BEFORE THE STATE OF NEW HAMPSHIRE
PUBLIC UTILITIES COMMISSION

Docket No. DE 17-189

Liberty Utilities (Granite State Electric) Corp. d/b/a Liberty Utilities
Request for Approval of Battery Storage Pilot

DIRECT TESTIMONY

OF

JUSTIN R. BARNES

May 2, 2018

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Attachments

I. INTRODUCTION AND QUALIFICATIONS

Q. Please state your full name, business address, and position.

A. My name is Justin Robert Barnes and my business address is 401 Harrison Oaks Blvd., Suite 100, Cary, North Carolina, 27513. My current position is Director of Research with EQ Research LLC ("EQ Research").

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 for clients, provide subject matter oversight of EQ Research's electric industry regulatory and general rate case tracking services, and perform customized research and analysis as necessary to fulfill client requests. Most of my work focuses on the customer-sited solar and energy storage sector and how the

[1] The North Carolina Solar Center has since been renamed the North Carolina Clean Energy Technology Center.

evolving state and federal legislative, regulatory, and ratemaking landscape affects the industry.

I have testified before the Public Service Commission of South Carolina, the Oklahoma Corporation Commission, the Colorado Public Utilities Commission, the Utah Public Service Commission, the Public Utility Commission of Texas, and the North Carolina Utilities Commission as an expert in distributed generation ("DG") policy, rate design, and cost of service. My *curriculum vitae* is attached as Attachment JRB-1.

Q. Have you previously submitted testimony before the New Hampshire Public Utilities Commission ("Commission")?

A. No.

Q. What specific expertise do you have that qualifies you as an expert in this proceeding?

A. I possess a detailed understanding of how regulators in other states have evaluated programs and proposals for utility ownership of customer-sited distributed energy resources ("DERs") and regulators' efforts to realize the benefits of customer-sited energy storage. This includes the benefits and drawbacks of different approaches, how they are weighed, and the overall strategies being employed. I believe that this information can provide valuable insights to the Commission.

Q. On whose behalf are you testifying?

A. I am testifying on behalf of Sunrun Inc. and ReVision Energy, Inc.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to suggest improvements to Liberty Utilities' ("Liberty or "the Company") proposal for establishing a residential energy storage pilot program (the "Storage Pilot Program"). The modifications I suggest are based on insights that can be gained from experiences in other states, which I place in the context of New Hampshire law governing utility ownership of DERs and the specifics of Liberty's Storage Pilot Program.[2] I also compare Liberty's proposed Storage Pilot Program based on utility-owned assets to an alternative model that allows customers to furnish and control battery storage systems enrolled in the program. My recommendations for an alternative design are intended to make the program:

1. More competitively neutral;
2. More replicable and scalable;
3. More cost-effective; and
4. More transparent and certain from a costs and benefits standpoint.

To be clear, on a conceptual level, I support the underlying objective of the program: using customer-sited DERs as system resources to produce benefits for all ratepayers. In this respect I applaud Liberty's efforts to explore the opportunities that DERs present. While my testimony discusses flaws present in the Company's proposed design and analysis, in my opinion the Company's design *might* still produce net benefits. The alternative design I propose addresses those flaws and uncertainties so as to result in a program that is *more likely* to

[2] As defined in NH Stat. 374-G.

produce *greater benefits*. Furthermore, if customers adopt DERs of their own volition in the future, this alternative design provides avenues for these DERs to be utilized to produce system benefits.

Q. Please summarize your recommendations to the Commission.

A. I recommend that the Commission allow Liberty to establish a Storage Pilot Program, but direct Liberty to modify the program to allow customers to furnish their own equipment under an alternative program design. I describe this alternative design in detail in my testimony and in an appended conceptual program design document (Attachment JRB-2). Should Liberty be permitted to own a portion of the energy storage systems that participate in the program, the amount of utility ownership should be limited to 25% of total program size (if applicable), however that is denominated (e.g., number of customers, energy storage capacity).

As a secondary recommendation, if the Commission elects to approve a Storage Pilot Program based on 100% utility-owned assets, Liberty should be directed to:

1. Reduce the size by at least 75% to make it more consistent with the character of a "pilot" program.
2. Employ a traditional competitive request for proposals ("RFP") process to select one or more providers, of either hardware or service solutions.
3. In parallel, develop an equivalent program of at least three times the size that allows customers to furnish their own device. The parameters for this program should follow my alternative program design.

My primary recommendations are meant to be considered together as a whole. My secondary recommendations could each be adopted independently, but they would most effectively support competitive neutrality, scalability, and cost-effectiveness if they were pursued together.

II. EXPERIENCES FROM OTHER STATES AND THEIR RELEVANCE TO LIBERTY'S ENERGY STORAGE PILOT PROGRAM

Q. Why are experiences in other states relevant to the Commission's consideration of Liberty's Energy Storage Pilot Program?

A. Pilot programs of this type, involving either or both utility-owned customer-sited assets and the tests of how customer-sited energy storage can provide value to participating customers, utilities, and other ratepayers are not uncommon. These programs or policies all have their own unique context, but there are a number of themes that can be distilled from regulatory evaluations and progress to date. While I hesitate to call these themes "best practices", as I explain below there are common elements between these themes and the parameters set for utility DER ownership in New Hampshire.

Q. Has utility ownership of customer-sited DERs, including energy storage, been permitted by regulators in other states?

A. Yes, though typically with limits. Most often regulators have not had any express statutory guidance on the matter so their determinations reflect the merits of a given proposal in the context of larger policy objectives.

Q. What common themes have you identified in state regulatory consideration of utility-owned customer-sited DERs?

A. Regulators have often expressed concerns about the cost-effectiveness of utility-ownership relative to non-utility ownership and potential impacts on the competitive market for the same product or service. Consequently, where approved the programs have been small relative to the overall market, designed to test the utility ownership model with minimal risk, serve a need not met by the competitive market (e.g., services for low-income customers), expand competition through providing more diverse options for customers, and avoid creating a monopoly service where one is not necessary.

Q. Can you provide any examples of regulatory decisions illustrating the characteristics you describe above?

A. Yes. To date, programs established by Arizona Public Service ("APS") and Tucson Electric Power ("TEP") are the most prominent examples of utility-owned residential DERs. In 2014, APS was authorized to establish a 10 MW, $28.5 million residential solar program[3] and TEP was permitted to establish a 3.5 MW, 600 customer, $10 million residential solar program.[4] In both instances, the Arizona Corporation Commission ("ACC") discussed the characteristics I describe above. For instance, for both programs, the ACC noted that its decisions were not a determination of prudency or cost recovery. Furthermore, in the TEP

[3] ACC. Docket No. E-01345A-14-0250. Decision No. 74878. December 23, 2014. ("APS Decision").
[4] ACC. Docket No. E-01933A-14-0248. Decision No. 74884. December 31, 2014. ("TEP Decision")

case, the ACC reasoned that the program size of 600 customers and $10 million in capital investment was tiny compared to the utility's 400,000 customer base and $2.2 billion rate base.[5] In the APS case, the ACC noted that the pilot would address the needs of underserved customers and required the utility to conduct a competitive RFP for solar providers through an independently monitored process.[6] The ACC later declined to approve a subsequent request from TEP to expand its program to serve an additional 1,000 customers, reasoning that the "inconvenience" of allowing the program to become fully subscribed without a successor was "outweighed by ensuring that nonparticipating ratepayers are not paying more than is necessary for the addition of renewable resources."[7]

Separately, the New York Public Service Commission ("NYPSC") has espoused similar principles in defining the conditions for utility ownership of DERs in its Reforming the Energy Vision ("REV") effort. The NYPSC first established that generally "utility ownership of DER will not be allowed unless markets have had an opportunity to provide a service and have failed to do so in a cost-effective manner."[8] It then described exceptions to this general rule as follows:[9]

1. Procurement of DERs has been solicited to meet a system need, and a utility has demonstrated that competitive alternatives proposed by non-utility parties are clearly inadequate or more costly than a traditional utility infrastructure alternative;

[5] TEP Decision. p. 18.
[6] APS Decision. pp. 5-6.
[7] ACC. Docket No. E-01933A-15-0239. Decision No. 75815. November 21, 2016. p. 34.
[8] NYPSC. Docket No. 14-M-0101. *Order Adopting a Regulatory Policy Framework and Implementation Plan*. February 26, 2015. p. 70.
[9] Id.

2. A project consists of energy storage integrated into distribution system architecture [referring to systems on utility property];
3. A project will enable low- or moderate-income residential customers to benefit from DERs where markets are not likely to satisfy the need; or
4. A project is being sponsored for demonstration purposes.

Of significance with respect to exception (4) is that the NYPSC observed "partnerships with utilities and third parties can accelerate market understanding and the development of sustainable business models."[10] In other words, demonstration projects are intended to support the scaling of DERs through early stage utility and third-party partnerships. Demonstration projects in aggregate are limited to the greater of 0.5% of a utility's revenue requirement or $10 million.[11]

Q. Is it common for utility ownership of DERs to extend to non-wires alternative ("NWA") projects?

A. No. The general idea behind NWA projects is that DERs may be a more cost-effective solution than traditional utility investments to meet some system needs. It follows from this premise that in some cases more cost-effective competitive solutions are possible for 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., DERs or distribution investments), to provide the most cost-effective solution.

[10] Id.
[11] Id. p. 116.

Competitive NWA solicitations are the vehicle by which this competition to provide the most cost-effective solution is realized. While some utility solutions may not be wires-based (e.g., a battery at a substation), the NWA concept is not defined by the resource inasmuch as it is defined by the introduction of competition into the process. Substituting one utility investment for another as a "NWA" without consideration of competing solutions, including consideration of the core competencies of providers offering solutions is inconsistent with the purpose of NWAs.

Q. What common themes have you identified in state regulatory consideration of energy storage deployment programs or policies?

A. There is a general recognition that maximizing the benefits energy storage can provide requires the "stacking" of value streams at the customer, distribution, and bulk system or wholesale level. This requires coordination of the operation and control of storage devices so that they can be used to provide multiple services (i.e., "multi-use applications" or "MUAs") without creating conflicts between the provision of one service and another. Customer-sited energy storage is considered to have the most *potential* value because it allows benefits to be created within all three domains.

There is also a general objective of developing participation models that unlock access to private capital. There are at least two virtues to supporting private investment. First, enabling private investment allows energy storage or DER deployment to be scaled, since private capital offers an essentially unlimited well

to draw from. Second, private investment under models where revenues are based on performance insulates ratepayers from risk. In practice, this involves demonstrating and validating performance from both a technical and economic (i.e., revenue) perspective. Both elements are critical for creating investor confidence.

It is also worth noting that there is frequently a more holistic focus on the services that can be provided by DERs more generally, as opposed to confining efforts to energy storage specifically. That is, in the same way that a group of DERs located at different customer sites can complement one another to form a larger aggregate resource, at the individual customer level multiple DERs can complement each other as well.

Q. Can you cite any examples of these characteristics?

A. Yes. As I've described above, New York's designation of demonstration projects is oriented in this fashion. Utilities in New York have proposed several projects along these lines. For instance, Consolidated Edison ("ConEd") in New York has pursued several storage demonstration projects intended to test different deployment models and use cases, all of which target wholesale market integration and test benefits sharing mechanisms. Among these are a residential behind-the-meter ("BTM") solar-paired storage "virtual power plant",[12] a mobile

[12] NYPSC. Docket No. 14-M-0101. ConEd Clean Virtual Power Plant REV Demonstration Project. July 1, 2015, Approved via an August 3, 2015 PSC Letter.

grid-scale storage model referred to as "Storage on Demand" [13], and a commercial in-front-of-the-meter project utilizing a site leasing model.[14]

California has also been in the forefront on efforts of this type. For instance, in January 2018 the California Public Utilities Commission adopted a Decision establishing a rule-based framework for energy storage MUAs.[15] Likewise, Hawaii is in the initial stages of developing an aggregator-based demand response ("DR") model for DERs to provide capacity (via time of use rates), fast frequency response, and reserves through a standardized tariff-based regime. The initial demonstration version of this effort was authorized in January 2018.[16]

Q. Are efforts to support the concept of "value-stacking" present outside of the specific examples you describe above?

A. Yes. At the state level there are numerous other efforts that have not yet reached the stage of defining rules or implementing formal programs. Those include more narrow demonstration projects, such as a locally targeted DER deployment program in Connecticut. In this program, United Illuminating ("UI") will employ 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

[13] NYPSC. Docket No. 14-M-0101. Coned Storage on Demand REV Demonstration Project. February 27, 2017. Approved via a May 18, 2017 PSC Notice.
[14] NYPSC. Docket No. 14-M-0101. Coned Commercial Energy Storage REV Demonstration Project. January 20, 2017. Approved via a May 18, 2017 PSC Notice.
[15] California Public Utilities Commission. Docket No. 15-03-011. D.18-01-003. January 17, 2018.
[16] Hawaii Public Utilities Commission. Docket No. 2015-0412. Order No. 35238. January 25, 2018.

metered generation during summer peak hours for seven years.[17] Other states, including but not limited to Massachusetts, Maryland, the District of Columbia, and Rhode Island, are pursuing broad "grid transformation" where energy storage and DER enablement are prominent among the many objectives.

Apart from this, the Federal Energy Regulatory Commission ("FERC") has recently addressed the concept of value-stacking in Order No. 841 directing regional transmission organizations ("RTOs") and independent systems operators ("ISOs") to adopt market reforms that facilitate energy storage participation in bulk power markets. The FERC is also in the process of developing further rules encompassing DER integration and DER aggregations in RTO and ISO wholesale markets.[18] Efforts on the part of individual RTOs and ISOs are likewise underway, such as the California Independent System Operator's long-running Energy Storage and Distributed Energy Resources initiative,[19] the PJM's DER Subcommittee,[20] and the New York Independent System Operator's DER Roadmap initiative.[21]

Q. Are these themes consistent with New Hampshire law governing utility ownership of DERs?

A. I believe they are. Section 374-G:1 of the New Hampshire statutes defines the objective of utility investment in DERs as follows:

[17] Connecticut Public Utility Regulatory Authority. Docket No. 17-06-03. Decision dated January 24, 2018.
[18] FERC. Docket No. RM18-9.
[19] This initiative is now in its 3rd phase. See: http://www.caiso.com/informed/Pages/StakeholderProcesses/EnergyStorage_DistributedEnergyResources.aspx.
[20] A successor to prior special meetings that began in 2016. See: http://www.pjm.com/committees-and-groups/subcommittees/ders.aspx.
[21] See: http://www.nyiso.com/public/markets_operations/market_data/demand_response/index.jsp.

> Distributed energy resources can increase overall energy efficiency and provide energy security and diversity by eliminating, displacing, or better managing traditional fossil fuel energy deliveries from the centralized bulk power grid, in keeping with the objectives of RSA 362-F:1. It is therefore in the public interest to *stimulate investment in distributed energy resources in New Hampshire in diverse ways*, including by encouraging New Hampshire electric public utilities to invest in renewable and clean distributed energy resources *at the lowest reasonable cost to taxpayers* benefiting the transmission and distribution system under state regulatory oversight. [Emphasis added]

Section 374-G:5(II) elaborates on how the Commission should evaluate utility applications, directing the Commission to, among other things, consider and weigh:

1. "The effect on competition within the region's electricity markets and the state's energy services market." (Subsection f)
2. The costs and benefits to the utility's customers, including but not limited to a demonstration that the company has exercised competitive processes to reasonably minimize costs of the project to ratepayers and to maximize private investment in the project." (Subsection g)

Thus, as in other states, utility ownership of DERs is permitted in New Hampshire, but with an express "lowest reasonable cost" qualifier, and with an express objective of stimulating investments "in diverse ways". Furthermore, as in other states, in New Hampshire the Commission is expected to exercise its judgment on whether a project is in the public interest, including consideration of the effects it would have on competition, overall costs and benefits, and the extent to which private investment is maximized. All of these characteristics are similar to those present in other states. The chief differences are that in New Hampshire the

question of whether utility ownership of customer-sited DERs is permitted is moot, and direct statutory guidance exists with respect to the evaluation parameters. Those parameters though, are not dissimilar from what other regulators have arrived at independently in their own evaluations.

Q. What do you conclude from your evaluation of New Hampshire law and regulatory proceedings involving similar proposals in other states?

A. The characteristics of evaluations and experiences in other states have value in the context of Liberty's application. The primary foci in those states have been:

1. Preserving and/or enhancing competition and the options available to customers.
2. Validating models that enable greater storage and/or DER deployment through the mobilization of private capital.

These themes are consistent with provisions of New Hampshire law emphasizing an objective of supporting DER investments "in diverse ways", maximizing private investment, and consideration of the effects that utility-owned DER applications would have on competition in the state's energy service market.

III. LIBERTY'S APPLICATION AND ANALYSIS

Q. Please briefly summarize Liberty's proposed Storage Pilot Program.

A. Liberty proposes to install 5 megawatts ("MW") of BTM energy storage systems in the homes of up to 1,000 residential customers.[22] The battery storage systems

[22] The total number of customers may be less than this if participants elect to install multiple batteries.

are to be owned by the Company and included in its rate base. Participating customers will make an up-front payment of $1,000 or monthly payments of $10 for 10 years, and in return will be permitted to use the battery for back-up generation and time-of-use ("TOU") rate management under a new rate option available exclusively to pilot customers. Liberty will control the charge and discharge of the batteries generally, and dispatch them during expected peak periods to reduce ISO-NE transmission charges.

The program is effectively broken into two tranches. The first tranche targets the installation of roughly 300 batteries to support an NWA pilot in a local area. This tranche limits participation to customers served by the specific circuits that are part of the NWA pilot. The second tranche comprises the remaining 700 batteries and would be open to residential customers throughout the Company's service territory.

Q. Did the Company consider other arrangements beyond full utility ownership and control of the participating systems?

A. No.[23]

Q. What objectives does the Company identify for the Storage Pilot Program?

A. Company Witness Tebbetts lists the following questions that the program seeks to answer:[24]

- What are the behavioral changes of customers taking service under the TOU

[23] Attachment JRB-4, Liberty response to Office of the Consumer Advocate ("OCA") Data Requests, Set 1, IR 1-37; Attachment JRB-5, Liberty response to Sunrun Technical Session Data Requests, Set 1, IR 1-5.
[24] Supplemental Direct Testimony of Heather Tebbetts ("Tebbetts Supplemental Direct"). p. 14.

pricing?

- What types of behaviors changed, such as doing chores later in the day or weekend that require the use of the batteries to avoid utilizing power from the grid?
- If the customer's behavior did not change, why not?

- How accurate were the predicted peaks from ISO-NE versus actual peak periods?
- How are the batteries affecting the distribution system, either positively or negatively?
- Has customer satisfaction with reliability increased?
- Do the benefits of battery installations at customer locations with on-site generation differ from those without on-site generation? If so, in what ways?

Q. Has the Company performed a cost-benefit analysis of the program, and if so, what are the results?

A. The Company has produced three different cost-benefit analyses. Initially, Liberty filed a cost-benefit evaluation showing a potential monetary savings to ratepayers of roughly $1.8 million over 15 years, and a net present value ("NPV") of $65,000.[25] However, the Company later submitted a revised analysis, among other things incorporating a degradation factor for the batteries, showing monetary savings of only roughly $254,000 and an NPV of roughly ($1.1 million). The

[25] Tebbetts Supplemental Direct. Attachment A, p. 2

circuit upgrade associated with the NWA project shows an NPV of roughly ($620,000) in the revised analysis. [26]

Subsequent to the issuance of the revised cost-benefit analysis, Liberty provided a further revision incorporating its assessment of the program under a Total Resource Cost ("TRC") cost-effectiveness protocol. Most significantly, this version incorporated two additional benefit categories, avoided capacity costs and participant customer savings, producing an NPV of $2.96 million.[27]

Q. Are you confident that the Company's cost-benefit analysis is accurate?

A. No. I have identified several flaws that cause me to question both the results of the analysis and the level of rigor applied by Liberty in performing it. The specific problems that I have identified are as follows:

1. It is inappropriate to count customer bill savings as a system benefit in the TRC, and in fact, some portion of the customer savings benefits may be more properly classified as costs.
2. The Company made numerous errors in its estimates of customer bill savings, which lead to a dramatic overstatement of participant customer benefits.
3. The Company's inclusion of the benefits of avoided capacity costs is premature, since it has not articulated how those potential benefits will be realized.

[26] Tebbetts Supplemental Direct. Revised Attachment A, p. 2
[27] Attachment JRB-6, Liberty response to Staff Technical Session Data Requests, Set 3, IR 3-1.1, Tab "TRC Model 2."

Q. Why is it inappropriate to count participant bill savings as a TRC benefit category?

A. Participant bill savings are simply not a component of the TRC in common practice.[28] The TRC assesses savings for *all customers* (i.e., participants and non-participants) so counting participant savings as a separate category would double count benefits. In other words, the TRC represents a combination of the Participant Cost Test assessing benefits for participants, and the Ratepayer Impact Measure Test assessing a program from the perspective of non-participants.

Q. What errors have you identified in Liberty's estimates of participant bill savings?

A. The Company's analysis presents a comparison between a customer on the standard residential rate (Rate D) and that same customer with an energy storage system that charges during off-peak hours and discharges during critical peak hours under its proposed TOU rate. The results of the calculations are monthly bill estimates under both scenarios. The difference between the two monthly bills is customer bill savings after the monthly battery cost is subtracted. I have identified the following errors in the Company's estimates:

1. The derivation of non-battery customer bills includes energy to charge the battery. The total monthly use calculations for battery customers (except for the low use group, where the mistake is symmetrical) are adjusted to

[28] See, e.g.: Regulatory Assistance Project. *Energy Efficiency Cost-Effectiveness Screening: How to Properly Account for 'Other Program Impacts' and Environmental Compliance Costs*. November 2012. Available at: http://www.synapse-energy.com/sites/default/files/SynapseReport.2012-11.RAP_.EE-Cost-Effectiveness-Screening.12-014.pdf.

subtract charging energy, since it nets to zero (apart from efficiency losses) when discharge energy reduces critical peak use. This mistake makes the total monthly use underlying the calculations for non-battery customer higher than for battery customers, inflating the monthly bill estimate and the savings estimate.

2. Liberty failed to model weekend and holiday days as fully off-peak days. In total, weekends and holidays amount to 114 days per year during which critical peak savings cannot be achieved because all hours are off-peak.
3. The Company misplaced a decimal point in the Stranded Cost portion of the non-battery customer bill estimate, increasing it from the correct rate of 0.049 cents/kWh to 0.49 cents/kWh. The correct (lower) number was used for the battery customer, inflating the savings estimates by making the non-battery customer's bill higher than it should be.
4. A similar error was made in the System Benefits Charge component, listing it as 0.354 cents/kWh for the battery customer (an incorrect rate under the current tariff) and using the correct rate of 0.457 cents/kWh for the non-battery customer. This also increases the non-battery customer's bill beyond what it should actually be.
5. The Company failed to incorporate efficiency losses resulting from charge and discharge of the battery.

Q. How does this affect participant bill savings?

A. My estimates of customer savings after correcting for these errors show dramatically lower savings, as illustrated in Table 1 below depicting net monthly

savings under a one battery per customer scenario. Liberty's estimates are provided in the top row followed by the results of my own calculations.

Table 1: Comparison of Participant Savings Estimates

Savings Estimates	Customer Group			
	Low (1)	Med-Low (2)	Med-High (3)	High (4)
Net Monthly Savings (Liberty)	$3.13	$31.20	$59.72	$109.75
TOU-Only Savings	$2.20	$6.47	$12.84	$23.92
Battery Savings	$6.64	$14.67	$23.25	$39.32
Battery Cost	$10.00	$10.00	$10.00	$10.00
Total Net Monthly Savings	($1.17)	$11.14	$26.09	$53.24
Total Net Battery Savings	($3.36)	$4.67	$13.25	$29.32
Difference in Total Net Savings From Liberty Estimate	($4.30)	($20.06)	($33.63)	($56.51)

Q. Please explain the distinction you have made between TOU-only savings and battery savings.

A. Based on the Company's load research data, Liberty's TOU rate will produce bill savings for all customer groups without the use of a battery and without requiring any change in customer load patterns. I refer to this savings as TOU-only savings, which I arrived at by modeling the customer group profiles against the TOU rate without use of a battery. The battery savings are the savings actually associated with the use of the battery to shift load from critical peak times to off-peak times.

Q. Why does the TOU rate produce bill savings without requiring any load shifting by customers via any means?

A. I believe it stems from the fact that Liberty did not account for weekends and holidays as off-peak periods when developing the rate design.

Q. What portion of customer savings may be more properly classified as a program cost?

A. There are two components. First, since TOU savings accrue without accompanying cost savings, the TOU rate itself represents a subsidy or incentive cost. Second, while the Company has not modeled this aspect, when the Company dispatches the battery to reduce transmission charges, the customer is to be compensated for any exports that occur.[29] That compensation could be considered a program cost of achieving the transmission cost savings. Over the life of the program it could easily amount to several hundred thousand dollars. Total battery savings themselves might be considered a program cost since the TOU rate functions as an incentive for load shifting. That cost would be balanced by the avoided cost benefits of that load shifting in the TRC protocol.

Q. Please explain why you characterize the Company's inclusion of avoided capacity costs as a program benefit as "premature".

A. In contrast to energy efficiency measures that produce capacity savings via automatic load reductions, energy storage systems must be dispatched specifically to avoid capacity costs in order to produce capacity cost savings. Certainly, customer use of the battery during critical peak periods and utility dispatch plans could produce capacity savings, but it remains to be seen how much savings would accrue. Liberty assumes that the full battery capacity is used to produce capacity savings, but does not indicate that the batteries will be dispatched for this purpose, or the mechanics of how savings will be realized via ISO-NE capacity

[29] Tebbetts Direct. p. 17, lines 11-15.

charge settlement processes. In other words, capacity cost savings are achievable with battery storage, but it cannot just be assumed that they will be generated, much less in a certain amount, without direct attention and planning. This objective could be integrated into the program, or realized outside of the program by third parties, provided those third-parties can own and operate the batteries.

Q. Given the results of the updated cost-benefit analysis, how does the Company justify continuing to pursue the program?

A. At the time the first revised cost-benefit analysis showing a negative NPV was served, Company Witness Tebbetts stated "The pilot, while showing a lower net present value than the upgrade alone, will provide qualitative and quantitative benefits to customers with reduction [sic] to transmission costs and the ability to retrieve data to inform future decisions for grid modernization and possibly net metering tariffs."[30]

Q. What are your conclusions about the reliability of the Company's cost-benefit analyses?

A. I cannot consider them to be reliable given the number of materially significant errors, uncertainties, and inconsistencies I have discovered. This is not to say that a residential energy storage program targeting similar objectives is incapable of producing net benefits, or even that Liberty's design would not produce net benefits. However, as I describe later in my testimony, the alternative program design I propose offers a higher degree of certainty of achieving net benefits.

[30] Tebbetts Technical Statement accompanying Revised Attachment A. April 6, 2018. p. 3

IV. FLAWS IN LIBERTY'S STORAGE PILOT PROGRAM DESIGN

Q. Please summarize your concerns with the design of the Storage Pilot Program.

A. I have two major criticisms. First, the program is not designed to identify or test the effectiveness of different potential solutions to the objectives of reducing transmission costs and deferring distribution investments. Rather than attempting to identify optimal or lower cost solutions, Liberty simply selected the "solution" (i.e., utility-ownership and control) that is the most financially beneficial to itself. This type of approach flies in the face of an evolving electricity system landscape that views consumers as a resource and potential solution to system needs. In other words, it simply perpetuates and reinforces the business-as-usual model of utility command and control rather than customer empowerment.

Furthermore, the program would prevent, or at a minimum delay for years to come, the development of a competitive residential energy storage market in Liberty's service territory and the customer empowerment that would stem from that. For any customer interested in energy storage, participating in Liberty's program would be the most viable option. There are several factors that contribute to this outcome, as follows:

1. At present, the competitive market for residential energy storage is nascent in New Hampshire and the proposed Pilot program is extraordinarily large relative to the Company's residential customer base.

2. The Company's TOU rate offer as part of this program is designed in a way that makes it more attractive to prospective energy storage customers than the only other TOU rate option available to other customers.
3. The design is highly rigid and narrow, resting on full utility control of the energy storage systems and a limited scope of services, as opposed to creating a platform suitable for the competitive provision of those same or future, additional, services.

Another important consideration is that Liberty's program design conflates many different demonstration elements, adding complexity that may not be necessary to demonstrate customer value and net benefits from residential storage. A TOU rate could be utilized effectively to incentivize daily load shifting when the battery is not dispatched for peak shaving. However, this might best be added as an element to further enhance a fundamentally sound program rather than an integral part of the program itself.

Q. Please explain why the current state of New Hampshire's market for energy storage is important when considering how Liberty's proposed program would affect the development of a competitive market.

A. Consumer adoption of DERs tends to be a gradual process that begins slowly and accelerates over time. In the early stages of a DER market there are a relatively small number of potential customers that may be actively interested in installing DERs for a variety of reasons, such as unfamiliarity with the technology or underwhelming economics. Those who do invest under these circumstances are

often referred to as "early adopters". They serve as the foundation for service providers to grow their businesses over time. Without access to these customers, competing providers will be unable to gain a foothold and a competitive market will not emerge.

Q. How does the size of Liberty's Energy Storage Pilot frustrate the development of a competitive market for residential energy storage?

A. Liberty proposes a program that could enroll up to 1,000 residential customers. This represents roughly 2.8% of the total number of residential customers in its service territory. By comparison, as of January 2018 Liberty had only 396 residential solar net metering customers in total, and from January 2017 to January 2018 this number increased by only 57 customers. The utility did not report having any customers with on-site energy storage. Furthermore, the scale of Liberty's program exceeds reported numbers of residential energy storage deployment even in the service territories of much larger utilities in more advanced DER markets, such as Pacific Gas and Electric (640 residential storage customers) and Southern California Edison (703 residential storage customers).[31]

Based on these statistics, it is clear that Liberty's program would almost certainly dominate the residential energy storage market for years to come, preventing other providers from being able to sell and finance residential energy storage.

[31] EIA Form 861M. https://www.eia.gov/electricity/data/eia861m/.

Q. How does Liberty's Program compare to existing utility-owned DER programs?

A. In terms of absolute size it is comparable to the largest programs approved to date, such as those established in Arizona, but an absolute size comparison disguises the potential effects on competition. For instance, the TEP residential solar program (600 customers) equates to only 0.16% of that utility's residential customers. Moreover, it was established at a time when a competitive residential rooftop solar market had already developed, as at the time it was approved TEP already had more than 9,000 residential solar customers.[32] In fact, in discussing the program, ACC staff noted that competitive effects would likely be minimal noting that the utility had recently received more than 500 new solar interconnection requests during a single month.[33] APS's residential solar program (10 MW) is of a similar scale relative to the competitive market since APS has roughly three times as many residential customers as TEP.

Similarly, Liberty refers repeatedly to a similar Green Mountain Power ("GMP") program as a model for its own program. While GMP's program is sized at 10 MW according to Liberty, GMP has roughly 221,000 residential customers.[34] Thus when scaled based on the total number of residential customers, Liberty's program is three times the size of GMP's. Moreover, GMP has recently petitioned

[32] EIA Form 861. Net Metering (2015). https://www.eia.gov/electricity/data/eia861/.
[33] TEP Decision. p. 8.
[34] EIA Form 861M. https://www.eia.gov/electricity/data/eia861m/.

the Vermont Public Service Board ("VTPSB") for permission to establish a Bring Your Own Device ("BYOD") pilot program that allows non-utility ownership.[35]

Thus Liberty's "pilot" is far larger than other utility-owned DER programs on a general per customer basis, as well as in relation to the size of existing competitive market. It resembles a major capital investment project rather than a "pilot".

Q. How did Liberty arrive that the 5 MW/1,000 battery size for its proposed program?

A. The Company states that 1.5 MW is necessary to meet the need identified for the NWA project, and the incremental 3.5 MW was added to allow customers outside of the NWA area to participate. It further stated that a total of 5 MW would be large enough to provide a "noticeable monetary savings in transmission costs."[36]

Q. Is this justification sufficient to outweigh the detrimental competitive market impacts you have previously described?

A. No. First, the use of utility-owned assets for an NWA project runs contrary to the idea of NWAs in the first place. Typically, an NWA project is a vehicle for cost-effective competitive DER solutions to supplant the need for utility investment, not a means for utilities to simply substitute one type of investment for another without considering alternatives that may be more cost-effective. Second, the scale of monetary savings is irrelevant unless the program size has been optimized

[35] 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.
[36] Attachment JRB-7, Liberty Responses to Staff Data Requests, Set 1, IR 1-1.

to maximize those savings. In this case, Liberty's transmission cost savings estimates have a 1:1 relationship to the amount of capacity deployed so a larger program is no more cost-effective than a smaller one.

Q. Please explain how Liberty's TOU rate proposal creates inequities between utility-owned and non-utility owned residential storage.

A. The proposed pilot TOU rate has a rate spread totaling roughly 19 cents/kWh between the off-peak rate and critical peak rate. That rate spread is one measure of the customer benefits of load shifting using a storage device (i.e., charging off-peak and discharging on-peak). By comparison, Schedule D-10, the only other available residential TOU rate, has a total rate spread of roughly 10.3 cents/kWh. The disparity in potential load-shifting benefits would steer prospective residential storage customers towards the Company's program, and away from any offers from competing service providers. In other words, it grants Liberty a monopoly on the storage value proposition for customers since a customer can only achieve this enhanced value by contracting with the Company. It is anti-competitive on the most fundamental level.

Moreover, it is inequitable since customers that do not do business with Liberty (i.e., non-storage customers) would not have access to the rate, which as I have shown previously, appears to be less costly generally for participating customers.

Q. Please elaborate on what you consider to be unnecessarily rigid about the Storage Pilot Program and how that relates to establishing a viable competitive energy storage market.

A. As I have previously discussed, value-stacking and private investment are critical for scaling energy storage deployment. This demands the development of a flexible, solutions- and service-based framework where any party can receive compensation for the services they provide. Those services could include energy arbitrage via TOU-based energy rates offered by competitive retailers, and direct participation in the ISO-NE Forward Capacity Market ("FCM") or ancillary services markets. The rigid charge-discharge framework and full utility control of the battery would prevent value-stacking since it does not allow providers to adjust cycling to meet the requirements associated with providing these other services. Furthermore, Liberty intends to rely exclusively on Tesla's proprietary GridLogic software and battery platform. This reliance calls into question how other DERs that can provide the same service(s) could be integrated into Liberty's system now or in the future.

As proposed, the Storage Pilot Program *limits* the potential value that can be extracted from energy storage resources, rather than creating a foundation that can be built upon. At best, this is short-sighted. The alternative program design I propose solves for these issues by requiring allowing non-utility ownership and control, subject to performance requirements for the service being provided (i.e., transmission cost savings). All other value-stacking opportunities would remain

available to the extent that providing them does not conflict with these performance requirements.

Q. Do the Company's stated objectives for the program require it to use utility-owned assets?

A. No. In fact, in my opinion several of the stated objectives make little sense as justification for the program.

Q. Please elaborate on which of the Company's stated objectives "make little sense" and why this is the case.

A. My criticisms fall within two areas, whether the program is necessary to meet an objective, and whether the testing would produce useful results, as follows:

Validating Peak Forecasts: Liberty could validate its ability predict system peaks without the program at all. For that purpose, the Company might test its algorithm against data from past years, or attempt to do so on a forward-looking basis.

Studying Consumer TOU Responses: The study of customer behavioral responses to TOU rate designs does not require a customer to have on-site battery storage, utility-owned or otherwise. Furthermore, any conclusions that could be reached would likely be highly unreliable because most customers will not have on-site energy storage in the near future. It does not require a great leap in logic to expect that customers with on-site storage may rely on it for load-shifting purposes, rather than make the

behavioral changes that other customers would need to make. This is especially likely because Liberty's load research data shows that a single battery system is more than sufficient to offset average critical peak period energy use for all but the highest use customers.[37] In any case, a pilot TOU rate and/or comparison to customer behavior under the Company's existing D-10 rate would be sufficient for this purpose.

Studying Distribution Impacts: The value of this study would be diminished by the rigid, narrow program design. It would fail to capture how storage would be operated in a regime where operators seek to optimize dispatch to access different parts of the value stack, and would therefore fail to accurately represent how energy storage systems are expected to be operated in the future.

Q. How would you modify the design of the Storage Pilot Program and the objectives to make it a more valuable test bed?

A. Liberty's proposed program has an NWA tranche and general market tranche. Both tranches should be modified to make them solution-oriented, performance-based, and competitive. In other words, the utility should define the objective and then seek the most appropriate tool or tools for meeting that objective. Those needs can be distribution system support, wholesale market charge reduction, or both. The key is that the need drives the solution and not the other way around.

[37] Attachment JRB-8, Liberty response to Staff Technical Session Data Requests, Set 3, IR 3-1.1, Tab "Customer Bill Calc Backup TRC 2" (listing hourly average demands for customer groups).

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.

Q. Please summarize your recommendations to the Commission

A. I recommend that the Commission permit Liberty to establish a residential energy storage program, but direct it to modify the program to establish an alternative design that allows customers to furnish and control battery storage systems enrolled in the program. The alternative design I recommend is based on a Bring Your Own Device or BYOD model being pioneered by GMP in Vermont. I also recommend that if Liberty is permitted to own any portion of the energy storage systems that participate in the program, the amount of utility ownership be limited to 25% of total program size (if applicable), however that is denominated (e.g., number of customers, energy storage capacity).

In the alternative, if the Commission elects to approve a Storage Pilot Program based on 100% utility-owned assets, Liberty should be directed to:

1. Reduce the size by at least 75% to make it more consistent with the character of a "pilot" program.
2. Employ a traditional competitive RFP process to select one or more providers.
3. In parallel, develop an equivalent program of at least three times the size that allows customers to furnish their own device. The parameters for this program should follow my alternative program design.

Q. Does this conclude your testimony?

A. Yes.