Model

Option 2 - Cellular Based Metering

	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	
1 Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	
2 Units Installed	1,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3 #Units with Upfront Contribution	100															
4 #Units with Monthly Contribution	900	900	900	900	900	900	900	900	900	900	900					
Benefits																
5 Regional Network System (RNS) Charges	\$640,000	\$645,050	\$644,517	\$631,433	\$612,490	\$594,115	\$576,292	\$559,003	\$542,233	\$525,966	\$505,210	\$484,455	\$463,699	\$442,944	\$422,188	\$8,289,594
6 Local Network System (LNS) Charges	\$126,284	\$131,082	\$130,851	\$128,171	\$124,323	\$120,615	\$116,991	\$113,480	\$110,082	\$106,767	\$102,554	\$98,340	\$94,127	\$89,913	\$85,700	\$1,679,280
7 Distribution Circuit Upgrades (Rev Req)	\$0	\$96,101	\$92,889	\$89,797	\$86,815	\$83,934	\$81,148	\$78,450	\$75,831	\$73,226	\$70,622	\$68,017	\$65,412	\$62,807	\$60,202	\$1,085,251
8 Avoided Costs	\$264,706	\$189,721	\$149,437	\$139,138	\$191,379	\$228,996	\$275,207	\$327,946	\$363,058	\$375,271	\$384,445	\$354,235	\$330,844	\$337,063	\$308,705	\$4,220,151
9 Customer Savings	\$218,862	\$309,296	\$300,017	\$291,016	\$282,286	\$273,817	\$265,603	\$257,635	\$249,906	\$242,409	\$232,843	\$223,277	\$213,711	\$204,145	\$194,579	\$3,759,402
10 Customer Contribution	\$208,000	\$108,000	\$108,000	\$108,000	\$108,000	\$108,000	\$108,000	\$108,000	\$108,000	\$108,000	\$0	\$0	\$0	\$0	\$0	\$1,180,000
11 Total Benefits	\$1,457,851	\$1,479,250	\$1,425,711	\$1,387,555	\$1,405,293	\$1,409,478	\$1,423,242	\$1,444,514	\$1,449,109	\$1,431,639	\$1,295,673	\$1,228,323	\$1,167,793	\$1,136,872	\$1,071,375	\$20,213,677
Costs																
12 Revenue Requirement - Batteries	(\$1,522,041)	(\$1,396,114)	(\$1,287,404)	(\$1,190,992)	(\$1,103,335)	(\$1,015,704)	(\$928,047)	(\$851,385)	(\$785,693)	(\$720,000)	\$0	\$0	\$0	\$0	\$0	(\$10,800,715)
13 Revenue Requirement - Cell Based Meters	(\$43,873)	(\$42,023)	(\$40,220)	(\$38,461)	(\$36,743)	(\$35,062)	(\$33,415)	(\$31,801)	(\$30,191)	(\$28,582)	(\$26,973)	(\$25,364)	(\$23,755)	(\$22,145)	(\$20,536)	(\$479,144)
14 Monthly Cellular Reading Cost	(\$36,000)	(\$36,000)	(\$36,000)	(\$36,000)	(\$36,000)	(\$36,000)	(\$36,000)	(\$36,000)	(\$36,000)	(\$36,000)	(\$36,000)	(\$36,000)	(\$36,000)	(\$36,000)	(\$36,000)	(\$540,000)
15 Cogsdale Programming Costs	(\$92,290)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	(\$92,290)
16 Meter MV-90 Programming Costs	(\$80,000)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	(\$80,000)
17 Total Costs	(\$1,774,204)	(\$1,474,137)	(\$1,363,624)	(\$1,265,453)	(\$1,176,078)	(\$1,086,765)	(\$997,463)	(\$919,186)	(\$851,884)	(\$784,582)	(\$62,973)	(\$61,364)	(\$59,755)	(\$58,145)	(\$56,536)	(\$11,992,149)
18 Net Benefit to All Customers	(\$316,352)	\$5,113	\$62,087	\$122,102	\$229,214	\$322,712	\$425,779	\$525,328	\$597,225	\$647,056	\$1,232,700	\$1,166,959	\$1,108,039	\$1,078,727	\$1,014,839	\$8,221,528
Net Present Value Calculation																
19 Required Rate of Return		9.40%														
20 Net Present Value		\$2,965,867														

- 1 Year of installation
- 2 Total units in pilot
- 3 Based on Green Mountain Power's experience of 10% paying upfront
- 4 (2) - (3)
- 5 Calculation as described in testimony; Includes 3% degradation per year
- 6 Calculation as described in testimony
- 7 Page 7
- 8 Calculated using the most recent Avoided Energy Supply Components in New England: 2018 Report
- 9 Savings Calc TRC 2
- 10 Customer contribution of \$1000 upfront (100) plus \$10 per month (900)
- 11 Sum of lines 5-8
- 12 Page 3
- 13 Page 5
- 14 Verizon monthly cell data charges
- 15 Estimated programming costs associated with billing TOU rates
- 16 Estimated programming costs associated with reading cellular meters
- 17 Sum of lines 10-14
- 18 Sum of lines 9+15
- 19 Page 3
- 20 Net Present Value calculation of net benefits

Liberty Utilities (Granite State Electric) Corp. d/b/a Liberty Utilities

DE 17-189

Petition to Approve Battery Storage Pilot Program

Staff Data Requests - Set 1

Date Request Received: 2/16/18
Request No. Staff 1-1

Date of Response: 3/9/18
Respondent: Heather Tebbetts

REQUEST:

Refer to the pre-filed Direct Testimony of Heather M. Tebbetts, page 7, lines 9-11, and please explain why the size of the pilot program is proposed to be five MW and 1,000 batteries? Were larger or smaller pilot program sizes evaluated? If so, then please provide copies of all such evaluations and studies, and all supporting documentation and related workpapers in live Excel format with all formulae intact. If not, then please explain why no such evaluations were conducted.

RESPONSE:

The Company considered Green Mountain Power's program in which it proposed 10 MW of storage, or 2,000 batteries, but that amount was determined to be too large for a pilot program. After internal discussion and looking at the non-wires alternative ("NWA") possibilities in Lebanon, as described in my testimony, 1.5 MW for the NWA wasn't large enough, since customers outside of the targeted circuits may want to participate. Participation of customers outside the NWA targeted area will provide additional value and data through being able to study the behavior and usage changes of customers in non-targeted areas. In determining the proposed size of the pilot program, the Company also considered the annual level of transmission costs, and decided on up to 5 MW of storage, which will be enough to provide a noticeable monetary savings in transmission costs, thus providing benefit for all customers.

Low use

hourly usage		battery charge	Bill Calculation								
00:00 - 00:59	0.25	0.31	Customer Charge	battery \$14.57	battery \$14.57	Customer Charge	\$14.57	no battery \$14.57	no battery	monthly \$ 59.67	
0100 - 0159	0.22	0.32	Distribution	Critical Peak \$ 0.13304	\$ -	Distribution	1st 250 kWh 0.04070	\$ 10.17	battery	\$46.54	
0200 - 0259	0.20	0.35		On Peak \$ 0.03727	\$ 2.13		Excess 0.052841	\$ 1.55	difference	\$ 13.13 2 batteries	
0300 - 0359	0.21	0.40		Off Peak \$ 0.00940	\$ 1.59		Transmission 0.02011	\$ 5.62	monthly charge	\$10	
0400 - 0459	0.25	0.39	Transmission	Critical Peak \$ 0.07209	\$ -	Stranded Costs	0.0049	\$ 1.37	new savings	\$ 3.13 \$ (6.87)	
0500 - 0559	0.27			On Peak \$ 0.02019	\$ 1.15	ECT	0.00055	\$ 0.15			
0600 - 0659	0.30			Off Peak \$ 0.00509	\$ 0.86	SBC	0.00457	\$ 1.28			
0700 - 0759	0.30		Stranded Costs	\$ 0.00049	\$ 0.14	Energy Service	0.08931	\$ 24.95			
0800 - 0859	0.30		ECT	\$ 0.00055	\$ 0.15	total		\$ 59.67			
0900 - 0959	0.32		SBC	\$ 0.00354	\$ 0.99						
1000 - 1059	0.33		Energy Service	\$ 0.08931	\$ 24.95						
1100 - 1159	0.33				\$46.54						
1200 - 1259	0.32										
1300 - 1359	0.31										
1400 - 1459	0.31										
1500 - 1559	0.32										
1600 - 1659	0.35										
1700 - 1759	0.40										
1800 - 1859	0.39										
1900 - 1959	0.40										
2000 - 2059	0.41										
2100 - 2159	0.41										
2200 - 2259	0.36										
2300 - 2359	0.29										
battery offset			0								

usage			
	Day	Month	Battery Offset
Total	9	279	226
Critical Peak	2	53	-
On Peak	2	57	57
Off Peak	6	169	169

Medium Low Use

hourly usage		battery charge	Bill Calculation								
00:00 - 00:59	0.51	0.67	Customer Charge	battery \$14.57	battery \$14.57	Customer Charge	\$14.57	no battery \$14.57	no battery	monthly \$ 109.83	
0100 - 0159	0.46	0.67	Distribution	Critical Peak \$ 0.13304	\$ -	Distribution	1st 250 kWh 0.04070	\$ 10.17	battery	\$ 68.62	
0200 - 0259	0.43	0.77		On Peak \$ 0.03727	\$ 4.44		Excess 0.052841	\$ 16.94	difference	\$ 41.20 2 batteries	
0300 - 0359	0.43	0.90		Off Peak \$ 0.00940	\$ 3.13		Transmission 0.02011	\$ 11.47	monthly charge	\$10	
0400 - 0459	0.43	0.96	Transmission	Critical Peak \$ 0.07209	\$ -	Stranded Costs	0.0049	\$ 2.80	new savings	\$ 31.20 \$ 21.20	
0500 - 0559	0.45			On Peak \$ 0.02019	\$ 2.40	ECT	0.00055	\$ 0.31			
0600 - 0659	0.54			Off Peak \$ 0.00509	\$ 1.69	SBC	0.00457	\$ 2.61			
0700 - 0759	0.57		Stranded Costs	\$ 0.00049	\$ 0.22	Energy Service	0.08931	\$ 50.95			
0800 - 0859	0.61		ECT	\$ 0.00055	\$ 0.25	total		\$ 109.83			
0900 - 0959	0.62		SBC	\$ 0.00354	\$ 1.60						
1000 - 1059	0.66		Energy Service	\$ 0.08931	\$ 40.33						
1100 - 1159	0.69				\$ 68.62						
1200 - 1259	0.70										
1300 - 1359	0.69										
1400 - 1459	0.67										
1500 - 1559	0.67										
1600 - 1659	0.77										
1700 - 1759	0.90										
1800 - 1859	0.96										
1900 - 1959	0.93										
2000 - 2059	0.88										
2100 - 2159	0.80										
2200 - 2259	0.10										
2300 - 2359	0.59										
battery offset			0								

usage			
	Day	Month	Battery Offset
Total	19	571	452
Critical Peak	4	119	-
On Peak	4	119	119
Off Peak	11	333	333

Medium High Use

hourly usage		battery charge	Bill Calculation								
			battery		no battery						
00:00 - 00:59	0.88	1.05	Customer Charge	\$14.57	\$14.57	Customer Charge	\$14.57	\$14.57	monthly		
0100 - 0159	0.80	1.09							no battery	\$ 173.60	
0200 - 0259	0.74	1.24	Distribution			Distribution			battery	\$ 103.88	
0300 - 0359	0.72	1.41							difference	\$ 69.72	
0400 - 0459	0.76	1.44	Critical Peak	\$ 0.13304	\$ -	1st 250 kWh	0.04070	\$ 10.17		2 batteries	
0500 - 0559	0.82		On Peak	\$ 0.03727	\$ 6.59	Excess	0.052841	\$ 36.50		monthly	
0600 - 0659	0.96		Off Peak	\$ 0.00940	\$ 5.42	Transmission	0.02011	\$ 18.92	monthly charge	\$10	
0700 - 0759	0.91		Transmission			Stranded Costs	0.0049	\$ 4.61	new savings	\$ 59.72	
0800 - 0859	0.94		Critical Peak	\$ 0.07209	\$ -	ECT	0.00055	\$ 0.52		\$20	
0900 - 0959	0.98		On Peak	\$ 0.02019	\$ 3.57	SBC	0.00457	\$ 4.30			
1000 - 1059	0.96		Off Peak	\$ 0.00509	\$ 2.94	Energy Service	0.08931	\$ 84.01			
1100 - 1159	0.98		Stranded Costs	\$ 0.00049	\$ 0.37		total	\$ 173.60			
1200 - 1259	1.01		ECT	\$ 0.00055	\$ 0.41						
1300 - 1359	1.03		SBC	\$ 0.00354	\$ 2.67						
1400 - 1459	1.05		Energy Service	\$ 0.08931	\$ 67.33						
1500 - 1559	1.09				\$ 103.88						
1600 - 1659	1.24										
1700 - 1759	1.41										
1800 - 1859	1.44										
1900 - 1959	1.43										
2000 - 2059	1.42										
2100 - 2159	1.36										
2200 - 2259	1.21										
2300 - 2359	1.02										
battery offset			0								

usage			
	Day	Month	Battery Offset
Total	31	941	754
Critical Peak	6	187	-
On Peak	6	177	177
Off Peak	19	577	577

High Use

hourly usage		battery charge	Bill Calculation								
			battery		no battery						
00:00 - 00:59	1.37	1.85	Customer Charge	\$14.57	\$14.57	Customer Charge	\$14.57	\$14.57	monthly		
0100 - 0159	1.27	1.94							no battery	\$ 288.31	
0200 - 0259	1.21	2.10	Distribution			Distribution			battery	\$ 168.56	
0300 - 0359	1.21	2.29							difference	\$ 119.75	
0400 - 0459	1.27	2.39	Critical Peak	\$ 0.13304	\$ -	1st 250 kWh	0.04070	\$ 10.17		2 batteries	
0500 - 0559	1.45		On Peak	\$ 0.03727	\$ 12.35	Excess	0.052841	\$ 71.68		monthly	
0600 - 0659	1.81		Off Peak	\$ 0.00940	\$ 9.00	Transmission	0.02011	\$ 32.31	monthly charge	\$10	
0700 - 0759	1.87		Transmission			Stranded Costs	0.0049	\$ 7.87	new savings	\$ 109.75	
0800 - 0859	1.86		Critical Peak	\$ 0.07209	\$ -	ECT	0.00055	\$ 0.88		\$97.75	
0900 - 0959	1.83		On Peak	\$ 0.02019	\$ 6.69	SBC	0.00457	\$ 7.34			
1000 - 1059	1.87		Off Peak	\$ 0.00509	\$ 4.88	Energy Service	0.08931	\$ 143.48			
1100 - 1159	1.85		Stranded Costs	\$ 0.00049	\$ 0.63		total	\$ 288.31			
1200 - 1259	1.83		ECT	\$ 0.00055	\$ 0.71						
1300 - 1359	1.81		SBC	\$ 0.00354	\$ 4.56						
1400 - 1459	1.85		Energy Service	\$ 0.08931	\$ 115.16						
1500 - 1559	1.94				\$ 168.56						
1600 - 1659	2.10										
1700 - 1759	2.29										
1800 - 1859	2.39										
1900 - 1959	2.29										
2000 - 2059	2.19										
2100 - 2159	2.09										
2200 - 2259	1.80										
2300 - 2359	1.54										
battery offset			0								

usage			
	Day	Month	Battery Offset
Total	54	1,607	1,289
Critical Peak	11	317	-
On Peak	11	331	331
Off Peak	32	958	958

CERTIFICATE OF SERVICE

RE: Docket No. DE 17-189 Liberty Utilities (Granite State Electric) Corp. d/b/a Liberty Utilities, Petition to Approve Battery Storage Pilot Program

I hereby certify that I have this day served a true copy of the **Direct Testimony of Justin R. Barnes** upon parties of record on the attached service list in accordance with the requirements of N.H. Admin. Rule Puc 203.11.

Dated: May 2, 2018.

Blake Elder

Blake Elder
Keyes & Fox LLP
401 Harrison Oaks Blvd, Suite 100
Cary, NC 27513
Telephone: (919) 825-3339
Email: belder@keyesfox.com

SERVICE LIST - EMAIL ADDRESSES - DOCKET RELATED

Pursuant to N.H. Admin Rule Puc 203.11 (a) (1): Serve an electronic copy on each person identified on the service list.

Executive.Director@puc.nh.gov
allen.desbiens@eversource.com
amanda.noonan@puc.nh.gov
bargetsinger@keyesfox.com
brian.buckley@oca.nh.gov
brianna@nhsea.org
bwaugh@townandcitylaw.com
clifton.below@gmail.com
crauscher@sunrun.com
david.wiesner@puc.nh.gov
donald.kreis@oca.nh.gov
eemerson@primmer.com
ehawes@acadiacenter.org
elizabeth.nixon@puc.nh.gov
heather.tebbetts@libertyutilities.com
jack@revisionenergy.com
james.brennan@oca.nh.gov
jroberge@clf.org
karen.cramton@puc.nh.gov
karen.sinville@libertyutilities.com
kate@nhsea.org
kurt.demmer@puc.nh.gov
leszek.stachow@puc.nh.gov
lhuber@strategen.com
maureen.karpf@libertyutilities.com
mbirchard@clf.org
michael.sheehan@libertyutilities.com
ocalitigation@oca.nh.gov
paula.maville@lebcity.com
richard.chagnon@puc.nh.gov
Stephen.Hall@libertyutilities.com
steven.mullen@libertyutilities.com
tad.montgomery@lebcity.com
tom.frantz@puc.nh.gov