September 27, 2018

Via Electronic Mail

Judith Judson
Chair, Energy Efficiency Advisory Council (EEAC)
Commissioner, Massachusetts Department of Energy Resources (DOER)
100 Cambridge St, Suite 1020
Boston, MA 02114

Re: Sunrun Inc. Comments on 2nd Draft Three-Year (2019-2021) Energy Efficiency Plans

Dear Commissioner Judson and members of the EEAC:

Sunrun is the largest residential solar, storage, and energy services company in the country, with more than 200,000 customers in 23 states, the District of Columbia and Puerto Rico. We pioneered the "solar-as-a-service" model 11 years ago to make solar energy more accessible. Sunrun believes there is a better, less expensive, and cleaner way for families to power their homes, and with Sunrun's residential rooftop solar, storage, and energy services, homeowners are saving money, dramatically reducing their greenhouse gas footprint, and becoming energy management partners capable of delivering grid benefits and lowering system costs for other ratepayers.

Sunrun deploys home battery storage paired with solar, a smart inverter, and certain load management capabilities. Sunrun typically utilizes a DC-coupled architecture for 100% solar charging of the battery, with connectivity via WiFi or cellular for remote asset monitoring and dispatch. Sunrun customers are rapidly adopting battery storage paired with solar because they benefit from savings on their monthly electric utility bill. The Sunrun system also optimizes battery storage and solar production for customers based on customer preferences and market opportunities for the system to provide grid services.

Sunrun's fleet management capabilities across 200,000+ distributed assets, both solar and solar+storage, enable aggregation of individual sites for optimized dispatch for both customer and grid value, including peak load reduction, as proposed in the September draft 2019-2021 Three-Year Energy Efficiency Plan (Plan). As the draft Plan notes, the Program Administrators (PAs) are able to embrace new strategies and adopt emerging technologies to pursue new cost-effective opportunities and meet the goals of the Commonwealth, including greenhouse gas

emission reduction goals. Sunrun sees great promise in the ability of energy storage to contribute to these goals and provide benefits to ratepayers.

We commend the Energy Efficiency Advisory Council (EEAC) for its guidance to the PAs regarding the inclusion of behind-the-meter (BTM) energy storage in the Plan and applaud the PAs' initial proposals to incorporate energy storage into the Plan. Sunrun offers the following observations and recommendations to develop a robust and sustainable residential bring-your-own-battery (BYOB) program facilitated through third-party aggregators as part of the PAs' proposed Residential Storage Performance Program to deliver peak demand reduction benefits.

Residential Storage Performance Program

Sunrun commends the forward-thinking Residential Storage Performance Program proposal outlined in the September draft Plan; however, the Plan still requires additional detail on important program specifics, including program length, contract terms, number of peak events, payment levels, and interaction with other programs. Sunrun recommends the PAs' next draft include additional detail regarding program design and implementation by adapting the Plan to: 1) allow residential customers to participate in the program via a BYOB-based program individually or through third-party aggregators; 2) ensure customers can choose from multiple financing and ownership models to finance their systems; 3) ensure the program payment level is adequate to attract customers and developers for a robust program; 4) allow for statewide participation in the program; 5) allow customers with existing PV systems to participate if they add on new energy storage systems; and 6) ensure that program participants can layer this program with other state programs and incentives, such as Solar Massachusetts Renewable Target (SMART). These details all factor in to whether projects will be financeable and whether the program will be successful.

BYOB-Based Participation For Individuals or Through 3rd-Party Aggregators

As currently drafted, the Plan indicates that customers participating in the Residential Storage Performance Program will receive a signal or communication from the PA to trigger the customer response to decrease demand through the discharge of energy from storage.[1] Third-party, private (non-utility) aggregators are well-positioned to fill the role of receiving PA signals and managing storage system dispatch under the Residential Storage Performance Program.

In contrast to the bring your own device ("BYOD") program under the Residential Direct Load Control Program, energy storage system deployment is capital intensive and in most cases requires financing; and storage systems require ongoing asset management. Storage deployment, dispatch management, and financing are frequently handled by the same entity and often in a

[1] Three Year Plan at 63.

coordinated sales and installation process managed by that single entity. Relying on the PA to remotely control customers' energy storage systems to reduce load during called events creates capability redundancies in program management and execution, and also removes or reduces the cost reduction, marketing, and customer acquisition benefits of utilizing third-party aggregators who have developed sales and product offerings and financing models, and have built software platforms to monitor and dispatch their customers' energy storage systems.

To capture or enhance these benefits, Sunrun recommends the Residential Storage Performance Program be adapted to include a BYOB program element for customers to participate through third-party aggregators, in addition to allowing customers to participate without utilizing an aggregator. Aggregators can play a key role in recruiting and enrolling program participants without the utility taking on the risk and cost of deploying, maintaining, and dispatching each individual asset. For example, the PAs note in their Plan that they are striving to reach more "difficult to reach" customers, requiring more creative marketing approaches,[2] and that "residential active demand offerings present unique challenges for recruitment and implementation."[3] The Plan also notes that certain programs (including the active demand reduction programs inclusive of the storage performance initiative) and new marketing efforts are more expensive and leading to some measures becoming less cost-effective.[4] Adapting the Residential Storage Performance Program to allow BYOB-based customer participation through third-party aggregators can lead to more cost-effective and successful program implementation.

Aggregators can optimize the use of storage resources based on customer preferences (which may be unknown to the utility) and utility capacity commitments by having the PA send the signal or communication via API, phone call, email, or other appropriate signal to the aggregator(s) who would respond by dispatching their fleets and providing evaluation, measurement, and verification data to the PA. Aggregator participation will help to bring down the costs of program administration and marketing to the PAs, as storage developers and aggregators enter the market and take on the marketing and customer management responsibilities, such as customer education of program benefits and participation requirements. This is particularly important as it relates to customer education about participation in other programs, system operation considerations, and customer preferences, which could include co-optimization of a fleet of residential batteries such that when the utility requests a peak shaving event, the contracted capacity is delivered at an aggregate level based on optimization of the individual resources to account for individual customer preferences.

[2] Massachusetts Joint Statewide Electric and Gas Three-Year Energy Efficiency Plan 2019–2021 at 143 (Sept. 14, 2018) [hereinafter "Three Year Plan"].
[3] Three Year Plan at 62.
[4] Three Year Plan at 143-144.

To implement a BYOB-based customer program, Sunrun recommends the PAs adapt the Residential Storage Performance Program to reflect the the BYOB program framework utilizing third-party aggregators developed for Sunrun by expert consultant Justin Barnes, Director of Research at EQ Research LLC, in a proceeding pending before the New Hampshire Public Utilities Commission. The relevant portion of Mr. Barnes' testimony and recommended program design are attached to these comments.[5] Sunrun encourages the EEAC and the PAs to model the Residential Storage Performance Program after this attached program framework, which is based in part on a program that has already been deployed by Green Mountain Power in Vermont.[6] The EEAC and PAs may draw additional inspiration from the BYOB program proposed by PSEG-Long Island to implement a program for third-party aggregators to install residential batteries paired with new or existing solar for PSEG Long Island customers in order to catalyze the commercial and residential energy storage markets and provide load relief.[7]

Customer Choice in Financing Models

Sunrun commends the efforts to incorporate energy storage systems in the draft Plan, and specifically applauds the addition of energy storage as an eligible technology under the HEAT Loan program. We note, however, that private developers operating in Massachusetts provide consumers with multiple financing and leasing options and many customers may prefer to use the financing options offered by private developers, or combine these financing options with programs such as the HEAT Loan. We strongly encourage the PAs to allow customers to participate in the Residential Storage Performance Program regardless of the type or source of financing utilized by the participant, thus allowing the use of private capital in addition to HEAT Loan financing to advance statewide energy efficiency goals.

Set a Sufficient Performance Payment Level to Create a Robust Program

There is currently significant uncertainty surrounding the integration of distribution-level load reduction technologies to provide wholesale market benefits. For instance, if the Residential Storage Performance Program is used to reduce the ISO-NE Installed Capacity Requirement (ICR), the *Avoided Energy Supply Components in New England: 2018 Report* suggests Capacity DRIPE benefits of $156/kW-yr. However, ISO-NE rules would prohibit the storage system from also participating as a supply resource and capturing ISO-NE revenues.

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[5] Mr. Barnes' testimony discusses additional topics beyond the BYOB framework due to the specific context of New Hampshire proceeding. The most relevant portions of the testimony are Section V entitled "Alternative Program Design Model" and Attachment 2 entitled "Concept Bring Your Own Device Program Design."

[6] *See, e.g.,* Brooks, David, *Using Customer Batteries as a Power Source Saved Vt. Utility $500K*, Concord Monitor (July 23, 2018) *available at* https://granitegeek.concordmonitor.com/2018/07/23/using-customer-batteries-as-a-power-source-saved-vt-utility-500k/.

[7] *See* PSEG-LI, Utility 2.0 Long Range Plan 2018 Annual Update at 99-100 (June 29, 2018) *available at* https://www.lipower.org/wp-content/uploads/2018/06/2018-06-29-PSEG-LI-Utility-2.0-2018-Annual-Update.pdf.

Despite these restrictions, the Residential Storage Performance Program is a significant opportunity to develop a distribution-level retail program that can deliver near- and long-term wholesale market savings to ratepayers that result from retail load management through retail market mechanisms without these resources having to participate in the wholesale market. To capture these benefits through the Residential Storage Performance Program, however, the payment level must at least reflect the opportunity cost of foregone revenue streams that customers lose access to as a result of participating in the Residential Storage Performance Program. It is important, therefore, that the performance payments not be viewed as an additional revenue stream that could be earned on top of wholesale market revenue earning opportunities, but instead as an alternative revenue stream that reflects the opportunity cost of not participating in the wholesale market. In other words, the Residential Storage Performance Program payment value must be set at a level adequate to encourage a robust demand management program capable of meeting demand reduction goals on its own accord.

The adoption of performance-based payment arrangement is a workable construct, however, as discussed above, offering only performance-based payments for capital-intensive demand management measures risks lower deployment levels than a program that provides some form of upfront payment or rebate. To maximize deployment under a performance-payment-only construct, Sunrun recommends setting performance payments at a fixed monthly or annual rate to improve predictability and financeability of projects; however, annual payments must be greater than what would be received under an upfront rebate in order to account for the uncertainties of receiving the payments and the significantly higher upfront capital cost. Sunrun recommends a robust level of payment over a 10-year program term. Given the right payment amount, we estimate that 50% of new residential solar installations could be paired with storage. As discussed below, this should be complementary and in addition to SMART incentive payments.

It is important to note that battery aggregation and dispatch (including monitoring, ensuring connectivity, optimization and potentially equipment maintenance) requires costs presumably borne by an aggregator. While battery value can still be strongly net positive after these costs, it is important to consider the structure for delivery of compensation to enable management costs to be recovered. An optimal structure is for compensation to be paid to aggregators who then pass revenue through to customers, either as an upfront financed payment (netted from the cost of purchasing and installing the battery, which the aggregator may also carry out) or as an ongoing payment. Another structure would be to split a management fee and a customer credit, although this is suboptimal due to the limitations it creates for business models. An ongoing payment to customers, to then turn around and pay aggregators on an ongoing basis, would be likely to create significant barriers to enrollment and retention in the program for residential customers.

Allow for Statewide Participation

There is enormous value to be realized by enabling a statewide residential energy storage program through a BYOB customer- and aggregator-based participation model. Sunrun urges the EEAC and PAs to design the Residential Storage Performance Program and establish the payment structure discussed above to ensure that residential storage systems are leveraged to provide the load management and system relief, reduced system costs, and higher levels of renewable energy integration benefits they are capable of -- all of which further the Commonwealth's energy and climate goals.

Indeed, recent storage deployment numbers suggest that residential storage represents an unprecedented opportunity for Massachusetts to integrate these resources into load management strategies. GTM Research recently reported that a record 57.5 MWh of residential grid-connected energy storage was deployed in the U.S. in Q2 2018, outpacing both C&I and front-of-meter deployments with tenfold year-over-year growth.[8] The rapid growth in residential storage installations reflects customers' growing demand for the resilience benefits that storage can provide and underscores the enormous potential for these resource to provide ADM-oriented performance/operational benefits. As such, ensuring that the Residential Storage Performance Program stimulates broad storage assets deployment will improve the efficiency, operation, and resiliency of the electric grid and improve the ability of the PAs to achieve the reduction benefits envisioned in the draft Plan.

A statewide program available to all PA customers will increase awareness of the benefits of energy storage across the entire state, which in turn will lead to increased storage deployment at a faster pace, spur innovation, accelerate cost declines, and significantly advance progress toward Massachusetts's energy storage deployment goals. Specifically, allowing participation from customers statewide will simplify the customer engagement efforts of the PAs and 3rd-party aggregators, reduce the program administration costs and make the program more cost-effective. Moreover, universal eligibility would reduce the need for targeted direct mail campaigns and would allow adoption to occur via word-of-mouth and peer-to-peer diffusion. One of the most significant drivers of solar adoption to date has been peer influence, which often takes the form of individuals learning about the benefits of solar and storage from those in their social networks.[9] This beneficial, viral effect would be stifled by a program confined to certain

[8] Munsel, Mike, *Led by Surging Residential Sector, Q2 US Energy Storage Deployments Grow 200% Year-Over-Year*, Greentech Media (Sept. 6, 2018) *available at* https://www.greentechmedia.com/articles/read/led-by-surging-residential-sector-q2-us-energy-storage-deployments-grow-200#gs.8eGWeH4.

[9] *See*, Mooney, Chris, *Why Do People Put Solar on Their Roofs? Because Other People Put Solar on Their Roofs*, The Washington Post (Oct. 23, 2014) *available at* http://www.washingtonpost.com/blogs/wonkblog/wp/2014/10/23/study-solar-energy-isnt-just-for-rich-liberals-any-more/; *see also* Cargil, Pamela, *Drivers of Residential Solar Adoption: Environmental Preference or Peer Pressure?* PVSolar Report (Jan. 27, 2014) *available at* http://pvsolarreport.com/drivers-of-residential-solar-adoption-environmental-or-peer/.

areas, in which one resident could be eligible for the program while his or her neighbor would not be eligible. As such, Sunrun urges the EEAC and PAs to ensure the Residential Storage Performance Program is designed for successful implementation across the Commonwealth.

Allow Customers with Existing PV Systems to Participate

The Plan states that the PAs anticipate that most energy storage installed by residential customers participating in the Residential Storage Performance program will be paired with solar PV systems, and thus, allowing customers to pair storage with solar PV systems is essential to ensure program success. The PAs should clarify in the program materials that customers with existing PV systems are eligible to participate in the program if they add a new energy storage facility to their PV system, or if they enroll an existing energy storage system in the program. Allowing customers with existing PV and/or storage systems to participate will allow for more efficient customer recruitment since these customers are already known to be interested in customer-sited generation and have existing relationships with providers of distribution generation services that may also serve the role of an aggregator.

Coordinate Residential Storage Performance Program with Complementary Programs

Storage has the ability to provide multiple services with a single asset, and allowing customers to receive payments for providing different services encourages the greatest amount of beneficial energy storage deployment possible. The Residential Storage Performance Program should be designed to allow customers to participate without excluding customer participation in other state programs and incentives. While the updated September draft Plan states that customer participation in the Residential Storage Performance Program will "provide the customer with an additional revenue stream that complements other state programs, such as SMART, which offers adders for combining solar and storage,"[10] the final rules should explicitly provide that compensation earned from participation in the Residential Storage Performance Program is in addition to incentives received under SMART and other similar programs.

Conclusion

Sunrun appreciates the opportunity to submit these comments and recommendations for the EEAC's and PAs consideration.

[10] Three Year Plan at 64.

Respectfully submitted,

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Attachments

Excerpts from Direct Testimony of Justin R. Barnes

Section V of Testimony
&
Concept Bring Your Own Device Program Design

New Hampshire PUC Docket No. DE 17-189
May 2, 2018

I will describe the specifics of an alternative model that permits non-utility owned storage to be enrolled in the following section. With respect to objectives, I recommend that if the Commission permits any utility ownership of storage assets, one of the chief objectives should be to develop data on how utility ownership compares to non-utility ownership. That could include measurements of relative cost-effectiveness, operational performance, and customer satisfaction. With the exception of customer behavioral responses to the TOU rate, which would require significant modification in order to return useful data, all of the Company's testing objectives could be pursued in this fashion. However, the results would be far more robust and valuable to both Liberty and the Commission under a comparative framework.

V. ALTERNATIVE PROGRAM DESIGN MODEL

Q. Please summarize the principal characteristics of an alternative design for the Storage Pilot Program.

A. My proposed design is based in part on GMP's recent BYOD program proposal. However, it has elements similar to some other programs that utilize an aggregator type structure with long-term pay for performance contracts, such the numerous NWA solicitations that have been issued in New York. The alternative program would have the characteristics listed below, and Attachment JRB-2 contains a concept program design.

1. Participants are permitted to use non-utility owned energy storage assets to participate in the program, access value on the same terms as utility-

owned assets, and be eligible for the same customer tariffs (such as TOU) offered to customers with utility-owned assets.

2. Direct control of the DER remains with the system owner or another party they designate for this purpose, such as an aggregator entity.
3. Customers with solar-paired energy storage are able to participate without limits or any additional conditions beyond those that would otherwise apply.
4. Payments for program participation may be distributed directly to an aggregator entity, either at the election of an individual participating customer or through a direct services agreement between the utility and the aggregator (e.g., for a specific amount of capacity).
5. Payment rates are established under a standardized minimum fixed rate system for the duration of participation, subject to performance rules consistent with the use case, punitive measures for non-performance, and potential enhanced payments for performance.
6. Program benefits and risks are shared in a systematic, equitable manner between participants and non-participants.
7. Any utility-owned storage assets are limited to no more than 25% of the total size of the program (if applicable), however that is denominated (e.g., number of customers, total capacity).
8. Customers may opt-out of the program at any time via coordination with any aggregator that they have designated as the system operator.

Q. Why did you choose the GMP BYOD program as a base model?

A. The BYOD model and its predecessors are among the most innovative, flexible, and forward-thinking DER utilization programs that I am aware of. The BYOD version in particular is well-suited for supporting the growth of a competitive energy storage market while balancing the risks and benefits to participants and non-participants.

Q. Please describe the advantages that your proposed design has over Liberty's Storage Pilot Program proposal.

A. There are several advantages. First, my proposed design is consistent with developing a competitive market for residential energy storage in Liberty's service territory through the creation of a level playing field for all potential providers. Second, the design is flexible enough to allow any operator to pursue additional revenue streams not encumbered by the participation payment, such as those that may be available in the ISO-NE wholesale market. This additional revenue could permit owner-operators to offer more attractive pricing to prospective customers while also providing system-wide benefits. Third, the performance-based design would reduce risks to both participant and non-participant customers. Finally, the design allows for a much clearer and transparent evaluation of program costs and benefits relative to what Liberty has proposed.

Q. Please describe how the payment for performance design would operate.

A. Non-performance that is not remedied within a cure period, such as 30 days, would result in a payment reduction. Procedures for removal from the program could be considered for repeated non-performance. However, since permanent removal from the program could sacrifice years' worth of savings for non-participating ratepayers, removals should be temporary pending the resolution of the source of non-performance. Re-enrollments could allow the available capacity of a participating system to be modified to a new amount if necessary.

Q. How would customers participating through aggregators be affected by non-performance issues?

A. Since customers participating through aggregators would assign the participation payment to the aggregator, the aggregator – not the customer – would be at risk for non-performance.

Q. Should utility-owned assets be subject to the same performance requirements as non-utility assets?

A. Yes. It is important that utility-owned assets be held to the same standard as non-utility assets, subject to punitive measures for non-performance. However, any customer that enrolls using a utility-owned or controlled asset should be held harmless against poor performance. In this way both participants and non-participants would be protected from the impacts of poor performance by utility-owned assets, as they are for non-utility-owned assets.

Q. Would this still retain an incentive for Liberty to support adoption of energy storage systems?

A. Yes. Liberty would capture the same portion of participation payments as an aggregator or independent participant, generating revenue for itself. The playing field would be entirely level and like other storage owners; Liberty would "share" in the cost savings produced by the program. I describe this sharing mechanism later in my testimony.

Q. How would energy storage systems be dispatched?

A. Presumably any utility-owned assets would be directly controlled by Liberty. Other customers would have the option to control the system themselves or designate a third-party to do so, either Liberty or an aggregator. For systems not directly controlled by the utility, the operator would receive a notice in advance of the event that allows sufficient time to fully charge the battery. Given how straightforward Liberty's proposed use cases currently are, this notice could be as simple as coordinated communication directly with aggregators. Alternatively, Liberty could select any number of scalable DER management system ("DERMS") platforms that function as a flexible, long-term provider-agnostic solution, or otherwise use open communication protocols. The program could also employ a multi-level notice system, where a day-ahead preliminary notice informs the operator that an event is likely to be called the following day, which is later confirmed by a final notice. Non-utility operators would then dispatch the system in line with these instructions.

Q. How should the amount of participation payments be determined?

A. At a high level, the payments should be based on net benefits, such as the projected reduction in transmission charges described in the Company's application minus program costs (e.g., metering). When calculating benefits, it may also be appropriate to assume that for various reasons (e.g., forecast error), the storage assets may not be 100% effective at reducing costs. For instance, GMP's initial similar pilot assumed that utility-owned systems would be 75% effective at reducing regional network service ("RNS") charges.[38] The pending BYOD filing assumes that the systems will be effective at reducing 8 out of 12 monthly peaks.[39] The benefits calculation is then translated into a fixed minimum participation payment based on the power made available to the utility.

In order to ensure that non-participating ratepayers experience some of the benefits of the program, a benefits sharing ratio should be established such that a portion of projected benefits are not paid out to participants and are instead retained by other ratepayers. I initially recommend that 90% of the net benefits be distributed to participants in order to create a strong enrollment incentive. If actual cost reduction benefits exceed the amount on which the minimum participation payment is based, those "excess" benefits can be shared between participants, non-participants, and Liberty.

[38] GMP Innovative Pilot Filing. December 2, 2015. Available at: https://greenmountainpower.com/wp-content/uploads/2017/01/Hudson-12.02.2015-Tesla-Pilot-Filing.pdf
[39] Attachment JRB-3, GMP Letter to the Vermont Public Service Board, "Green Mountain Power – Bring Your Own Device "BYOD" Innovative Pilot" dated February 23, 2018.

Q. It seems like the design you propose is still vulnerable to forecast errors that could lower the effectiveness. How could that issue be mitigated?

A. It is correct that program success will hinge on accurate forecasting and notice. The participation payment structure I have described addresses this concern in part by calculating payments under an assumption of less than 100% effectiveness. That provides a margin for forecast error.

Another part of mitigating this issue is fostering an environment that rewards Liberty for generating accurate forecasts and notices. Liberty should already have an ingrained incentive to do so, but it could be appropriate to provide an additional performance incentive that rewards the Company for excellent forecasting. This could be formulated as a benefits sharing arrangement between Liberty and non-participating customers where Liberty is granted a specified percentage (e.g., 33%) of the actual cost savings above the assumed net benefits amount if it achieves a specified forecast success rate.

For example, assume that the expected effectiveness rate is reductions in 9 of 12 monthly peaks (i.e., 75%) and the expected annual net benefits are $500,000. If Liberty correctly predicts 10 out of 12 monthly peaks and the actual savings are $550,000, Liberty is entitled to 33% of the difference, or $16,500. As I have described above, the remainder is split between participating and non-participating customers in equal shares, effectively splitting the excess equally among all parties.

Q. Why do you recommend a ten-year structure for program payments?

A. Ten years is generally cited as the useful life of lithium-ion based battery storage systems. A fixed or minimum characteristic is necessary to support financing, which is important because battery storage systems have high up-front costs. A fixed rate payment is functionally similar to how costs would be incurred if a system was owned by Liberty and included in its rate base.

Q. Would a minimum rate create risks to non-participating ratepayers, for instance, if transmission cost savings are lower than expected?

A. It would, though the design I propose contains several elements that mitigate non-participant risk. First, an assumption of less than 100% effectiveness and the sharing ratio provides a margin for error in cost projections, creating an insulating effect. This actually makes the risk to non-participants lower than would be the case under Liberty's design since under the Company's revised cost-benefit analysis, monetary savings over 15 years are essentially a breakeven for customers. Non-participant risk would also be lowered further by the pay for performance design I propose, which is not present in Liberty's application. Finally, non-participating customers could also retain a portion of the upside if cost savings turned out to be higher than expected. This is an appropriate balance of risk in my opinion.

Q. How can the BYOD design be more cost-effective than a utility-owned model?

A. Utility-owned assets create a fixed revenue requirement based on the utility's costs of deploying the resources, and in Liberty's proposal there would be no adjustment for performance. The BYOD design creates some "soft" revenue requirement (i.e., contracted payments to customers), but adjusts it downward if systems fail to perform and savings are not achieved. Furthermore, BYOD costs are manageable through the determination of performance payment levels and benefits sharing. Thus, the BYOD model can be designed at the outset to produce a high likelihood of net benefits, in effect ensuring that the resources that are deployed and receive payments are in fact cost-effective.

Q. Why is the BYOD design more transparent than what Liberty has proposed?

A. As I have previously described, Liberty's proposal is a mix of a direct subsidy to participants via the sharing of battery costs and additional compensation through the TOU rate. Some potential program costs, such as the amount of export compensation, are uncertain, while benefits depend on how well the batteries actually perform. Collectively, this makes it challenging to parse program costs, benefits, and risks because components become mixed together in ways that are not easy to separate.

In contrast, the BYOD design clearly segregates the program costs (i.e., compensation for customers or the aggregator) from benefits (i.e., system savings) in a manner that adjusts costs in line with savings (i.e., via pay for performance).

A properly designed TOU rate accompanying the BYOD design could produce additional participant savings aligned with reductions in system costs. In fact, the program design does not necessarily require a customer to take service under a TOU rate, since the benefits are distributed exclusively via participation payments.

Q. Please describe how you arrived at a 25% limitation for utility-owned assets within the program.

A. In most DER markets, a 25% share would represent significant share for a single provider. If the idea is to foster competition and cost-effectiveness, sufficient volume must be available to be spread among multiple competitive providers. On a relative utility size basis, Liberty's share would be roughly equivalent the size of the comparable GMP program the Company cites.

Q. Could your program design support the use of participant systems to produce benefits beyond transmission cost savings?

A. Yes. The design is compatible with other use cases, such as achieving savings on ISO-NE FCM charges. In fact, GMP's battery programs target FCM savings in addition to transmission cost savings. Any services not encumbered by the tariff could be pursued outside of the program at the election of the system owner, generating additional value.

Q. Could your program design also support NWA projects?

A. Yes. There are at least two options for adapting this general design for NWA services. Under one option, similar to Liberty's proposal, installations could be targeted towards a specific identified location at the outset as an open offer.

Participants (or aggregators) located in those local areas would receive an enhanced payment based on the incremental deferral benefits. That incremental amount would align system benefits with customer benefits, and compensate them for the greater restrictions placed on their own use of the battery. This is similar to the pilot recently adopted in Connecticut in UI's service territory that I described previously.

Alternatively, the NWA portion could use a direct solicitation to competitive providers and result in the selection of one or more providers to secure the capacity necessary to serve need. This could result in innovative approaches that Liberty may not have considered. The provider or providers selected would then be responsible for enrolling customers and capacity up to their contracted commitment level within the requisite time frame. This model is typical of how NWA opportunities are addressed in states such as California and New York, where solicitations define system characteristics, needs, and performance requirements in granular detail and leave it up to providers to develop resource portfolios and cost proposals for meeting those needs.[40]

Under either model, the payment would still take the form of a contracted, predictable revenue stream with standards for performance and punitive measures for non-performance.

[40] See, e.g., http://jointutilitiesofny.org/utility-specific-pages/nwa-opportunities/.

Q. Should a similar program be deployed to serve the non-residential sector?

A. I see no reason that a non-residential program could not or should not be developed. I have focused on the residential sector here simply because the Company's proposal is confined to the residential sector. If a similar program was implemented for non-residential customers some changes may be required to address the characteristics of that market. I recommend that a non-residential sector program only be established separate from the residential program to avoid the possibility that larger non-residential storage systems could impact the availability for residential customers.

VI. SUMMARY AND CONCLUSIONS

Q. Please summarize your thoughts on Liberty's proposed Storage Pilot Program.

A. I support the concept embodied in the program: using customer-sited DERs to produce system benefits and savings. As a concept, this objective is both worthwhile and forward-thinking. However, in my opinion the program as proposed suffers from some significant flaws that limit its potential to support the development of a vibrant, competitive energy storage market and reliably deliver energy storage benefits to customers. Central to these flaws are its rigid design and exclusive use of Liberty-owned and controlled storage assets. The program requires modifications in order the make it competitively neutral, scalable and replicable, more cost-effective, and transparent from the standpoint of costs and benefits.

Concept Bring Your Own Device ("BYOD") Program Design

Program Overview

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

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

Participation Agreements

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

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

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

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

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

Participation Payments

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

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

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

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

Participation payments will be subject to the following conditions:

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

Performance Rewards

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

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

[2] These monetary amounts are for illustrative purposes only.

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

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

Customer Obligations

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

Aggregator Obligation

For participating Aggregators, the following provisions will apply.

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

Measurement & Verification

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

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

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