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September 4, 2020

Via Electronic Filing

Aida Camacho-Welch, Secretary of the Board
Board of Public Utilities
44 South Clinton Avenue, 9th Floor
Trenton, New Jersey 08625

Re: In the Matter of the Petition of Public Service Electric and Gas for Approval of its Clean Energy Future – Electric Vehicle and Electric Storage ("CEF-EVES") Program on a Regulated Basis
BPU Docket No. EO18101111

Dear Secretary Camacho-Welch,

Enclosed please find the Direct Testimony of Justin R. Barnes (Public) on behalf of Sunrun Inc. ("Sunrun") for filing in the above-captioned matter. Certain information in Mr. Barnes' Direct Testimony has been marked confidential by Public Service Electric and Gas, and Sunrun does not challenge that designation.

All parties on the EO18101111 service list will be served with a copy of the public (redacted) version of the enclosed testimony. Only party representatives who have executed a non-disclosure agreement for this docket will be served with the confidential (unredacted) version of the enclosed testimony.

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Encl.: Direct Testimony of Justin R. Barnes (Public)
cc: Service List

STATE OF NEW JERSEY
BOARD OF PUBLIC UTILITIES

In the Matter of the Petition of Public Service Electric and Gas for Approval of its Clean Energy Future – Electric Vehicle and Electric Storage ("CEF-EVES") Program on a Regulated Basis	))))))	BPU Docket No. EO18101111

DIRECT TESTIMONY OF JUSTIN R. BARNES ON BEHALF OF SUNRUN INC.

PUBLIC VERSION

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Dated: September 4, 2020

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DIRECT TESTIMONY OF
JUSTIN R. BARNES
ON BEHALF OF
SUNRUN INC.
BPU DOCKET NO. EO18101111

I. INTRODUCTION AND QUALIFICATIONS

Q. PLEASE STATE YOUR FULL NAME, BUSINESS ADDRESS, AND POSITION.

A. My name is Justin Robert Barnes. My business address is 1155 Kildaire Farm Rd., Suite 202, Cary, North Carolina, 27511. My current position is Director of Research with EQ Research LLC.

Q. ON WHOSE BEHALF ARE YOU SUBMITTING TESTIMONY?

A. I am submitting testimony on behalf of Sunrun Inc.

Q. HAVE YOU PREVIOUSLY SUBMITTED TESTIMONY BEFORE THE NEW JERSEY BOARD OF PUBLIC UTILITIES ("BPU" OR "BOARD")?

A. No.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL AND OCCUPATIONAL BACKGROUND.

A. I obtained a Bachelor of Science in Geography from the University of Oklahoma in Norman in 2003 and a Master of Science in Environmental Policy from Michigan Technological University in 2006. Beginning in 2007 I was employed at the North Carolina Solar Center at N.C. State University ("NCSU"). I worked at NCSU through mid-2013, during which time I worked primarily on the *Database of State Incentives for Renewables and Efficiency ("DSIRE")* project and the U.S. Department of Energy ("DOE") Solar America Communities

project.[1] I began at EQ Research as a Senior Policy Analyst in 2013 and became the Director of Research in 2016.

In my current position I coordinate EQ Research's various research projects, provide subject matter oversight of EQ Research's electric industry regulatory and general rate case tracking services, and perform customized research and analysis. Most of my work focuses on the customer-sited solar and energy storage sector and how the evolving state and federal legislative, regulatory, and ratemaking landscape affects the industry.

I have submitted testimony before utility regulatory commissions in Colorado, Hawaii, Georgia, New Hampshire, New York, North Carolina, Oklahoma, South Carolina, Texas, Utah, and Virginia, as well as to the City Council of New Orleans, on various issues related to clean energy policy, rate design, and cost of service.[2] These individual regulatory proceedings have involved a mix of general rate cases and other types of contested cases, two of which involved utility energy storage program proposals and mechanisms for procuring grid services from customer-sited energy storage resources.[3] My *curriculum vitae* is attached as Attachment JRB-1.

[1] The North Carolina Solar Center has since been renamed the North Carolina Clean Energy Technology Center.
[2] The City Council of New Orleans regulates the rates and operations of Entergy New Orleans in a manner equivalent to state utility regulatory commissions.
[3] Those two proceedings are New York Case No. 19-E-0065, a Consolidated Edison rate case, and New Hampshire Docket No. DE 17-189, a proposal by Liberty Utilities to deploy a residential energy storage program. The New Hampshire case produced a settlement that contemplates the development of a residential BYOD program similar to what I propose in my testimony in the instant proceeding.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. The purpose of my testimony is to suggest improvements to the proposals made by the Public Service Electric and Gas Company ("PSEG" or "the Company") for its Energy Storage Program. More specifically, I discuss the numerous reasons why PSEG's proposed Energy Storage Program should incorporate a segment seeking to utilize residential behind-the-meter ("BTM") solar-paired energy storage systems to provide grid services, and provide a straw program design based on programs that have been deployed by other utilities. These programs are often referred to as Bring-Your-Own-Device ("BYOD") or Bring-Your-Own-Battery ("BYOB") programs because they allow non-utility storage owners to participate under standard program terms with any qualifying storage device that can meet program requirements. Participating storage resources are compensated based on the performance of the enrolled devices in supplying the grid service they are signed up to perform. I refer to this general program design as "BYOD" throughout my testimony.

While I do not take a position on the costs, benefits, and relative merits of the Company's specific proposed energy storage investment, it is my assessment that PSEG's exclusive focus on large-scale, utility-owned storage is shortsighted, incomplete, and potentially more costly and risky for ratepayers than a payment for service model under BYOD. My proposal for a BYOD program is not necessarily intended to displace some or all of the Company's proposed energy storage investments. However, it could and should serve as an alternative means for providing some of the services that the Company seeks to provide with its

proposals. Beyond making the energy storage program itself more diverse and inclusive, this would provide a valuable opportunity to compare the performance and relative cost-effectiveness of utility-owned energy storage solutions to those provided by privately-owned systems in the competitive market. In other words, I do not propose a BYOD program to the exclusion of any of the Company's specific proposed investments, but as a necessary component of any energy storage program that the BPU approves.

Q. PLEASE DESCRIBE HOW YOUR TESTIMONY IS ORGANIZED.

A. In Section II of my testimony I discuss insufficiencies in PSEG's proposed Energy Storage Program. This includes an evaluation of the Company's specific proposals, the need for a program segment targeting non-utility owned residential BTM energy storage, examples of program designs deployed in other jurisdictions, and the merits of a BYOD design relative to PSEG's proposed programs. In Section III of my testimony I present a Straw BYOD Program Design with certain minimum program characteristics and options for defining additional program details that would be necessary to implement a BYOD program. Section IV contains my concluding remarks.

Q. PLEASE SUMMARIZE YOUR RECOMMENDATIONS TO THE BOARD.

A. I recommend that the Board, in any Order approving any portion of the Company's Energy Storage Program, approve the establishment of a BYOD program for non-utility-owned BTM storage to provide grid services in PSEG territory. In order to implement the program, the Board should direct PSEG to: (a) develop a BYOD program for non-utility-owned BTM energy storage which

features the minimum characteristics I identify herein; and (b) propose a final program design to the Board within a time frame convenient to the Board but no more than nine months after the issuance of a Board Order in this proceeding. I further recommend that the BYOD program be initially targeted at producing peak load reductions and distribution deferral and utilize programs operating in other jurisdictions as templates and be incorporated into programs proposed by PSEG in this proceeding in order to facilitate prompt development and deployment.

Q. WHY IS IT IMPORTANT THAT THE BOARD TAKE ACTION IN LINE WITH YOUR RECOMMENDATIONS IN THE INSTANT PROCEEDING?

A. The Clean Energy Act of 2018 establishes the goal of deploying 600 MW of energy storage by 2021 and 2,000 MW by 2030. The Board's Energy Master Plan states "New Jersey should maximize the development of offshore wind and in-state renewable energy generation (including community solar) and the interconnection of carbon-neutral distributed energy resources (DER) – on-site systems, *storage*, equipment or processes that are appropriately sized, modular, and decentralized – to support the economy and increase local jobs, encourage private sector investment, accelerate clean power production, and improve resiliency."[4]

BTM energy storage will be a valuable contributor towards those objectives, and the instant proceeding provides an immediate opportunity to establish a mechanism to achieve the policy outcomes directed by the Clean

[4] 2019 New Jersey Energy Master Plan Pathway to 2050 at p. 10 (emphasis added) *available at* https://nj.gov/emp/docs/pdf/2020_NJBPU_EMP.pdf ("Energy Master Plan").

Energy Act of 2018. The BYOD program I recommend provides a low-risk opportunity to produce immediate societal and ratepayer benefits consistent with those identified in the Energy Master Plan. Accordingly, I urge the Board to adopt a BYOD program consistent with the framework recommended herein as a "no-regrets" approach to support the achievement of New Jersey's energy storage objectives.

Q. HOW WOULD YOU RESPOND TO ANY CONCERNS THAT A NINE-MONTH PROGRAM DEVELOPMENT TIMELINE IS TOO AGGRESSIVE OR THAT THE DEVELOPMENT OF SUCH A PROGRAM IS NECESSARILY A COMPLEX AFFAIR?

A. I appreciate that the Board might feel a need for caution in adopting a program model that it is not familiar with. However, as I discuss in detail in my testimony, the program design I propose is conceptually simple and draws from numerous other examples of similar programs from other jurisdictions as well as from the work that PSEG has already done in preparing its energy storage program proposals. Furthermore, it is readily compatible with a layered design under which the simplest applications can be adopted first and the program can evolve to address more complex arrangements over time. My proposal is a far more cautious approach to supporting energy storage deployment than what PSEG has proposed from the standpoint of ratepayer costs and risks because it is designed to enable non-ratepayer investment and limit ratepayer costs to the value of the services that are actually delivered.

In addition, should a final program design submitted by PSEG not be sufficient to merit Board approval, the Board will have an opportunity at that time to provide further guidance and specify such additional steps it deems necessary to implement the BYOD program.

II. INSUFFICIENCY OF PSEG'S ENERGY STORAGE PROGRAM

A. Evaluation of the Company's Proposals

Q. PLEASE BRIEFLY SUMMARIZE THE COMPANY'S PROPOSED INVESTMENTS IN ENERGY STORAGE?

A. The Company proposes five energy storage subprograms which collectively seek to install 35 MW of energy storage over six years. The proposed programs have an estimated capital cost of $109.4 million and are expected to incur ongoing expenses of $70 million over the expected 15-year life of the systems installed.[5] The five subprograms each target a different use case, as reflected in Table 1 below from the testimony of Company Witnesses Hranicka and Alvarez.[6]

[5] Direct Testimony of Todd W. Hranicka and Raymond C. Alvarez ("Hranicka and Alvarez Direct") at 2:6-8. By letter dated August 3, 2020 PSEG notified parties that in substitution for Jorge L. Cardenas, "PSE&G intends to present a two-witness panel comprised of Todd W. Hranicka, Director of Solar Energy and project lead for energy storage and electric vehicle implementation planning, and Raymond C. Alvarez, Senior Director of Asset Strategy, Technology and Systems. The panel will adopt the testimony of Mr. Cardenas in its totality." For ease of reference I refer to this testimony as "Hranicka and Alvarez Direct" throughout.

[6] *Id.* at 5.

Table 1: CEF-ES Subprogram Overview

Use	Description	Customer Benefit	Number of Installations	Storage MW	Program Cost
1. Solar Smoothing	ESS used to smooth short-term changes in voltage due to intermittent generation	Relieves rapid power fluctuations on distribution circuits, extends life of impacted infrastructure and mitigates voltage disturbances at customer locations	5	10	$13.1
2. Distribution Deferral	ESSs that resolve forecasted overloads on the system	Utilizes non-wires alternatives to defer or eliminate the need for traditional utility upgrades	7	13	$38.6
3. Outage Management	Deploy fleet of mobile ESSs for contingency resources during substation construction	ESSs to help reduce the cost of substation construction by reducing the need for mobile transformers	6	6	$20.0
4. Microgrids for Critical Facilities	Provide capital to support the development of microgrids	Enables critical facilities to operate independent of the electric grid during extended grid outages	1 to 4	2	$25.7*
5. Peak Reduction for Public Sector Facilities	ESSs sited at public sector facilities and deployed to reduce peak demand	ESSs to help resolve potential overloads, address power quality issues at host sites, reduce bills for public sector customers	4	4	$11.9
Total			23-26	35	$109.4

*Program Cost includes funding for 2 MW of storage and 4 MW of solar, or additional generation, to supplement storage

All of the subprograms would use utility-owned assets and feature relatively large-scale energy storage devices. The smallest individual storage assets that PSEG envisions being part of the program are 0.5 MW/4 MWh systems within the Microgrids for Critical Facilities segment of the program.[7]

Q. DID THE COMPANY CONSIDER NON-UTILITY OWNED ENERGY STORAGE FOR ANY OF ITS PROPOSALS?

A. No. In response to an information request the Company stated that it "designed its program without non-utility owned energy storage opportunities, and did not conduct a specific analysis to consider non-utility owned storage."[8]

Q. DOES THE COMPANY HAVE ANY PLANS TO SUPPORT THE DEPLOYMENT OF NON-UTILITY OWNED STORAGE IN THE FUTURE?

[7] *Id.* at 18:17
[8] Company Response to Sunrun-PSEG-0008.

A. PSEG has stated that it "is open to these opportunities in the future" but did not describe any specific plans.[9] In the specific context of its Solar Smoothing subprogram, PSEG has stated that the use of energy storage to address voltage fluctuations "may be expanded in a distributed and coordinated manner with behind the meter storage installations in the future."[10] However, the Company provided no further specific information on such an expansion.

Q. DO ANY OF THE SUBPROGRAMS INVOLVE BTM ENERGY STORAGE ASSETS?

A. Yes. The Peak Reduction for Public Sector Facilities program segment would utilize BTM assets, with a goal of producing energy cost savings and resiliency benefits for the host customer (*i.e.*, back-up power) and avoided transmission and distribution investments.[11]

Q. DO ANY OF THE PROGRAMS SUPPORT RESIDENTIAL ENERGY STORAGE DEPLOYMENT?

A. No.

Q. COULD BTM RESIDENTIAL ENERGY STORAGE PROVIDE ANY OF THE SERVICES PSEG SEEKS TO PROVIDE VIA UTILITY-OWNED STORAGE?

A. Yes. Residential BTM energy storage could provide similar benefits as the proposed utility-owned storage for various subprograms. For instance, residential storage can provide services similar to those envisioned to be provided by storage

[9] *Id.*
[10] Company Response to Sunrun-PSEG-0009(b).
[11] Hranicka and Alvarez Direct at 19-20.

systems sited at public sector facilities under the Peak Reduction for Public Sector Facilities subprogram (*e.g.*, peak reduction, customer cost savings, improved resiliency). Residential energy storage is also well suited to provide services described in the proposed Solar Smoothing and Distribution Deferral subprograms.

In the Peak Demand Reduction context, dispatch of BTM storage during forecasted peak periods can be used to reduce generation capacity costs, in a manner similar to that which would occur if a customer was responding to an on-peak retail rate. In the case of BYOD, the storage response would be more targeted to address true system peaks. As discussed later in my testimony, this model is already being used in existing BYOD programs in Connecticut, Massachusetts, Rhode Island, and Vermont.

With respect to the Distribution Deferral subprogram, there are numerous examples of programs that target the use of BTM energy storage, including residential-sited systems, for mitigating the impacts of distribution circuit peaks. In fact, PSEG Long Island ("PSEG-LI") operates one such program in New York via the Long Island Power Authority's Dynamic Load Management ("DLM") Tariffs. The three components of this program, in the words of PSEG-LI's Program Guidelines and Operating Procedures, share the "common objective" of "Reducing the electric load on the PSEG Long Island electric and deferring transmission and distribution upgrades and help customers save energy."[12]

[12] PSEG-LI, Program Guidelines and Operational Procedures For Dynamic Load Management Tariff Programs, Section 1.0: Purpose (June 2019) *available at:*

Other utilities in New York, such as Consolidated Edison, also operate DLM programs and separately hold competitive solicitations for Non-Wires Alternative ("NWA") projects that target the use of DERs to defer or replace specific planned distribution upgrade projects.[13] Active NWA programs are also present in California via the state's Distribution Investment Deferral Framework process,[14] and in Hawaii via the Integrated Grid Planning Initiative.[15]

In another more narrowly-designed program, United Illuminating ("UI") in Connecticut is employing a targeted marketing campaign in partnership with the Connecticut Green Bank to reduce substation loading through the installation of storage-ready solar systems at customer residences. Participants would receive an incentive of $0.05/kWh for metered generation during summer peak hours for seven years.[16] Numerous utilities have conducted narrow pilots of this type, and regulators in many other states have begun to develop advanced distribution planning and NWA frameworks that include utilization of BTM DERs among the objectives.

Finally, with respect to Solar Smoothing, PSEG has acknowledged the potential applicability of BTM storage for addressing voltage fluctuations, and has also acknowledged that: (a) large-scale solar installations are not exclusively responsible for circuit impacts, and (b) energy storage systems are most effective

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https://www.psegliny.com/businessandcontractorservices/businessandcommercialsavings/-/media/F9B52424E0FF48FBBD8AC4E336EDBE24.ashx

[13] *See*, for example, a list of solicitations on the New York REV Connect website, available at: https://nyrevconnect.com/non-wires-alternatives/.

[14] California Public Utilities Commission. Docket No. R.14-08-013, D.18-02-004 (Feb. 15, 2018).

[15] Hawaii Public Utilities Commission. Docket No. 2018-0165, Order No. 36725 (Nov. 4, 2019).

[16] Connecticut Public Utilities Regulatory Authority, Docket No. 17-06-03, Decision dated January 24, 2018.

when placed close to the source of the issue.[17] The implication is that in some cases residential and other small-scale BTM energy storage installations could be *more* effective at addressing voltage fluctuation issues than larger, centralized storage facilities.

Q. WOULD THERE BE ANY NEED FOR BTM RESIDENTIAL ENERGY STORAGE TO BE UTILITY-OWNED IN ORDER TO PROVIDE THESE SERVICES?

A. No. Non-utility energy storage owners are fully capable of operating systems in line with system needs if they are provided with the proper incentive and signal to do so. In fact, the NWA conceptual framework is based in large part on the substitution of competitive solutions to meet needs that have traditionally been met by monopoly providers. Implicit within the NWA construct is that utilities and non-utilities are *competing*, within their respective areas of core competency (*i.e.*, non-utility owned DERs vs. utility capital investments in distribution infrastructure), to provide the most cost-effective solution to a particular grid need.

Q. DO THE COMPANY'S PROPOSED PROJECTS ASSOCIATED WITH A DISTRIBUTION DEFERRAL USE CASE ALIGN WELL WITH THE NWA CONCEPTUAL FRAMEWORK?

A. No. The NWA framework centers on identifying cost-effective solutions to traditional grid investments in a technology neutral manner (*i.e.*, a least-cost, best-fit standard of evaluation). It is likely that in many cases a non-wires solution will

[17] Company Response to Sunrun-PSEG-0009(a) and (c).

include a certain amount of energy storage, but PSEG's Distribution Deferral and Public Sector Peak Reduction subprograms effectively hardwire the "solution" as utility-owned energy storage of a certain size and placement without considering other combinations of resources, ownership arrangements, and other factors. In other words, these subprogram proposals lack the holistic, solutions-oriented focus central to the NWA framework.

There are two significant drawbacks to PSEG's approach. First, in the context of an individual deferral opportunity, PSEG's approach may prove more costly than other equally (or more) suitable combinations of resources. Second, the narrow focus fails to take meaningful steps in the direction of establishing a foundation for pursuing least-cost, best-fit distribution deferral solutions more broadly in the future. That is, it limits the potential experience and learning opportunities for both PSEG and competitive market non-utility service providers that are critical for developing *scalable* platforms through which the most cost-effective distribution solutions can be identified and procured. PSEG's approach threatens to create a high degree of path dependency towards utility-owned, centralized NWA solutions and stymie the ability of competitive market (*i.e.*, non-utility) energy storage providers to deliver cost-effective solutions to meet the same grid needs.

Q. ARE THE COMPANY'S SPECIFIC PROPOSALS SUFFICIENT TO ADDRESS ITS STATED OVERALL GOALS FOR THE PROGRAM?

A. No. Company Witnesses Hranicka and Alvarez describe the overarching need and goals for the Energy Storage Program as follows:[18]

> Across the country, utilities have deployed energy storage systems ("ESSs") as flexible tools to solve an array of issues. As costs for ESSs decline in the coming years, energy storage will likely transform how the modern utility manages the supply and demand of electricity on its network. The collection of projects proposed in this filing will help to ensure that when energy storage applications become more widely adopted and cost feasible, PSE&G will be well-positioned to effectively deploy ESSs in the appropriate applications.

Part of this transformation of how a utility manages supply and demand is tethered to the increased penetration of customer-sited distributed energy resources ("DERs"), including BTM solar and solar-paired storage. As the Energy Master Plan emphasizes, customer-sited DERs have an important role to play in shaping the future of the electricity system, and in fact are one of the driving forces behind the need for the industry to evolve in the first place.[19]

Operationalizing DERs to provide grid services requires basic platforms that support the utilization of those resources, individually or in aggregated groups. In order for PSEG to "be well-positioned to effectively deploy ESSs in the appropriate applications" it must begin developing that basic underlying platform and the programs to address system needs using DERs.

[18] Hranicka and Alvarez Direct at 2:9-14

[19] *See e.g.,* Energy Master Plan at p. 176 (stating "[t]hrough development of the IDPs, mechanisms and policies should be determined to enable equal and efficient access to interconnect DERs, as discussed in Goal 2.1.5. In addition, IDPs will enable DERs to be fully valued for their avoided distribution costs, congestion mitigation, risk diversification, resiliency, and reliability, as discussed in Goal 2.1.6, Through this planning process, the electric public utilities will assess and recommend physical, market, and operational changes to the electric grid to ensure safe, reliable, and affordable services and to create streamlined and equally accessible integration of DERs.").

PSEG's approach to energy storage in the instant proceeding has a large gap in that it devotes only very limited attention to BTM energy storage resources overall, and none to developing a participation pathway for aggregated sets of dispersed, non-utility-owned resources to provide grid services. Furthermore, the six-year timeline for the proposed program is troubling in this context because it at least suggests an extended period during which PSEG's learning about how to operationalize energy storage resources to provide grid benefits is confined to large-scale, utility-owned applications to the exclusion of applications that rely on aggregations of dispersed DERs.

As noted above, programs in other states demonstrate that non-utility owned DERs can provide cost-effective solutions to distribution deferral, peak demand reduction, and other grid services. While these programs are currently in the beginning stages of deployment, they show great promise in their ability to unlock the value that customer-sited energy storage can provide to ratepayers more broadly. New Jersey ratepayers would be similarly well-served from the adoption of BYOD programs to provide customer-sited storage the market participation pathways necessary for these resources to deliver grid services and benefit ratepayers more broadly.

Q. ARE THERE ANY OTHER BENEFITS TO INCORPORATING A NON-UTILITY-OWNED BTM SEGMENT INTO THE PROGRAM?

A. Yes, there are several. First, a non-utility-owned program segment would allow for comparisons to be made between the relative performance and cost-effectiveness of utility-owned and non-utility-owned assets. Such an evaluation

could also be extended to encompass comparisons between more centralized larger storage facilities and aggregations of smaller storage facilities.

Second, establishing a viable and sustainable market for energy storage depends on the mobilization of private capital. Achieving New Jersey's ambitious energy storage goals will require a massive acceleration in the deployment of both large- and small-scale storage resources. Residential customer adoption of energy storage relies entirely on private investment and with the right market signals, can be incentivized to scale rapidly. Moreover, mobilizing non-utility owned energy storage assets to provide grid services under BYOD programs where the storage customer is compensated based on their storage device's performance leverages private investment and insulates ratepayers from risk.

B. Current Residential Storage Opportunities in New Jersey

Q. PLEASE SUMMARIZE USE CASES FOR RESIDENTIAL ENERGY STORAGE IN NEW JERSEY AT PRESENT.

A. Currently, the only readily identifiable viable use case for energy storage in PSEG's territory is the provision of back-up power. Residential customers do not have any means of extracting value or providing services through any utility programs or an incentive to engage in rate arbitrage via time-of-use ("TOU") rates. In other words, residential storage systems do not have the market participation opportunities or have the appropriate price signals to operate anywhere close to their full range of capabilities.

Q. PSEG OFFERS A RESIDENTIAL TOU RATE UNDER RATE SCHEDULE RLM. PLEASE EXPLAIN WHY RATE SCHEDULE RLM FAILS TO PROVIDE A VALUE PROPOSITION FOR RESIDENTIAL ENERGY STORAGE.

A. There are several factors involved. At the outset, one should assume that residential energy storage will typically be paired with solar and the facility enrolled in net metering. The first factor is the Schedule RLM has a much higher monthly fixed charge than the standard residential rate schedule (Schedule RS), a premium of $8.99/month (including the SUT). Therefore, any customer that enrolls in Schedule RLM effectively starts "behind" in terms of potential net metering bill savings relative to the Schedule RS.

Second, Schedule RLM has a 7 AM – 9 PM Monday – Friday on-peak window. Therefore, apart from weekends, virtually all solar production will take place during the on-peak period even without the shifting capability provided by energy storage. Consequently, opportunities to shift off-peak production to the on-peak window are limited because most exports will already occur during the on-peak period.

Third, PSEG implements net metering for customers on TOU rates using a time bin design, where exports during the on-peak period offset only on-peak net usage and off-peak exports offset only off-peak net usage. This characteristic further limits the benefits of export shifting because shifting off-peak exports is only valuable to the extent that a customer has remaining on-peak net usage. Shifting an excess of off-peak exports (*i.e.*, beyond an amount that fully offsets

customer load during the peak period) results in those credits being unusable, subject to an anniversary reconciliation at the avoided cost rate.

Collectively, these factors result in the value proposition for battery storage under Schedule RLM being limited to shifting excess on-peak production to off-peak hours. The financial benefit is derived from the difference between the off-peak retail rate and the anniversary cash-out rate. This difference is relatively small, resulting in an equally small value for export shifting.

The result is that while Schedule RLM produces slightly more customer savings opportunities for storage-paired solar systems than for solar only, it produces lower savings than a solar-only configuration taking service under Schedule RS. Accordingly, a residential customer with a storage-paired solar system is better off using the battery only for back-up power and remaining on Schedule RS. Table 1 provides a comparison of customer savings outcomes for a hypothetical customer with a solar system that provides an approximate 100% load offset. It compares savings under Schedule RS and Schedule RLM under a solar only configuration, and provides a comparison to maximum theoretical savings under Schedule RLM with storage operated to shift excess on-peak production to off-peak hours.[20]

[20] This analysis was done using the National Renewable Energy Laboratory's System Advisor Model ("SAM") with default system assumptions other than adjustments to produce an approximate 100% load offset. The customer load profile was sourced from the standard residential load profiles available within SAM. The analysis uses only base charges under Schedule RS and Schedule RLM, excluding riders that would have the same effect regardless of the rate and solar and storage scenario.

Table 1: Residential Solar and Storage Bill Savings

Rate Schedule	Pre-Solar Annual Bill	Annual Solar Savings	Annual Bill Post Solar
Rate RS (Solar Only)	$1,336	$1,338	-$2
Rate RLM (Solar Only)	$1,533	$1,355	$178
Rate RLM (Solar + Storage)	$1,533	$1,412	$121

Q. HOW IS THIS RELEVANT TO THE COMPANY'S ENERGY STORAGE PROGRAM PROPOSAL?

A. A lack of attention to BTM residential storage ensures that customers will be dissuaded from installing battery storage because the added cost produces no additional savings, and those that do install BTM storage will operate the storage system only for back-up power. Both result in the underutilization of a potentially valuable system resource. As such, the value proposition for residential and other customer-sited storage in New Jersey is low under current market conditions. Creating market participation pathways for customers to enroll their storage devices in utility programs and providing compensation for services actually delivered (*i.e.,* "pay for performance") can quickly change that value proposition though and incentivize greater customer investment in and adoption of energy storage.

This private investment can in turn be leveraged through utility programs that allow non-utility owned storage assets to provide grid services without the need for ratepayer dollars to be spent to achieve the same service. The Energy Master Plan underscores this observation stating:

> Today's distribution grid . . . generally has no means to provide additional revenues or price signals to DER. Without the ability to send meaningful price signals at the distribution level, the state will not be able to recognize the full value that distributed resources may provide. And wholesale market revenues, which are accessible by some DER, are neither sufficient to drive DER investment, nor targeted to maximize the localized benefits that DER can provide. To fix this disconnect between value to consumers and the lack of payment streams to the DER, resources must be able to engage in value stacking, which is the practice of allowing a single energy resource to receive multiple different streams of revenue corresponding to different services, or "use cases," provided by the resource. NJBPU will recommend pathways to further unlock benefits of DER deployment in competitive markets, such as DER aggregation, as well as evaluate how to better value the services that DER provides at the distribution level.[21]

The Company's Energy Storage Program proposal identifies numerous use cases that present opportunities to unlock the value for BTM energy storage to both storage customers and to ratepayers as a whole if non-utility-owned BTM storage is permitted to participate in meeting those needs. Instituting market participation pathways for customers to provide grid services is essential to unlocking the benefits these resources can provide to ratepayers more broadly and creating the revenue streams necessary to stimulate private investment in energy storage.

[21] Energy Master Plan at p. 110.

C. Examples from Other Jurisdictions

Q. HOW WOULD YOU CHARACTERIZE THE CURRENT STATUS OF EFFORTS IN OTHER STATES TO ESTABLISH MECHANISMS FOR SUPPORTING THE USE OF BTM ENERGY STORAGE TO PROVIDE GRID SERVICES?

A. At an overall level I think it is fair to say that development remains in its early stages. At present I consider there to be two broad groups of programs, with some jurisdictions pursuing one or the other, and sometimes both. One group is composed of NWA initiatives that typically use competitive solicitations as a mechanism for securing DERs to defer specific planned distribution projects. The other group is composed of programmatic or tariff-based initiatives that offer standardized compensation based on standardized terms and conditions. What I refer to as BYOD falls into the latter category. Some of these programs target energy storage specifically, while others resemble more traditional demand response ("DR") programs that have been adapted to better accommodate energy storage.

Q. PLEASE IDENTIFY THE EXAMPLES THAT YOU ARE AWARE OF THAT FIT THE CHARACTER OF A BYOD PROGRAM.

A. Table 2 lists several programs with the general BYOD attributes, along with high-level summaries of the individual programs – such as use case and the compensation regime. Each program of course contains numerous other elements and parameters but the basic details summarized in Table 2 illustrate the overall character of the programs.

Table 2: Residential BYOD Program Examples[22]

State	Utility	Program	Compensation	Use Case
Connecticut	Eversource	Connected Solutions – Targeted Seasonal	$225/kW-summer & $50/kW-winter (avg. per peak event), locked in for five years.	Reduction in ISO-NE capacity charges.
Connecticut	United Illuminating	ConnectSun	$0.05/kWh from June – Sept. on-peak energy, locked in for five years, plus $500 rebate for additional metering.	Distribution deferral on two circuits.
Massachusetts	National Grid	Connected Solutions – Targeted Seasonal	$225/kW-summer & $50/kW-winter (avg. per peak event), locked in for five years.	Reduction in ISO-NE capacity charges.
Massachusetts	Eversource	Connected Solutions – Targeted Seasonal	$225/kW-summer & $50/kW-winter (avg. per peak event), locked in for five years.	Reduction in ISO-NE capacity charges.
Massachusetts	National Grid, Unitil, Eversource	Connected Solutions – Daily Dispatch	$/kW for dispatch on a daily basis. Further details of permanent program forthcoming.	Reduction in ISO-NE capacity charges.
New Hampshire[23]	Liberty Utilities	Residential Battery Storage Pilot	Phase 1 (Utility-Owned): Arbitrage via new TOU rate. Phase 2 (BYOD): TBD	Reduction in ISO-NE transmission and potentially capacity charges.
New York	PSEG Long Island	Dynamic Load Management Tariff	$/kW-month capacity reservation payment (May – September), differentiated by location. 10-year rate lock-in for energy storage systems. Minor $/kWh payment during events.	CSRP: System-wide distribution deferral DLRP: Local distribution network reliability emergencies

[22] Attachment JRB-2 contains a reproduction of Table 2 with citations and references.

[23] A BYOD version of the currently active utility-owned battery storage program is slated to be developed upon the successful demonstration of the current program. New Hampshire is also pursuing the development of a statewide BYOD program via its 2021-2023 energy efficiency and demand response program development process.

New York	Consolidated Edison NY	Commercial Demand Response Programs	$/kW-month capacity reservation payment (May – September) differentiated by location & number of event calls per peak season. Rates may change annually. Minor $/kWh payment during events.	CSRP: System-wide distribution deferral DLRP: Local distribution network reliability emergencies
Rhode Island	National Grid	Connected Solutions – Targeted Seasonal	$400/kW-summer season (avg. per peak event), locked in for five years.	Reduction in ISO-NE capacity charges.
Vermont	Green Mountain Power	Bring Your Own Device	Up-front payment of $850/kW for 3-hour storage discharge capability or $950/kW for 4-hour discharge capability (10% event performance tolerance subject to claw back), plus $850 for systems installed under solar self-consumption option. Adder of $100/kW for standalone systems and additions to existing solar in certain locations. 10-year program commitment.	Reduction in ISO-NE transmission and capacity charges; solar production shifting.

Q. DO YOU CONSIDER ANY PARTICULAR PROGRAM FROM TABLE 2 TO BE A PARTICULARLY GOOD EXAMPLE FOR NEW JERSEY TO FOLLOW?

A. The Green Mountain Power ("GMP") BYOD program in Vermont has the longest history and has gone through several iterations and refinements since it was first debuted as a utility-owned BTM energy storage program limited to Tesla Powerwalls. The current program is the result of a joint effort between GMP and Renewable Energy Vermont to develop a program that leverages competitive market forces to drive down costs for ratepayers, is more responsive to customer preferences, expands the eligibility criteria to accept other battery storage systems in addition to the Tesla Powerwall, and generally expands accessibility to the program to more customers than earlier versions. The full Terms and Conditions

of the GMP BYOD tariff are attached to my testimony as Attachment JRB-3. I also discuss several characteristics of the most recent GMP BYOD program as well as BYOD programs adopted in other states in the context of the Straw BYOD Program Design I propose in Section III of my testimony.

D. Beneficial Attributes of BYOD Generally

Q. PLEASE SUMMARIZE THE BENEFICIAL ATTRIBUTES OF PROCURING GRID SERVICES FROM BTM RESOURCES THROUGH A BYOD DESIGN RELATIVE TO THE COMPANY'S PROPOSAL.

A. There are numerous benefits to pursuing an energy storage deployment strategy that includes BTM resources generally, and more specifically under a BYOD program design. I identify the benefits as including the following:

- Enhanced resource diversity and resilience;
- Lower costs and risks to ratepayers;
- Scalability through the enablement of private capital investment;
- Establishment of a foundation for utilizing BTM resources to their maximum capability; and
- Expanding access to the benefits of energy storage across the income spectrum.

To a large degree these beneficial attributes are interconnected with one another as parts of a whole. For instance, achieving greater resource diversity depends on successful deployment, which in turn depends on establishing an easily accessible platform for utilizing BTM resources and investor and consumer

confidence. Likewise, achieving scale hinges on a design that is cost-effective and beneficial to both participant ratepayers and non-participant ratepayers.

Q. PLEASE ELABORATE ON WHY ENHANCED RESOURCE DIVERSITY AND RESILIENCE ARE BENEFICIAL.

A. Generally speaking, a collection of individual separate resources operating in coordination produce a lower potential for failure at any given time than using centralized units to accomplish the same objective. As a simple example, if a distribution deferral project relies on a single MW-scale energy storage system, that failure of that system completely compromises the use case. On the other hand, it is extraordinarily unlikely that a collection of 100 individual systems serving the same need would fail to perform at the same time. If a few systems fail, the aggregated resource as a whole is still largely intact and capable of providing the service, or at a minimum limiting the magnitude of any negative consequences. The diverse resource is therefore more resilient.

Q. PLEASE EXPLAIN HOW BTM RESOURCE UTILIZATION UNDER A BYOD DESIGN COULD PRODUCE LOWER COSTS AND RISKS TO RATEPAYERS.

A. As I discuss in Section III of my testimony, the BYOD design I recommend is based on a pay for performance model. Under this model ratepayers as a whole only pay for what they receive. On the other hand, utility investments under a rate of return model establish a long-term revenue requirement that in theory does not change even if some of the assumptions on cost savings turn out to be incorrect. Furthermore, since under a BYOD model the participants are only paid for

services delivered, ratepayers are not subject to the potential for unforeseen future costs, such as greater than expected O&M expenses or component failures.

PSEG proposes a program with capital costs estimated at $109.4 million and ongoing expenses of $70 million over the expected 15-year life. Balancing these costs are expectations of cost savings and potential market revenues. [redacted] At the very least, the revenue projections are quite speculative and potentially uncertain.

Q. PLEASE ELABORATE ON WHY SCALABILITY IS A BENEFICIAL ATTRIBUTE AND HOW A BYOD DESIGN PROVIDES IT.

A. New Jersey has an objective of reaching 2,000 MW of energy storage deployment by 2030. PSEG's proposal in the instant proceeding would secure only 35 MW of that total at a considerable cost. It is difficult to see how full achievement of the energy storage deployment objective can be realized at a reasonable cost to ratepayers (and a reasonable level of risk) without the deployment of private, non-ratepayer capital. BYOD provides a mechanism to animate the private market for energy storage investment, effectuating a sharing of cost and mitigation of ratepayer risk.

[redacted]

Essentially, it takes advantage of the interests of private consumers in deploying energy storage for both monetary and non-monetary reasons. The monetary benefits to those private consumers correspond to payment for services delivered consistent with the value of those services. That allows the customer to achieve non-monetary benefits, such as access to back-up power for home and business resiliency, at a lower cost. Furthermore, since most BTM energy storage is installed in conjunction with on-site solar, these capital investments are supported by the provision of federal investment tax credits available to energy storage that charges primarily from on-site solar, and other incentives. This can also be seen as a form of "sharing" of energy storage capital investment costs.

Q. HOW CAN A BYOD PROGRAM SERVE AS A FOUNDATION FOR MAXIMIZING THE UTILIZATION OF DERS AND WHY IS THAT IMPORTANT?

A. It is unquestioned that the penetration of BTM DERs, including those that incorporate energy storage, will continue to increase in New Jersey and elsewhere in the coming years. This poses challenges but also presents opportunities for moving towards a more resilient and decentralized grid.[25] BYOD provides a plug-and-play solution for targeting the operation of BTM energy storage, and BTM DERs more generally, in a way that increases utilization in ways that are beneficial to both DER owners and other ratepayers. It is critical that such an effort begin now using relatively simple use cases in order to establish a platform onto which more complex use cases and multi-use cases can be layered over time.

[25] *See generally,* Energy Master Plan.

Every month that goes by without such a framework sacrifices the services that could have been provided and slows the longer-term development and evolution of more advanced designs.

Q. ARE THERE OTHER BENEFITS TO ADOPTING A BYOD PROGRAM AS YOU RECOMMEND THAT THE BOARD SHOULD BE AWARE OF?

A. Yes. BYOD advances other important policy goals, including expanding access to the benefits of energy storage (and other transformational clean energy technologies) to low-moderate income ("LMI") customers and environmental justice communities. The Energy Master Plan emphasizes that New Jersey "should encourage, support, and enable LMI and environmental justice communities to assess the impacts of localized pollution, assess energy demand, build more resilient communities, *and establish opportunities across all sectors to develop the innovation economy at the local level and to participate in and benefit from the clean energy economy*."[26]

The Energy Master Plan continues:

> "[The Board] should explore the creation of [DER] incentive programs targeted at LMI and environmental justice communities. DERs include a wide variety of technologies including renewable distributed generation like energy efficiency, photovoltaic (PV), smart inverters, *battery storage*, demand response, and EVs *that provide numerous grid and customer benefits*. *Programs also should consider how DERs can be combined to maximize their value to the grid and to customers, while at the same time recognizing the importance in local planning and engagement, as well as in utility distribution planning, when determining where DERs should be located to best serve the communities*."[27]

[26] Energy Master Plan at p. 198 (emphasis added).
[27] *Id.* at p. 204 (emphasis added).

The BYOD program I recommend herein would help expand access to energy storage across the income spectrum to LMI customers and to customers in environmental justice communities by providing the market participation pathways necessary for customer-sited storage systems to maximize their value to the grid. The pay for performance element of the BYOD program provides a revenue stream for the grid service delivered, thereby driving down the effective cost of adopting energy storage and making it more affordable. This in turn allows these customers to be both active participants in helping New Jersey achieve its clean energy goals and receive direct individual benefits from adopting energy storage.

To put a finer point on this, the BYOD program supports individual customer use-cases, such as the availability of back-up power to enhance the resilience of the customer's home or business, that directly benefit customers in ways that the centralized grid model cannot. For example, if PSEG builds an energy storage system for the purpose of distribution deferral, any benefits achieved are shared among ratepayers as a whole. Individual ratepayers may be better off, but they do not receive any separate individual benefits – and the monetary benefits accruing to any individual customer (*i.e.,* cost savings) more or less depend on how much electricity they consume.

On the other hand, a collection of BYOD systems located at customers' homes that targets the same distribution deferral can be deployed to meet the distribution deferral need to benefit all ratepayers *and* directly benefit those customers (and their neighbors) during a power outage (*e.g.*, a place to charge

phones, store food, etc.). This model leverages private investment to deliver the same grid service that would be provided by the centralized utility owned system; while at the same time enhances the resiliency of the individual customer as well as that of the entire community during extreme weather and other events. The recent power outages caused by Hurricane Isaias are a stark reminder of the importance of providing simple and viable pathways for customers and communities to invest in resiliency and the BYOD program provides that pathway. Distributed deployment and greater penetration of energy storage and other DERs in local areas opens opportunities for more advanced applications like microgrids that take resilience a step further while at the same time creating a distributed storage asset base that can be leveraged to provide grid services to benefit all ratepayers.

By providing a simple market participation pathway, BYOD enables greater adoption of energy storage across the income spectrum to bring the benefits of the clean energy economy to traditionally underserved customers and communities and facilitates active customer participation in achieving a cleaner, more resilient, cost-effective and equitable electric service model.

III. STRAW BYOD PROGRAM DESIGN

A. Basic BYOD Program Design

Q. PLEASE EXPLAIN WHAT YOU MEAN IN REFERENCE TO A "STRAW BYOD PROGRAM DESIGN."

A. The Straw BYOD Program Design is the BYOD program structure model. This contains certain minimum program characteristics that the program should have

based on my review of BYOD programs in other states. I refer to this as a "straw" design because further refinement would be necessary to flesh out additional details such as specific compensation rates, operational protocols, and other processes. PSEG should be directed to work with potential industry participants to finalize a program design based on a BYOD model approved by the Board in this proceeding.

Q. PLEASE BRIEFLY SUMMARIZE THE OVERARCHING STRUCTURE OF A BYOD PROGRAM.

A. Generally speaking, BYOD refers to a program design that facilitates utility procurement of grid services (*e.g.*, peak load reduction) from non-utility owned customer-sited devices (*e.g.*, battery storage) in exchange for compensation under standard terms and conditions. Most often the term has been applied to programs centered on energy storage, but BYOD has also been used in the context of thermostats with remote-control capability. The terms, conditions, and device qualifications reflect the service being procured pursuant to an identified need. Many variations can arise from this basic framework, but ultimately BYOD targets a "plug and play" grid services procurement model where the customer with a storage asset can enroll in a utility program to provide a particular grid service pursuant to a standard offer price set in the grid service program tariff.

Another element key to a well-designed BYOD program is structuring participating customer compensation under a "pay for performance" mechanism. This ensures that participating customer compensation is based on the enrolled device actually providing the grid service it enrolled in the program to provide.

The pay for performance design ensures that ratepayers are held harmless if a customer's device does not perform (*i.e.*, customer payment is dependent upon the customer's storage system performing correctly) during any particular grid event. Pay for performance mechanisms can be designed in multiple ways, including reservation payments to encourage enrollment coupled with the payments tied to the device's performance during an event.

One further key characteristic of a BYOD program is the role that resource aggregation and third-party aggregators play. BYOD targets the coordinated operation of many individual resources towards serving a defined need. Resource aggregators supply this requisite coordination and are therefore critical to the success of a program. Aggregation also streamlines the transactional and administrative aspects of the program and offers additional flexibility with respect to participation and meeting program commitments.

Q. PLEASE SUMMARIZE HOW THE BYOD MODEL CAN BE APPLIED TO CUSTOMER-SITED ENERGY STORAGE TO PROVIDE GRID SERVICES THAT PSEG PROPOSES TO PROVIDE WITH UTILITY OWNED STORAGE ASSETS.

A. A battery storage owner that enrolls a device in the program is compensated for dispatching the storage in response to system needs. By enrolling in the program, the energy storage system owner is committing to providing a specific amount of flexible capacity that can be drawn on to meet the system need. The actual compensation mechanism can take multiple forms. For instance, compensation could take the form of an up-front payment accompanied by a commitment term,

ongoing payments over time, or a combination of the two. The program administrator (*e.g.*, the utility) is responsible for providing the dispatch signal with appropriate notice to the third-party aggregator, or possibly directly to the participating customer (for larger customers). This type of protocol is similar to the system used in more generalized DR programs and as part critical peak pricing or peak credit programs.

Like these types of programs, a BYOD program will typically contain provisions that limit the timing of called events to certain hours, and may limit the duration and number of called events over a specified time period. For instance, participants might be required to dispatch the storage device for three hours at a time and no more than five times a month. The dispatch protocols and requirements correspond to the grid need targeted by the program and could feature multiple options (*e.g.*, a two-hour and three-hour duration option, enhanced compensation for shorter periods of notice, etc.).

Q. HOW COULD A BTM RESIDENTIAL ENERGY STORAGE COMPONENT FUNCTION IN CONCERT WITH NET METERING?

A. A residential customer with storage-paired solar that takes service under Schedule RS is not "net metering" the storage component. The storage system is idled apart from occasional charge and discharge for battery maintenance purposes. Only the solar system is being net-metered, and the customer has no incentive to charge the energy storage from the grid, or discharge it to produce exports.

Nothing about this basic arrangement changes if the energy storage system is enrolled in a grid service program. The solar system continues to be net

metered at the exact same rate it would otherwise be, and the energy storage system is dispatched to serve a grid need. The customer effectively benefits by having access to back-up power during an outage at a lower net cost than would otherwise be the case because the payments received for providing grid services help reduce the costs of the storage system.

The model is also compatible with both customer-owned and third-party owned ("TPO") energy storage systems. Competition between energy storage providers and customer preferences will ultimately determine the type(s) and character of contractual arrangements that are offered based on what customers find to be the most attractive. Customers may prefer to use a third-party owner and operator to manage their participation in the program due to the added complexity involved with meeting storage operation and dispatch requirements.

Q. WHAT SPECIFIC PROGRAM CHARARACTERISTICS DO YOU RECOMMEND FOR A PSEG BYOD PROGRAM FOR CUSTOMER-SITED ENERGY STORAGE?

A. I recommend the following minimum design elements, several of which I discuss in more detail in following sections:

1. Customers with solar-paired storage should be permitted to participate on terms identical to customers without paired solar.
2. The program should be based on a pay for performance model.
3. Storage owners should be permitted to aggregate multiple devices that they own into a single "resource".

4. Performance should be evaluated at the level of the aggregated resource (if applicable) rather than the individual storage system level.
5. Performance should be measured directly at the storage device using inverter data, rather than using a baseline load methodology or additional non-integrated metering.
6. Storage owners should be permitted to have their energy storage system controlled remotely by another entity (*e.g.*, a third-party owner, third-party DER aggregator or the program administrator).
7. Compensation rates should be based on long-term costs avoided by dispatch of the enrolled device, assignable to the system owner.
8. Storage owners should be permitted to lock-in the participation compensation for ten years.
9. If the program is capped (*e.g.*, based on enrolled capacity) and devices at non-residential customer sites are permitted to participate, a carve-out should be established for systems on residential customer sites.
10. Utility-owned BTM energy storage should not be permitted to participate in the program.

Q. WHAT TYPES OF "GRID SERVICES" DO YOU ENVISION BEING PART OF A BYOD PROGRAM?

A. The simplest application of BYOD has historically been for targeting system-wide peak capacity costs. In the case of PSEG that would correspond to avoided generation capacity costs,[28] which PSEG includes in its illustration of costs and

[28] Some programs have also targeted reducing the allocation of transmission costs to a utility's customers.

benefits of its proposed Distribution Deferral subprogram.[29] This model is simple insofar as it can be applied across an entire service territory and may involve less frequent dispatch over more readily predictable time frames than dispatch to mitigate more localized distribution capacity issues.

Having said that, a BYOD program can also target distribution deferral on a system-wide basis and in designated local areas. For instance, the PSEG-LI and Consolidated Edison New York DLM programs are broken into two program segments: the Commercial System Relief Program ("CSRP") and the Distribution Load Relief Program ("DLRP"). CSRP events are called in response to system-wide peak demand, providing peak shaving throughout the service area, and higher compensation rates apply for load reductions on certain networks. DLRP events are called on a network-specific basis to address more isolated reliability needs, also with price differentiation based on location. A given customer can participate in both at the same time.[30] In the PSEG context, such a system could differentiate compensation between the circuits PSEG has identified with planning capacity violations and other circuits.[31]

Beyond distribution deferral, as PSEG has acknowledged, BTM energy storage could be used to address the voltage fluctuations associated with the Solar Smoothing use case and in some cases might do so more effectively than more

[29] PSEG response to RCR-POL-0019.
[30] *See* Consolidated Edison New York, Schedule for Electric Delivery Service, Rider T *available at* https://www.coned.com/_external/cerates/documents/elecPSC10/electric-tariff.pdf; *see also* Long Island Power Authority, Tariff for Electric Service, Section XIII: Dynamic Load Management and accompanying Commercial System Relief Program and Distribution Load Relief Program Payment Statements *available at* https://www.lipower.org/about-us/tariff/.
[31] *See* Hranicka and Alvarez Direct at 11, Table 3 (identifying 28 4 kV circuits and 43 13 kV circuits with planning capacity violations).

centralized storage facilities.[32] Accordingly, it is plausible that a BYOD program could be extended to a voltage mitigation use case as well. While such an application is likely to be more complex than capacity-related use cases, solar-paired energy storage systems installed in solar self-consumption mode would by their nature provide a smoothing benefit at the locations where they are installed. Accordingly, although solar self-consumption mode does not directly aid in grid integration of other large projects, it could reduce the contribution that a collection of small systems located in close proximity to one another make to voltage fluctuation issues on a circuit.

Q. IS IT NECESSARY THAT AN INITIAL VERSION OF A BYOD PROGRAM TO SEEK ALL OF THESE POSSIBLE SERVICES?

A. No. Although it would be ideal to design a program that fully addresses all potential grid services that could be provided by BTM energy storage, seeking to do so threatens to make perfect the enemy of the good. The deployment of a program that targets only a few services can serve as a foundation for a more comprehensive program that targets additional services while still providing immediate benefits to both participants and non-participants makes far more sense.

Q. WHAT WOULD BE A REASONABLE STARTING POINT FOR SUCH AN INITIAL BYOD PROGRAM?

A. A program targeting generation capacity cost savings is likely the lowest hanging fruit. [redacted]

[32] Company Response to Sunrun-PSEG-0009(a) and (c).

[redacted] Targeting capacity cost savings with a BYOD program would only require a modest difference in approach. In a BYOD program, instead dispatching the utility-owned energy storage systems directly during peak events, PSEG would instead provide notice and dispatch instructions to the non-utility storage owner participants and aggregators. Post-event performance verification would validate to what degree the participating systems met their program commitments and the amount of pay for performance compensation due. Nothing would prevent additional services and compensation structures from being added over time as opt-ins for existing participants and new participants.

Q. ARE THERE OTHER ALREADY OPERATING BYOD PROGRAMS THAT TARGET GENERATION CAPACITY COST SAVINGS?

A. Yes. As shown in Table 2, most of the currently operating programs are focused on generating capacity cost savings. Furthermore, even though New York DLM programs target distribution deferral, the approach to calling peak events is more or less identical to what is necessary to target generation capacity savings. There is no reason that any one of these examples could not be replicated in a PSEG program in a relatively short time frame. Stated another way, this particular wheel has already been invented.

[redacted]

B. Pay for Performance Model

Q. PLEASE DESCRIBE SPECIFICALLY WHAT YOU MEAN BY A "PAY FOR PERFORMANCE MODEL".

A. In basic terms, I used the term "pay for performance" to refer to a design that awards payments based on the ratio of what a device owner committed to do versus what they actually delivered. In a basic example, an energy storage owner may commit to providing 3 kW of storage discharge over a four-hour window for whenever a peak is predicted to occur. In return for this commitment they receive an annual payment of $100/kW (a $300 payment). However, if the storage owner only delivers 2 kW on average during a year, the payment is reduced to $200 in total.

Q. DOES THE PAYMENT TRANSACTION MODEL NECESSARILY NEED TO PROVIDE COMPENSATION OVER TIME AS THE SERVICES ARE DELIVERED?

A. No. There are multiple ways to execute a pay for performance arrangement that do not rely exclusively on payment for services as they are delivered that do not compromise the model. For instance, up-front payments can be implemented with a defined commitment period, performance tolerance requirement, and claw back mechanism that can collectively effectuate pay for performance. This is the structure used in GMP Vermont's BYOD program, which uses a 10% performance tolerance and requires repayment of a pro-rated portion of the up-front payment if an enrolled storage device exits the program.

Another option is to provide a portion of the total expected payment over the commitment term (*e.g.*, 50%) as an up-front payment and provide the remainder over time as the service is delivered. The portion of the compensation that accrues over time can be used to reflect actual performance and function as a true-up for the up-front payment (*i.e.,* deductions for underperformance).

Q. ARE THERE MERITS TO PROVIDING A PORTION OR ALL OF THE COMPENSATION AS AN UP-FRONT PAYMENT RELATIVE TO AN ONGOING PERFORMANCE PAYMENT?

A. Yes. First, up-front payments are simpler to administer than ongoing performance payments. Second, the effective reduction in up-front costs lowers the amount of costs that may need to be financed, producing lower financing costs for the system owner.

Q. HOW WOULD THE SERVICE COMMITMENT REQUIRED OF THE ENERGY STORAGE OWNER BE ESTABLISHED?

A. The nature of the grid service need defines the capacity commitment that is required, such as the duration, feasible notice, and time windows when an event may be called. The energy storage owner determines the amount of capacity they are able and willing to commit and the system is operated to meet that commitment. For instance, an energy storage device might be committed for only a portion of its maximum discharge rating due to the duration of the commitment window, the timing of potential events, the customer's desire to reserve a certain amount of discharge capacity for their own use (*i.e.*, backup power), and other reasons. Providing customers with the flexibility to select from a menu of

discharge service commitment options (similar to GMP's BYOD program) allows the customer to work with the DER system owner and/or DER aggregator to balance the customer's needs with program participation requirements.

C. Device Aggregation

Q. PLEASE EXPLAIN WHAT YOU MEAN BY "DEVICE AGGREGATION".

A. The program should allow for multiple energy storage systems to be operated as a collective aggregated resource. This includes allowing customer-owned systems to enroll in the program through a DER aggregator. Similarly, for TPO systems, the energy storage system owner should be permitted to enroll multiple individual systems in the program as a collective aggregated resource. The aggregated resource is viewed within the program as a single unit for the purposes of compensation and performance measurement.

Q. WHY IS IT IMPORTANT THAT THE PROGRAM PERMIT AGGREGATION?

A. Aggregation has several benefits. First, it simplifies and consolidates the transactions involved between the program administrator and energy storage owner participants (*e.g.*, dispatch communication, device management, payments, performance verification, and others).

Second, aggregation for the purpose of performance commitments and measurements provides third party DER aggregators with flexibility to determine the level of commitment they can offer and how they manage individual units in order to meet that commitment. For instance, a DER aggregator with 50 participating units may want to assume that one or more units may not be

operating during any given called event. De-rating every individual unit to reflect that assumption could strand potentially available capacity. An aggregated portfolio allows other units in the portfolio to make up for a potential shortfall in availability from other units.

Third, aggregation of DERs is a core component to the evolution of a more decentralized and resilient grid. Indeed, as the Energy Master Plan notes, the Board is committed to recommending pathways to further unlock benefits of DER deployment in competitive markets, such as though DER aggregation, and evaluating how to better value the services that DER provides at the distribution level. Those benefits extend beyond electricity generation, and include increased resiliency, lower grid electricity demand via BTM energy generation, deferred or avoided grid upgrades, and lower Locational Marginal Prices.[34] Achieving this future will require the coordinated operation of DERs, and it is critically important that even early stage efforts begin establishing the platforms and frameworks necessary to achieve that result.

Q. WHY IS IT APPROPRIATE TO EVALUATE PERFORMANCE AT THE AGGREGATED RESOURCE LEVEL?

A. The framework for performance measurement should be aligned with the framework for commitments. Furthermore, the value of the service itself does not depend on which specific units fill a commitment. It only matters that the aggregate commitment is achieved.

[34] Energy Master Plan at p. 110.

Q. WHAT ADDITIONAL PARAMETERS NEED TO BE DETERMINED TO FACILITATE A RESOURCE AGGREGATION FRAMEWORK?

A. Three primary issues must be resolved. First, whether there is a minimum size for aggregations, and if so, what that minimum is. To simplify program administration, it could be beneficial to limit the program to resources or aggregations of a minimum size (*e.g.*, 50 kW). Second, the process through which aggregate commitments can be updated to reflect changes in the composition of an aggregate resource, or updates for other reasons, must be determined. Third, protocols must be developed to facilitate aggregation where resources are enrolled in multiple program segments, such as a system level program and one that is more localized. That is, an aggregation of resources could contain some systems enrolled to provide a system-wide service (*e.g.,* peak load reduction) while a subset of that group also provides another service with geographic limitations (*e.g.*, distribution deferral). The aggregation framework should be designed to accommodate such a "multi-use" scenario.

D. Performance Measurement

Q. PLEASE EXPLAIN THE DISTINCTION BETWEEN PERFORMANCE MEASUREMENT AND PERFORMANCE EVALUATION.

A. Performance measurement refers to the means through which performance data is collected. Performance evaluation refers to how that data is used for the purpose of determining payments owed for services and compliance with program rules. Measurement must take place at the individual device level, but as I noted in the

prior sub-section of my testimony, evaluation should take place at the aggregated portfolio level for aggregations of resources.

Q. PLEASE EXPLAIN YOUR RECOMMENDATION THAT PERFORMANCE BE MEASURED AT THE ENERGY STORAGE DEVICE LEVEL.

A. Direct measurement is the most accurate way to determine how well dispatch of the energy storage device matches the dispatch instruction. The use of a baseline load methodology introduces the additional complication of devising appropriate baselines, and by its very nature represents only an approximation of the response to dispatch instructions. Furthermore, executing a baseline load methodology would require additional interval metering that would either deplete the value of participation (if charged to storage owners) or the cost-effectiveness of the program (if recovered from non-participants).

Q. DOES DIRECT MEASUREMENT OF THE ENERGY STORAGE DEVICE REQUIRE ADDITIONAL INTERVAL METERING?

A. Installing additional meters to measure energy storage device performance is not necessary. Direct measurement of the energy storage device can be accomplished using inverter measurements. Modern inverters are capable of recording interval discharge data sufficient for validating performance with high accuracy.

Q. ARE YOU RECOMMENDING ANY SPECIFIC MEASURES TO ADDRESS UNDERPERFORMANCE?

A. Not at this time. The pay for performance model addresses the primary concern that a resource owner would be compensated for underperformance – *i.e.*, receive

payment even if the device did not perform the service it was called upon to provide. Beyond that there is the possibility that persistent underperformance could compromise the use case underlying the arrangement. This could be the case where a minimum need exists, such as with deferral of a specific distribution investment. Under these circumstances additional performance assurance requirements could be considered. For instance, a resource or aggregation of resources might be de-rated for future periods until the performance issue is cured (*i.e.*, limiting maximum payments), or repeated uncured underperformance could result in removal from the program.[35]

While potential punitive measures may be worth considering, I caution against their immediate deployment in the early stages of a new program due to the potential negative effects they could have on participation. The need for such measures should be assessed based on initial program performance; and in the event that such measures are established, participants should have reasonable opportunities to cure underperformance before being assessed penalties.

Q. HAS NON-PERFORMANCE BEEN A SIGNIFICANT ISSUE IN EXISTING BYOD PROGRAMS?

A. Broadly speaking, no, although not all of the programs have long operational histories to draw from. The longest running programs are the multiple versions of the GMP Vermont residential battery storage program, and the New York DLM programs, though the New York DLM programs are more generalized DR

[35] To the extent that any forward compensation for services has been provided as an up-front payment, removal from the program would need trigger a claw back mechanism for a pro-rated amount of the up-front payment to effectuate a pay for performance model.

programs that are not limited to battery storage. The simple fact that these programs have persisted and even been expanded over time is indicative that regulators are comfortable with the historic performance and believe the programs have value.

As a specific example, Consolidated Edison's 2019 DLM program report cites a performance factor (the ratio capacity pledged to capacity delivered) of 83% in 2019 and 85% in 2018 for CSRP planned events.[36] A planned event refers to an event called with at least 21 hours of notice. It is also worth noting that the recent approval of the Daily Dispatch BYOD programs in Massachusetts hinged on the successful completion of limited pilots during Summer 2019. According to the Order approving the programs, by the end of the its residential pilot National Grid reached a 93% performance level while participants (limited to non-residential customers) in the Eversource pilot met 91% of their committed dispatch levels.[37]

Q. DO YOU HAVE ANY OTHER OBSERVATIONS ON THE ISSUE OF NON-PERFORMANCE THAT THE BPU SHOULD BE AWARE OF?

A. Yes. It is notable that the Daily Dispatch pilot programs in Massachusetts were "first generation" programs. The fact that they produced high quality results nearly immediately indicates that it is simply not that difficult to deploy a

[36] New York Public Service Commission, Case No. 09-E-0115, Consolidated Edison Company of New York, Inc., Report on Program Performance and Cost Effectiveness of Demand Response Programs – 2019 (Nov. 15, 2019) *available at* https://tinyurl.com/rcr75qe.

[37] Massachusetts Department of Public Utilities, Docket Nos. 20-33 through 20-36, Order dated July 28, 2020 at p. 6, *available at* https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/12489986.

successful BYOD program. While this might initially seem surprising, it is less so if one considers the conceptual and operational simplicity of the BYOD model.

E. Compensation Rates

Q. HOW SHOULD THE AMOUNT OF CAPACITY RESERVATION PAYMENTS BE DETERMINED?

A. At a high level, the payments should be based on avoided costs, such as the projected generation capacity cost savings or the marginal cost of deferred or eliminated distribution investments. A compensation structure based on marginal cost savings, coupled with a pay for performance only design, ensures that other ratepayers do not experience higher costs as a result of the program. The direct translation of avoided costs into compensation rates could be structured to reduce ratepayer risk, allow benefits sharing, and reflect program costs.

Q. PLEASE ELABORATE ON POTENTIAL ADJUSTMENTS TO A DIRECT PASSTHROUGH OF AVOIDED COSTS FOR PARTICIPANT COMPENSATION.

A. While a pay for performance model addresses performance risk to non-participants, it does not address the risk that event calls may not perfectly align with cost avoidance (*i.e.*, forecast error).[38] For instance, it could be that dispatches targeting generation capacity cost reductions miss one of the top five PJM peak hours. To address this, compensation could be pro-rated to assume that event calls will not be 100% effective. For instance, in its initial utility-owned customer-sited storage pilot, GMP in Vermont assumed that systems would only be 75%

[38] One virtue of a daily dispatch model is that mitigates potential issues with forecast error.

effective at reducing transmission charges.[39] A later version of the program using a BYOD model assumes that the systems will be effective at reducing 8 out of 12 monthly peaks.[40] The avoided costs calculation based on these assumptions is then translated into a fixed minimum participation payment based on the power made available to the utility.

Separately, a direct pass-through of total avoided costs in the form of compensation to participants does not produce savings for non-participants. In other words, the cost of the service is provided by one resource, but at the same cost of the alternative resource, thereby providing zero net-savings (*i.e.*, zero net - benefit). A benefits sharing ratio could reserve a portion of projected avoided costs (*e.g.*, 10%) for non-participant ratepayers.

Q. DO YOU RECOMMEND THAT THE BPU INCORPORATE ADJUSTMENTS OF THIS TYPE INTO THE BYOD COMPENSATION DESIGN?

A. Not necessarily in the initial version of the program. The initial version of the program should target participation as the highest priority goal in order to validate program operation. Lowering the compensation rate with these types of adjustments could chill participation and detract from the ultimate success of the program. Such adjustments would be worth considering in the future though once a successful framework has been established.

[39] GMP Innovative Pilot Filing (Dec. 2, 2015) *available at* https://greenmountainpower.com/wp-content/uploads/2017/01/Hudson-12.02.2015-Tesla-Pilot-Filing.pdf.
[40] GMP Letter to the Vermont Public Service Board (Feb. 23, 2018) *available at* https://greenmountainpower.com/wp-content/uploads/2019/04/Exh.-REV-Joint-5-Attachment-GMP.DPS2_.Q66.c5-BYOD-Pilot-Initial-Filing-2-23-18.pdf

Q. PLEASE EXPLAIN YOUR RECOMMENDATION THAT CUSTOMERS BE PERMITTED TO LOCK-IN COMPENSATION RATES FOR TEN YEARS.

A. Ten years is typically cited as the minimum useful life of lithium-ion based battery storage systems, though I note that in the instant proceeding PSEG assumes a useful life of 15 years. A fixed or minimum compensation lock-in feature is an important financing consideration due to the high upfront costs of energy storage systems. A fixed rate payment is functionally similar to how costs would be incurred if an energy storage system was owned by PSEG and included in its rate base. The 10-year lock in is used in other utility programs as well. The PSEG-LI DLM program allows a 10-year rate lock-in for energy storage systems and the GMP Vermont BYOD program effectively does so through its up-front payment model and 10-year commitment term.

Q. WOULD A MINIMUM LOCKED-IN RATE CREATE RISKS TO NON-PARTICIPATING RATEPAYERS, FOR INSTANCE, IF COST SAVINGS ARE LOWER THAN EXPECTED?

A. It would, though the design I propose can incorporate several discretionary elements to mitigate non-participant risk. First, assumptions of: (a) less than 100% effectiveness, and (b) a non-participant sharing ratio, could provide a margin for error in cost projections, creating an insulating effect. In addition, it is important to acknowledge that non-participating customers would also retain the upside if cost savings turned out to be higher than expected. This is an appropriate balance of risk in my opinion, and a better deal than ratepayers receive under a

utility-owned storage scenario since pay for performance ensures that ratepayers are not saddled with large capital investment costs and the attendant performance-related risk.

Q. HOW WOULD COMPENSATION FOR SERVICES BE DISTRIBUTED TO PARTICIPANT ENERGY STORAGE OWNERS?

A. Payment for services would be assigned to the energy storage owner, which could be an individual customer participant or a third-party owner and operator. Individual participants should be permitted to assign their payment to another entity through private contractual agreements between those entities, such as a third-party operator (*i.e.*, DER aggregator) that does not own the energy storage system and the storage owner or between the storage owner (in the case of TPO systems) and the host customer.

F. Sector and Ownership Issues

Q. SHOULD NON-RESIDENTIAL CUSTOMERS BE PERMITTED TO PARTICIPATE IN ANY BYOD PROGRAM THE BPU ADOPTS?

A. The BYOD design is equally compatible with non-residential sited energy storage systems as it is with residential-sited systems. If the BPU were to adopt a BYOD program, it would not be unreasonable for it to also permit participation from systems located on non-residential customer sites.

Q. WHY DO YOU RECOMMEND THAT ANY ADOPTED BYOD PROGRAM INCLUDE A RESIDENTIAL-ONLY SEGMENT?

A. If the size of the program is capped the potential exists for a small number of large non-residential energy storage systems to fill a large portion (or all) of the

program and correspondingly limit the availability to residential participants. A residential carve-out would ensure that this does not occur.

Q. IF NON-RESIDENTIAL ENERGY STORAGE SYSTEMS WOULD PROVIDE THE SAME GRID SERVICES, WHY SHOULD THEIR PARTICIPATION BE LIMITED?

A. BYOD presents significant market transformation and learning opportunities. It is important that "lessons learned" encompass experiences with a diverse set of resources that may be subject to different participation issues and barriers. For instance, a residential program segment is important for identifying issues and opportunities associated with aggregation of these assets, which may not present themselves in the context of large non-residential systems that participate individually.

Q. PLEASE EXPLAIN YOUR RECOMMENDATION THAT UTILITY-OWNED BTM ENERGY STORAGE NOT BE PERMITTED TO PARTICIPATE IN THE BYOD PROGRAM YOU RECOMMEND?

A. Ample opportunities exist for PSEG to pursue utility-owned energy storage through other means, such as through the instant proceeding. One of the core goals of a BYOD program is to establish a value proposition and scalable grid services procurement regime for non-utility owned energy storage. Extending the current utility monopoly on providing grid services into a program specifically intended to animate the competitive market for grid services would be antithetical to the goals of encouraging non-utility investment in energy storage and animating competitive grid service markets.

Moreover, participation of utility-owned assets in a program that the utility itself administers raises a host of competitive concerns that would need to be addressed, which in turn would complicate the successful establishment of the program. Utility ownership of BYOD resources is simply incompatible with the objectives of a BYOD program, and antithetical to fostering a competitive energy storage market in New Jersey. Accordingly, it should not be permitted under any circumstances.

G. Development of a Final Program Design

Q. HOW SHOULD THE FINAL PROGRAM DESIGN BE DEVELOPED?

A. First, I recommend that the Board adopt a conceptual BYOD framework based on minimum program characteristics I identified in the Straw BYOD Design. I further recommend that PSEG be directed to: (a) consult with industry, Board Staff, the Office of Rate Counsel, and other interested stakeholders to further develop the remaining program details; and (b) submit a final BYOD program proposal for Board approval within a time frame that the Board deems sufficient and convenient, but no more than nine months after a Board Order adopting the conceptual BYOD framework.

Q. WHAT MINIMUM CONTENTS SHOULD THE BOARD REQUIRE IN PSEG'S FINAL PROGRAM FILING?

A. At a minimum PSEG's filing should include: (a) a full set of proposed program terms and conditions, such as those attached as Attachment JRB-3; (b) justifications for all substantive program terms and conditions, including but not limited to compensation rates, performance measurement protocols, and all

program processes; (c) a detailed description of the Company's consultation efforts that includes participant lists, summaries of individual meetings or consultations held and materials from those events; (d) a list of consensus and non-consensus issues tethered to the proposed terms and conditions; and (e) an implementation plan that includes a program timeline and marketing plan.

The Board may wish to specify further requirements to ensure that it receives a high quality program design that fully addresses any particular concerns it has, such as interim progress reporting. I generally support the inclusion of greater rather than lesser detail in any Board directives surrounding the development of a final program design, but I expect that the Board has a better idea than I do of what it specifically wants to see in a final program proposal.

IV. CONCLUSION

Q. PLEASE BRIEFLY SUMMARIZE YOUR CONCLUSIONS ON PSEG'S ENERGY STORAGE PROGRAM APPLICATION.

A. PSEG's collective proposals seek to utilize energy storage systems under a variety of use cases to provide grid services. Notably lacking in those proposals is any program or mechanism for supporting the use of non-utility-owned BTM energy storage to provide those same services, despite the fact that non-utility-owned BTM energy storage systems are equally capable of doing so at a lower cost and lower risk to ratepayers. Furthermore, by failing to provide market participation pathways for non-utility-owned BTM energy storage, the Company's Application falls short of providing the support necessary to achieve the objectives established in New Jersey's Energy Master Plan, which embraces the role that customer-sited

DERs, including energy storage, should play in a more decentralized and resilient grid. Accordingly, the Company's Energy Storage Program proposal is incomplete and should not be approved without modifications to remedy this gap.

Q. WHAT MODIFICATIONS SHOULD THE BOARD MAKE TO THE COMPANY'S PROPOSED ENERGY STORAGE PROGRAM?

A. The Board, in any Order approving a portion or all of the Company's Application, should adopt establish a BYOD program that supports the use of non-utility-owned BTM energy storage systems to provide grid services in accordance with minimum program characteristics described in my testimony. Among other things, these characteristics include: (a) a pay for performance mechanism to reward participating customers for the service provide while at the same time insulating non-participating ratepayers from risk of paying for a non-performing asset; and (b) providing customers the option to participate through DER aggregators. To facilitate the prompt establishment of a BYOD program I recommend:

1. PSEG be directed to consult with industry, Board Staff, the Office of Rate Counsel, and other interested parties to finalize the program design and submit that final design for Board approval within a timeframe established by the Board, but no longer than nine months after a Board Order;
2. The initial version of the program should target the Peak Load Reduction and Distribution Deferral use cases described in the Company's application for deployment as full program offerings in the PSEG territory; and
3. The program design should reflect simplicity and ease of deployment as first priorities, and seek to use existing programs as templates to the greatest

degree practicable. With respect to this recommendation, I have attached one such template, the terms and conditions for a program operated by GMP in Vermont, as Attachment JRB-3.

Q. DO YOU HAVE ANY FURTHER CONCLUDING REMARKS TO THE BOARD ON YOUR PROPOSAL?

A. Yes. I recognize that my BYOD program proposal may be novel to New Jersey and the Board, and that my discussion of minimum program characteristics may at first glance appear to imply a fairly complex endeavor. Accordingly, I understand that the Board may be inclined to defer adopting a BYOD program in the instant proceeding in order to assemble additional information and out of a general abundance of caution. Doing so would be a mistake for several reasons.

First, adopting a BYOD program using a pay for performance design is actually a cautious and prudent approach to supporting the use of energy storage to provide grid services because the design itself insulates ratepayers from risk. Second, PSEG's proposal presents the Board with an immediate opportunity to pursue the objectives for DERs laid out in the Energy Master Plan. Third, while there is a need to develop the finer design details for a BYOD program, the BYOD model itself is conceptually very simple, and compatible with simple designs that can be evolved over time. Given the availability of existing full programs in other states to use as templates, a nine-month window for PSEG to develop a final program design with stakeholders should be more than sufficient to produce a proposal for Board consideration. Should the Board have reservations at that time, it will have the opportunity to provide further guidance

or establish such other steps it deems appropriate to implement the BYOD program.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes it does at this time. However, I reserve the right to supplement my testimony based on any new or updated information that becomes available during the course of this proceeding.

Attachment JRB-1

JUSTIN R. BARNES

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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 analysis to fulfill client requests, and for internal and published reports, focused primarily on drivers of distributed energy resource (DER) markets and policies.
- Provide expert witness testimony on topics including cost of service, rate design, distributed energy resource (DER) value, and DER policy including incentive program design, rate design issues, and competitive impacts of utility ownership of DERs.
- Managed the development of a solar power purchase agreement (PPA) toolkit for local governments, a comprehensive legal and policy resource for local governments interested in purchasing solar energy, and the planning and delivery of associated outreach efforts.

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 & OTHER REGULATORY ASSISTANCE

Virginia State Corporation Commission. Docket No. PUR-2020-00015. July 2020. On behalf of Appalachian Voices. Appalachian Power Company general rate case. Analysis of the cost basis for the residential customer charge, the Company's winter declining block rate proposal, and a proposed Coal Asset Retirement Rider (Rider CAR) providing for advance collection of anticipated accelerated depreciation of coal generation assets. Provided an alternative residential customer charge recommendation and an alternative rates proposal for addressing winter bill volatility for electric heating customers.

North Carolina Utilities Commission. Docket No. E-7 Sub 1219. April 2020. On behalf of the North Carolina Sustainable Energy Association. Duke Energy Progress general rate case. Provided analysis of available rate options for electric vehicle charging and recommended the adoption of residential and non-residential EV-specific rate options and appropriate design characteristics for those rate options.

North Carolina Utilities Commission. Docket No. E-7 Sub 1214. January 2020. On behalf of the North Carolina Sustainable Energy Association. Duke Energy Carolinas general rate case. Provided

analysis of available rate options for electric vehicle charging and recommended the adoption of residential and non-residential EV-specific rate options and appropriate design characteristics for those rate options.

Virginia State Corporation Commission. Docket No. PUR-2019-00060. November 2019. On behalf of Appalachian Voices. Old Dominion Power Company general rate case application. Analysis of the cost basis for the residential customer charge, proposal to change the residential customer charge from a monthly charge to a daily charge, and design of proposed customer green power program and utility owned commercial behind the meter solar proposal. Proposed modified optional rate structure for mid- to large-size non-residential customers with on-site solar and/or low load factors.

Georgia Public Service Commission. Docket No. 42516. October 2019. On behalf of Georgia Interfaith Power and Light, Southface Energy Institute, and Vote Solar. Georgia Power Company general rate case application. Analysis of the cost basis for the residential customer charge, the validity of the utility's minimum-intercept study, and a proposal to change the residential customer charge from a monthly charge to a daily charge.

Hawaii Public Utilities Commission. Docket No. 2018-0368. July 2019. On behalf of the Hawaii PV Coalition. Hawaii Electric Light Company (HELCO) general rate case application. Provided analysis of HELCO's proposed changes to its decoupling rider to make the decoupling charge non-bypassable and the alignment of the proposed modifications with state policy goals and the policy rationale for decoupling.

Virginia State Corporation Commission. Docket No. PUR-2019-00067. July 2019.* On behalf of the Southern Environmental Law Center. Appalachian Power Company residential electric vehicle (EV) rate proposal. Provided review and analysis of the proposal and developed comments discussing principles of time-of-use (TOU) rate design and proposing modifications to the Company's proposal to support greater equity among rural ratepayers and greater rate enrollment. ***This work involved comment preparation rather than testimony.**

New York Public Service Commission. Case No. 19-E-0065. May 2019. On behalf of The Alliance for Solar Choice. Consolidated Edison (ConEd) general rate case application. Provided review and analysis of the competitive impacts and alignment with state policy of ConEd's energy storage, distributed energy resource management system, and earnings adjustment mechanism (EAM) proposals. Proposed model for improving the utilization of customer-sited storage in existing demand response programs and an alternative EAM supportive of utilization of third party-owned battery storage.

South Carolina Public Service Commission. Docket No. 2018-318-E. March 2019. On behalf of Vote Solar. Duke Energy Progress general rate case application. Analysis of the cost basis for the residential customer charge and validity of the utility's minimum system study, AMI-enabled rate design plans, excess deferred income tax rider rate design, and grid modernization rider proposal, including the reasonableness of the program, class distribution of costs and benefits, and cost allocation.

South Carolina Public Service Commission. Docket No. 2018-319-E. February 2019. On behalf of Vote Solar. Duke Energy Carolinas general rate case application. Analysis of the cost basis for the residential customer charge and validity of the utility's minimum system study, AMI-enabled rate design plans, excess deferred income tax rider rate design, and grid modernization rider proposal, including the reasonableness of the program, class distribution of costs and benefits, and cost allocation.

New Orleans City Council. Docket No. UD-18-07. February 2019. On behalf of the Alliance for Affordable Energy. Entergy New Orleans general rate case application. Analysis of the cost basis for the residential customer charge, rate design for AMI, DSM and Grid Modernization Riders, and DSM

program performance incentive proposal. Developed recommendations for the residential customer charge, rider rate design, and a revised DSM performance incentive mechanism.

New Hampshire Public Utilities Commission. Docket No. DE 17-189. May 2018. On behalf of Sunrun Inc. Review of Liberty Utilities application for approval of customer-sited battery storage program, analysis of time-of-use rate design, program cost-benefit analysis, cost-effectiveness of utility-owned vs. non-utility owned storage assets. Developed a proposal for an alternative program utilizing non-utility owned assets under an aggregator model with elements for benefits sharing and ratepayer risk reduction.

North Carolina Utilities Commission. Docket No. E-7 Sub 1146. January 2018. On behalf of the North Carolina Sustainable Energy Association. Duke Energy Carolinas general rate case application. Analysis of the cost basis for the residential customer charge and validity of the utility's minimum system study, allocation of coal ash remediation costs, and grid modernization rider proposal, including the reasonableness of the program, class distribution of costs and benefits, and cost allocation.

Ohio Public Utilities Commission. Docket No. 17-1263-EL-SSO. November 2017*. On behalf of the Ohio Environmental Council. ***Testimony prepared but not filed due to settlement in related case.** Duke Energy Ohio proposal to reduce compensation to net metering customers. Provided analysis of capacity value of solar net metering resources in the PJM market and distribution of that value to customers. Also analyzed the cost basis of the utility proposal for recovery of net metering credit costs, focused on PJM settlement protocols and how the value of DG customer exports is distributed among ratepayers, load-serving entities, and distribution utilities based on load settlement practices.

North Carolina Utilities Commission, Docket No. E-2 Sub 1142. October 2017. On behalf of the North Carolina Sustainable Energy Association. Duke Energy Progress general rate case application. Analysis of the cost basis for the residential customer charge and validity of the utility's minimum system study, allocation of coal ash remediation costs, and advanced metering infrastructure deployment plans and cost-benefit analysis.

Public Utility Commission of Texas, Control No. 46831. June 2017. On behalf of the Energy Freedom Coalition of America. El Paso Electric general rate case application, including separate DG customer class. Analysis of separate DG rate class and rate design proposal, cost basis, DG load research study, and analysis of DG costs and benefits, and alignment of demand ratchets with cost causation principles and state policy goals, focused on impacts on customer-sited storage.

Utah Public Service Commission, Docket No. 14-035-114. June 2017. On behalf of Utah Clean Energy. Rocky Mountain Power application for separate distributed generation (DG) rate class. Provided analysis of grandfathering of existing DG customers and best practices for review of DG customer rates and DG value. Developed proposal for addressing revisions to DG customer rates in the future.

Colorado Public Utilities Commission, Proceeding No. 16A-0055E. May 2016. On behalf of the Energy Freedom Coalition of America. Public Service Company of Colorado application for solar energy purchase program. Analysis of program design from the perspective of customer demand and needs, and potential competitive impacts. Proposed alternative program design.

Public Utility Commission of Texas, Control No. 44941. December 2015. On behalf of Sunrun, Inc. El Paso Electric general rate case application, including separate DG customer class. Analysis of separate rate class and rate design proposal, cost basis, DG load research study, and analysis of DG costs and benefits.

Oklahoma Corporation Commission, Cause No. PUD 201500271. November 2015. On behalf of the Alliance for Solar Choice. Analysis of Oklahoma Gas & Electric proposal to place distributed generation customers on separate rates, rate impacts, cost basis of proposal, and alignment with rate design principles.

South Carolina Public Service Commission, Docket No. 2015-54-E. May 2015. On behalf of The Alliance for Solar Choice. South Carolina Electric & Gas application for distributed energy programs. Alignment of proposed programs with distributed energy best practices throughout the U.S., including incentive rate design and community solar program design.

South Carolina Public Service Commission, Docket No. 2015-53-E. April 2015. On behalf of The Alliance for Solar Choice. Duke Energy Carolinas application for distributed energy programs. Alignment of proposed programs with distributed energy best practices throughout the U.S., including incentive rate design and community solar program design.

South Carolina Public Service Commission, Docket No. 2015-55-E. April 2015. On behalf of The Alliance for Solar Choice. Duke Energy Progress application for distributed energy programs. Alignment of proposed programs with distributed energy best practices throughout the U.S., including incentive rate design and community solar program design.

South Carolina Public Service Commission, Docket No. 2014-246-E. December 2014. On behalf of The Alliance for Solar Choice. Generic investigation of distributed energy policy. Distributed energy best practices, including net metering and rate design for distributed energy customers.

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)

Attachment JRB-2

Table 2: Residential BYOD Program Examples

State	Utility	Program	Compensation	Use Case
Connecticut[1]	Eversource	Connected Solutions – Targeted Seasonal	$225/kW-summer & $50/kW-winter (avg. per peak event), locked in for five years.	Reduction in ISO-NE capacity charges.
Connecticut[2]	United Illuminating	ConnectSun	$0.05/kWh from June – Sept. on-peak energy, locked in for five years, plus $500 rebate for additional metering.	Distribution deferral on two circuits.
Massachusetts[3]	National Grid	Connected Solutions – Targeted Seasonal	$225/kW-summer & $50/kW-winter (avg. per peak event), locked in for five years.	Reduction in ISO-NE capacity charges.
Massachusetts[4]	Eversource	Connected Solutions – Targeted Seasonal	$225/kW-summer & $50/kW-winter (avg. per peak event), locked in for five years.	Reduction in ISO-NE capacity charges.
Massachusetts[5]	National Grid, Unitil, Eversource	Connected Solutions – Daily Dispatch	$/kW for dispatch on a daily basis. Further details of permanent program forthcoming.	Reduction in ISO-NE capacity charges.
New Hampshire[6]	Liberty Utilities	Residential Battery Storage Pilot	Phase 1 (Utility-Owned): Arbitrage via new TOU rate. Phase 2 (BYOD): TBD	Reduction in ISO-NE transmission and potentially capacity charges.

[1] Eversource Connecticut. Application for ConnectedSolutions: Small Scale Batteries, available at: https://www.eversource.com/content/ct-c/residential/save-money-energy/manage-energy-costs-usage/demand-response/battery-storage-demand-response
[2] Energize Connecticut. ConnectSun, available at: https://www.energizect.com/connectsun-home
[3] National Grid Massachusetts. Program Materials for Connected Solutions for Small Scale Batteries, available at: https://www.nationalgridus.com/media/pdfs/resi-ways-to-save/program-materials-for-connectedsolutions-for-small-scale-batteries-ma.pdf
[4] Eversource Massachusetts East. Application for ConnectedSolutions: Small Scale Batteries, available at: https://www.eversource.com/content/docs/default-source/save-money-energy/battery-demand-response-application.pdf?sfvrsn=3e03d362_4
[5] Massachusetts Department of Public Utilities. Docket Nos. 20-33, 20-34, 20-35, and 20-36. Order dated July 28, 2020 at p. 6, available at: https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/12489986
[6] New Hampshire Public Utilities Commission ("NH PUC"). Docket No. DE 17-189. Order No. 26,209. January 17, 2019. A BYOD version of the currently active utility-owned battery storage program is slated to be developed upon the successful demonstration of the current program. New Hampshire is also pursuing the development of a statewide BYOD program via its 2021-2023 energy efficiency and demand response program development process. *See* NH PUC Docket No. DE 20-092, available at: https://www.puc.nh.gov/Regulatory/Docketbk/2020/20-092.html

Table 2: Residential BYOD Program Examples

New York[7]	PSEG Long Island	Dynamic Load Management Tariff	$/kW-month capacity reservation payment (May – September), differentiated by location. 10-year rate lock-in for energy storage systems. Minor $/kWh payment during events.	CSRP: System-wide distribution deferral DLRP: Local distribution network reliability emergencies
New York[8]	Consolidated Edison NY	Commercial Demand Response Programs	$/kW-month capacity reservation payment (May – September) differentiated by location & number of event calls per peak season. Rates may change annually. Minor $/kWh payment during events.	CSRP: System-wide distribution deferral DLRP: Local distribution network reliability emergencies
Rhode Island[9]	National Grid	Connected Solutions – Targeted Seasonal	$400/kW-summer season (avg. per peak event), locked in for five years.	Reduction in ISO-NE capacity charges.
Vermont[10]	Green Mountain Power	Bring Your Own Device	Up-front payment of $850/kW for 3-hour storage discharge capability or $950/kW for 4-hour discharge capability (10% event performance tolerance subject to clawback), plus $850 for systems installed under solar self-consumption option. Adder of $100/kW for standalone systems and additions to existing solar in certain locations. 10-year program commitment.	Reduction in ISO-NE transmission and capacity charges; solar production shifting.

[7] Long Island Power Authority. Tariff for Electric Service, Section XIII: Dynamic Load Management and accompanying Commercial System Relief Program and Distribution Load Relief Program Payment Statements, available at: https://www.lipower.org/about-us/tariff/
[8] Consolidated Edison New York. Schedule for Electric Delivery Service, Rider T, available at: https://www.coned.com/_external/cerates/documents/elecPSC10/electric-tariff.pdf
[9] National Grid Rhode Island Program Materials for Connected Solutions for Small Scale Batteries, available at: https://www.nationalgridus.com/media/pdfs/resi-ways-to-save/ri-program-materials-for_-connectedsolutions-for-small-scale-batteries-v16.pdf
[10] Green Mountain Power. BYOD – Terms and Conditions, available at: https://greenmountainpower.com/bring-your-own-device/battery-systems/

Attachment JRB-3

GREEN MOUNTAIN POWER CORPORATION
Bring Your Own Device ("BYOD") Terms & Conditions

Below are important terms that you must understand and agree to in order to participate in the BYOD program. Application of these terms is dependent on the BYOD program that you have selected below, either the One-Time Upfront Incentive – Battery (Back Up Only) or One-time Upfront Incentive – Battery (Self-Consumption).

Customer: (printed) _____(the "Customer" or "You")

Email Address:_____
Phone Number:_____

GMP Account Number: _____
Name of Installer_____

Address for Installation:
_____("Home")

_____
("Equipment"). See Attachment for compatible list of equipment.

_____("Back Up Only") OR _____ ("Self-Consumption")

Device Manufacturer: _____
Device Serial #: _____

Power Limit and Capacity Available to GMP: ___2kW ___2.5kW ___3kW ___3.5kW ___4kW ___4.5kW ___5kW ___5.5kW ___6kW ___6.5kW ___7kW ___7.5kW ___8kW ___8.5kW ___9kW ___9.5kW ___10kW

___3 hour capacity ___4 hour capacity

BYOD Incentive To Be Sent To: ___Customer ___Installer

1. **Acknowledgment of Access to Equipment, Internet Access, and Customer data**: You agree that the Equipment: (i) has a working and reliable internet access in Customer's home that is positioned to communicate reliably with the Equipment; (ii) has a user account for the Equipment where applicable; (iii) has other system elements that may be specified as required by the Manufacturer of any of the equipment (i.e. smart phone apps); and (iv) **BECAUSE THE BATTERY EQUIPMENT CAN BE DEPLETED AT ANY TIME, YOU SHOULD NOT RELY EXCLUSIVELY ON THE BATTERY EQUIPMENT TO POWER LIFE-SUPPORTING EQUIPMENT**. You agree that GMP may access the Equipment remotely for load management purposes as state herein, and to monitor energy usage discharge and performance. It is your responsibility to ensure that you have all required system elements and that such elements are compatible and properly configured. You are responsible for all fees charged by your Internet service provider ("ISP") in connection with participation. You also acknowledge responsibility for compliance with all applicable agreements, terms of use/service, and other policies of your Equipment Manufacturer/Installer and your ISP.

_____
Customer Initials

2. **Equipment & Access Disruption Fee:** In the event that Equipment fails to operate or GMP is unable to communicate with the Equipment and communication or access is not restored as necessary within 30 days' after notice from GMP, for each One Time Up Front Incentive – Battery (Back Up Only) previously received, you will incur a charge of $12.70 per kW per month, until access is restored, or this Agreement is terminated in accordance with Paragraph 6.

3. **Equipment Performance**: If Equipment fails to perform within +/- 10% of the enrolled capacity noted above or to perform in self-consumption mode as required, you will have 30 days to resolve the issue and to have GMP test and verify that performance has been restored. If performance is not restored within 30 days, GMP may elect to terminate your participation in the BYOD program as provided in Paragraph 6.

4. **Control of Equipment During Peak Event and Data Access:** Unless you have selected the self-consumption option, You acknowledge that GMP will control the Equipment in your home as necessary and agree that GMP may access and control your Equipment during Peak Events as required. A "Peak Event" is defined as a period of time in which GMP will make necessary changes to the Equipment. 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 electronic method, at least 4 hours in advance.

As part of this Pilot, You consent to GMP and/or GMP third party vendor access and use of certain customer data and information, including energy usage and consumption data, as well as personally identifiable information. By signing up to participate in the BYOD Program, you consent to this information being accessed and provided to or by GMP and/or GMP third party vendors. This information will be used to assist in programming, reporting, monitoring, and controlling the Equipment, as well as other uses consistent with GMP's Privacy Policy (available upon request), and as provided in applicable third-party vendor terms and conditions. GMP control of Equipment enrolled in BYOD self-consumption option is not necessary or required, but the enrolled system must be connected to GMP and data made available as stated herein.

You consent to the terms and conditions expressed in Equipment monitoring platform(s) and web-based management services that GMP utilizes to enable control and access of Equipment, to view performance data, and otherwise enable required third party vendors or products, which may be amended or revised from time to time, and shall be posted and maintained on GMP's website at www.greenmountainpower.com. You expressly authorize GMP to use any interface necessary to facilitate vendor programming and communication with Equipment, to access data generated by your Equipment, and to issue commands for the operational control and management of the Equipment consistent with this Agreement, including without limitation charging and/or dispatching energy and storage resources. You agree not to terminate applicable software licenses, interface or engagement, or to request that the Equipment be disconnected from vendor programming or interface during the Term of this Agreement. **Acknowledgment of Customer:** You acknowledge and agree that GMP may control the operation, charge and discharge of the Equipment installed in your home as necessary, and that only the energy in the Equipment at the time of a grid outage will be available to you for backup power services. Other Equipment benefits and services, such as self-consumption (except for customers who elect self-consumption as discussed in Paragraph 9 of this agreement), load shifting for utility bill management, and other potential future services and benefits will not be available to you. You acknowledge that you remain responsible for maintenance, repair and replacement of the Equipment.

You acknowledge and understand that if your Equipment requires that it be recharged only by solar power for any reason, whether for operational, financial or other benefits or reasons, this may impact or delay the Equipment's return to a fully charged status and availability for the BYOD program commitments or back up power.

System outages, Equipment failure, or other circumstances outside GMP's control may impact or delay the charging status and availability of your Equipment. GMP cannot guarantee that your Equipment will be charged, fully charged, or available to you during

all system outages; however, the BYOD program is designed so that GMP will minimize use of your Equipment during or prior to a weather event that is expected to cause system outages.

BECAUSE THE BATTERY EQUIPMENT CAN BE DEPLETED AT ANY TIME, YOU SHOULD NOT RELY EXCLUSIVELY ON THE BATTERY EQUIPMENT TO POWER LIFE-SUPPORTING EQUIPMENT.

_____
Customer Initials

5. **Enrollment & Term:** This Agreement shall commence upon your enrollment and shall continue for a period of ten years (the "Initial Term"), renewing annually after the Initial Term.

6. **Termination:** Either party may terminate this Agreement by providing the other party 30 days' written notice of termination. Upon early termination by Customer, Customer will owe GMP a pro-rated one-time payment based on the calculation below, payable within 30 days of invoice:

   Number of months remaining in the Initial Term / total months in Initial Term * *per kW* incentive or per incentive given = Total amount *per kW* owed to GMP (Back up Only Incentive) or Total amount (no KW multiplier) owed to GMP (Self-Consumption Incentive).

   Examples:
   Back up Only Incentive: If 48 of the 120 months remain in the Term, Customer will owe 48/120 * $850 = $340 ***per kW***, or in the case of the higher incentive: 48/120 * $950 = $380 per kW. Installations in a GMP- constrained area as shown on GMP's website receiving an additional $100 incentive would be calculated as follows: 48/120*$950=$380 per kW or in the case of the higher incentive 48/120*1050=$420 per kW.

   Self-Consumption Incentive: If 48 of the 120 months remain in the Term, Customer will owe 48/120 * $850 = $340. Installations in a GMP- constrained area as shown on GMP's website receiving an additional $100 incentive would be calculated as follows: 48/120*$950=$380.00.

7. **Change in Home Ownership:** You acknowledge that you are required to own the premises where the Equipment is installed. By signing below, you represent that you own the premises where the Equipment is installed.

You agree to provide GMP with 30 days advance notice of a sale of the home where the Equipment is installed. In the event of a sale, you may choose to terminate this Agreement in accordance with Paragraph 6 or if the parties agree, the new owner may assume this Agreement in writing. You are responsible for providing GMP with an executed assignment and assumption agreement, in a form provided by or acceptable to GMP for our records. Assignments that attempt to relieve you from responsibility for sums incurred prior to the sale are not permitted. Sale or transfer of the Equipment to a third party who has not assumed this agreement shall constitute automatic termination of this Agreement, and in that case, You acknowledge that you will be billed for any up-front incentive on a pro-rata basis consistent with Paragraph 6.

8. Equipment Incentive Terms:

Backup Only Option: Customers have the option to provide GMP with a three-hour resource or a four-hour resource, which will dictate the amount of the one-time upfront incentive provided GMP. You acknowledge that the one-time incentive for Equipment used for back up and are not paired with self-consumption is calculated at $850 per kW (up to 10 kW) that is available for a minimum duration of 3 hours at the full chosen capacity rating or $950 per kw (up to 10kW) that is available for a minimum duration of 4 hours at the full chosen capacity rating. An additional $100 per kW (up to 10 kW) incentive payment will apply to Equipment installed as a stand-alone system or paired with a pre-existing solar array in a constrained area of GMP's grid as defined by the red, orange, and yellow sections on GMP's solar map at the time of sign up.

Self Consumption Option: You acknowledge that if you elect the one-time incentive for Equipment used for self-consumption, your household is required to self-supply from the Equipment for the duration of each Peak Event**,** and that the one-time incentive payment for Equipment paired with self-consumption is $850.00. An additional $100 incentive payment will apply to Equipment installed as a stand-alone system or paired with a pre-existing solar array in a constrained area of GMP's grid as defined by the red, orange, and yellow sections of GMP's solar map at the time of sign up. You agree to program your Equipment to perform in self-consumption mode consistent with this agreement for the Term, and to notify GMP if your Equipment is no longer being used in self-consumption mode. If requested, you agree to provide GMP with verification that your Equipment is being used in self-consumption mode in accordance with this agreement. If GMP determines that it is not being used in self-consumption mode, or that household grid consumption is not being reduced as expected during Peak Events, GMP shall have the option to terminate this Agreement in accordance with Paragraph 6.

The amount of the upfront incentive payment due will be confirmed by GMP once the Equipment completes a verification process to determine full functionality within GMP's energy platform.

Customers who receive the added incentive for being located in a constrained area of the GMP grid, agree to ensure that the Equipment is charging via solar between the hours of 10am and 2pm daily. GMP will review Charging patterns for any customers who receive the added incentive, and reserves the right to collect the added incentive amount if customer does not comply with this requirement.

Upfront incentives will be mailed out in the form of a check within approximately 2 weeks of GMP confirming the functionality of the installed system.

9. **Fees:** BYOD program fees are due and will be included on your GMP utility bill. Fees are non-by passable and include a monthly integration and communication fee of $3.97 (which covers the costs of software integration), additional manufacturer or network fees and charges if applicable (see next paragraph), access disruption fee of $12.70 per kW per month, if applicable, and any prorated return of incentive in the event of early termination.

10. If you enroll Equipment that requires additional manufacturer or network fees or charges, you will be responsible for those additional charges, which will be passed through by GMP to you. A list of those fees and charges is maintained on GMP's website here www.greenmountainpower.com.

11. **Liability:** To the fullest extent allowed by law, GMP shall not be liable for any direct, indirect, special or consequential damages to any persons or property resulting from or arising out of any use, repair, delay in repairing, replacement of, or modification to the Equipment.

12. **Indemnification**. You shall indemnify and hold harmless GMP for any injury or damage to any persons or property arising from GMP's access and use of the Equipment, or caused by any breach of this Agreement by you, your negligence or that of your household members, agents, servants, employees, tenants, licensees, invitees, tenant's invitees, or independent contractors.
13. **Notice** You must send any Notice required under this Agreement to EICFrontline@greenmountainpower.com.

14. **Governing Law**. This Agreement shall be governed by the laws of the State of Vermont. Except for the privacy policies referenced in Paragraph 4, and applicable Public Utility Commission Tariffs, this Agreement is the entire agreement between GMP and Customer pertaining to the Bring Your Own Device Program and supersedes any and all prior agreements, understandings, representations, and statements between the parties, whether oral or written. Any change to the terms of this Agreement must be in a writing signed by Customer and GMP. The parties agree that any dispute arising out of this Agreement

shall be brought either before the Vermont Public Utility Commission or before a State or Federal court in the State of Vermont.

15. **Miscellaneous.** Equipment eligibility is at the sole discretion of GMP. Equipment that is enrolled in other GMP tariff or incentive programs is not eligible.

By signing this Agreement, I agree that I have read and understand the above terms.

GMP Customer Signature:

_____
Name: _____
Date:_____

Compatible Equipment

Tesla Powerwall 2.0

Sonnenbatterie

Pika Energy Systems

SolarEdge StorEdge Compatible Systems

Sunverge Batteries

See GMP website for updates www.greenmountainpower.com

PUBLIC SERVICE ELECTRIC AND GAS COMPANY – IN THE MATTER OF THE PETITION OF PUBLIC SERVICE ELECTRIC AND GAS COMPANY FOR APPROVAL OF ITS CLEAN ENERGY FUTURE – ELECTRIC VEHICLE AND ENERGY STORAGE ("CEF-EVES") PROGRAM ON A REGULATED BASIS	))))))	**DOCKET NO. EO18101111**

CERTIFICATE OF SERVICE

I, Blake Elder, hereby certify that I have this day caused a copy of the foregoing document to be served upon the official service list for EO18101111, attached hereto, by electronic mail to all persons with a valid email address.

Dated: September 4, 2020.

/s/ Blake Elder
Blake Elder
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T: (919) 825-3339
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