Liberty Utilities

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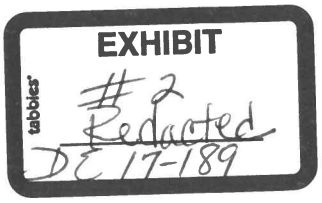

STATE OF NEW HAMPSHIRE
BEFORE THE
PUBLIC UTILITIES COMMISSION

Docket No. DE 17-___

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

DIRECT TESTIMONY

OF

HEATHER M. TEBBETTS

November 30, 2017

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Table of Contents

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I. INTRODUCTION AND QUALIFICATIONS

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

A. My name is Heather M. Tebbetts and my business address is 15 Buttrick Road, Londonderry, New Hampshire. I am a Senior Analyst for Liberty Utilities Service Corp. ("Liberty"), which provides services to Liberty Utilities (Granite State Electric) Corp. ("Liberty Utilities" or "the Company") and, in this capacity, am responsible for providing rate-related services for the Company.

Q. Please describe your educational background and training.

A. I graduated from Franklin Pierce University in 2004 with a Bachelor of Science degree in Finance. I received a Master's of Business Administration from Southern New Hampshire University in 2007.

Q. Please describe your professional background.

A. I joined Liberty in October 2014. Prior to my employment at Liberty, I was employed by Public Service Company of New Hampshire ("PSNH") as a Senior Analyst in NH Revenue Requirements from 2010 to 2014. Prior to my position in NH Revenue Requirements, I was a Staff Accountant in PSNH's Property Tax group from 2007 to 2010 and a Customer Service Representative III in PSNH's Customer Service Department from 2004 to 2007.

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

A. Yes, I have testified on numerous occasions before the Commission.

II. PURPOSE OF TESTIMONY

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to present Liberty Utilities' proposed pilot to own and install battery storage in customers' homes to reduce transmission costs in the short term, and to study the batteries' long-term effects on the distribution system to determine if there are cost deferrals or avoidances for future upgrades.

III. TRANSITION TO A MODERN UTILITY

Q. Please describe the current state of electric distribution utilities.

A. Historically, electric utilities have functioned as large, vertically integrated, regulated monopolies that were protected from competition by technological barriers, which prevented cost-effective customer-sited generation. Electric utilities have provided safe, reliable, and affordable services to their customers, and have had the opportunity to earn a predictable, stable rate of return. Electric distribution utilities have been a vital part of a power grid that provides a central, one-way power system to customers.

That traditional business model is evolving as technologies change to meet customers' desires. The rapid adoption of distributed renewable generation, coupled with the reduction in the cost of energy storage, and a more informed, technologically proficient consumer presents challenges to the traditional one-way power system utilities have provided in the past.

In order to meet the changing needs of customers and continue to provide value, electric utilities will need to offer customers a suite of solutions to address their complex and

varying energy needs. Electric utilities should move beyond simply selling customers more electricity. Instead electric utilities must understand and support their customers' goals of reducing electricity use, managing costs, and obtaining electricity from an array of environmentally friendly sources.

Q. What are the changing needs of customers?

A. Today's electric customer wants more than to simply have safe and reliable electricity service to their home or business. They have a better understanding how the electricity they use is produced, and are interested in environmentally beneficial products and services that reduce their carbon footprint and increase efficiency. They are cognizant of their behavior and its effect on the environment. Electric utilities need to recognize that customers not only want to reduce their environmental footprint, but also have the technological capacities to achieve their goal.

Understanding customers' service expectations is also important and at the forefront of changing customer needs. Modern companies are able to provide experiences beyond those offered by a traditional electric utility. With the advent of companies like Amazon, where customers can order a product and receive it in 24 hours, or Netflix, where driving to the movie rental store is a thing of the past, customers expect the same immediate attention to their questions or concerns from their utility. Electric utilities that do not address these emerging customer needs will be left behind like the landline phone companies millions of dollars in costs associated with poles and wires with a declining number of customers taking service. Customers' desire for a more responsive and interactive power system increases the importance of investment in a modern and flexible

distribution system, which is able to manage loads, provide real-time information, and interconnect distributed generation sources in multiple locations.

Q. What is battery storage?

A. Battery storage is the charging of batteries to store electricity that will be used at a later time. The reduction in the cost of battery storage technology will result in a paradigm shift in the electric utility industry, since electricity is perhaps the only commodity that is otherwise produced at the same time that it is consumed. There are multiple applications that make energy storage an attractive and flexible option for network operators. One value proposition for energy storage is to provide electricity supply during periods of renewable intermittency and load shifting by dispatching the battery when needed. Another key benefit is on-site resiliency. The core capabilities of energy storage are its fast response time, high availability, and low maintenance profile. Electric utilities can utilize battery storage by installing large scale integrated solar and storage systems, such as Green Mountain Power has done at its Panton facility, or customers can install small-scale batteries in their homes that can be charged by rooftop solar or from the electric grid.

Q. What are the potential benefits of battery storage aggregation?

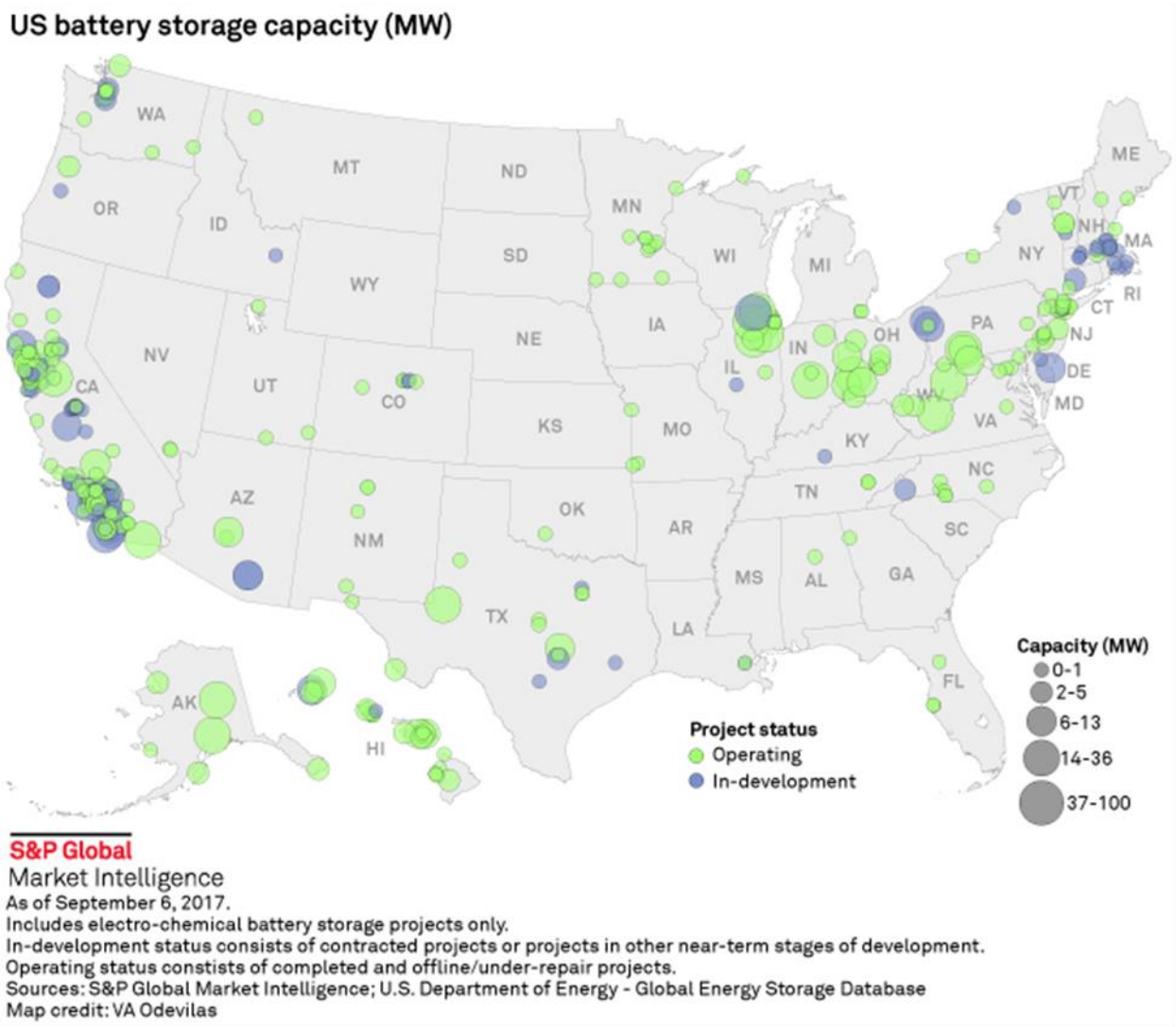
A. The goal of aggregating battery storage is to avoid grid costs, such as deferring upgrades to distribution substations or reducing transmission costs. Utilities can dispatch batteries on command. This flexibility allows a distribution utility to dispatch a fleet of batteries when the utility is experiencing a peak event. By using energy from the batteries instead of from the transmission system, the distribution utility can reduce its coincident peak

and therefore save on transmission costs. This reduction in cost will benefit all customers because transmission costs are based on the distribution utility's coincident peak load, that is, its load at the time of the ISO-New England peak.

Q. Has battery storage been deployed on a large scale around the country?

A. Yes. The map below shows the areas where large-scale battery storage has been deployed. As you can see, New Hampshire has not adopted battery storage on a large scale. Liberty Utilities' pilot, however, could signal the start of battery storage aggregation throughout New Hampshire.

Exhibit 1
Battery Storage Capacity in United States



Q. The states surrounding New Hampshire seem to have deployed battery storage. Does this have any implication for New Hampshire?

A. Yes. Regional and local (RNS and LNS) transmission charges are based on the coincident peak of the region. The costs of the transmission system do not disappear even as usage may go down due to energy efficiency and solar. As utilities in the

surrounding states install these technologies or provide incentives to customers to do so, transmission costs will be allocated to those utilities that do not take the same path. If Liberty can proactively avoid the reallocation of transmission costs now, there will be less impact on customers, if any, when other utilities in New England further deploy these technologies and programs.

IV. BATTERY STORAGE PILOT PROPOSAL

Storage Proposal

Q. Please describe Liberty Utilities' battery storage proposal.

A. Liberty Utilities is proposing to own 5 megawatts ("MW") of battery storage (nameplate), or about 1,000 batteries, which will be installed in residential customers' homes. The batteries will provide backup power for the customer, reduce peak demand, and potentially provide voltage and other support services as needed. The customer will have access to the battery capacity nearly all the time, except when a peak demand is predicted for the following day. In those cases, the Company will control the batteries to ensure they are charged and ready to be dispatched during the peak period. Participating customers will be required to take service under a time-of-use (TOU) rate, discussed below.

The near-term goal of the program is to reduce RNS and LNS transmission charges. The long-term goal is to study the effects of the batteries on the distribution system and the effects on transmission costs. Liberty Utilities will study distribution effects over the five-year period to determine the extent of the resulting deferral or avoidance of future upgrades to the distribution system.

Q. What is the Company requesting the Commission to approve?

A. The Company is requesting approval of a pilot program for battery storage to reduce transmission and possibly distribution costs. Liberty Utilities has not chosen a battery supplier or a software platform to aggregate and manage the batteries at this time. Liberty Utilities is requesting that the Commission approve its investment in batteries, allow it to charge participating customers a monthly fee for use of the batteries, allow Liberty Utilities to include the cost of the investment in rate base in its next rate case filing, and ultimately approve a TOU rate for customers who utilize battery storage under the pilot.

Q. Do you have a cost range for the pilot?

A. Yes. Based on research provided in Appendix 1, which is confidential, the recommended battery with the software platform costs is in the range of $7,000 to $9,000, which includes installation and metering. The Company will file for cost recovery of the pilot in its next rate case, after the installations are completed.

Q. Why will it take a period of five years to study the batteries' effects on the distribution system?

A. The batteries are intended to shift load from peak to off-peak periods, not reduce load. Since peaks only occur monthly and annually, many data points are needed to determine if the batteries are working as intended, and to study whether the batteries are reducing peak usage, and thus changing the criteria violation thresholds used to determine whether additional distribution system investment needs to be made in order to avoid capacity and reliability issues. The Company needs years of peak data points to evaluate whether

deferral or avoidance of system upgrades have been achieved. Additionally, the distribution system will have to be evaluated over a variety of different environmental conditions and take into account external variables such as seasonality, varying load growth, and the proliferation of higher levels of distributed energy resources and embedded generation within the grid.

Although we are looking to study some of these benefits for five years, the Commission should not interpret this as an intent to maintain a static program during the intervening period. Because residential battery storage technology continues to evolve, the Company may seek approvals for amendments to the pilot if the need arises.

Q. Does Liberty Utilities Plan on deploying additional battery storage in New Hampshire in the next 5 years during this pilot?

A. Liberty Utilities is studying all the use cases in the battery storage value chain, and anticipates that to the extent additional benefits can be determined, applications for additional battery storage will be brought forward to the Commission for approval.

Q. What are the estimated immediate savings on RNS and LNS transmission costs?

A. Between July 2016 and June 2017, the Company paid $11.55 per kilowatt-month, on a total of 1,830 MW for the twelve-month period, for both RNS and LNS. That translates into approximately $21 million paid to ISO-New England and National Grid for transmission costs. If the Company installs 5 MW of storage, we estimate that usage of the transmission system will be reduced and customers will save about $693,000 a year in transmission costs, based on full utilization of the batteries. Since the transmission rate is

reconciled annually, customers will receive the benefit of lower annual charges paid to ISO-New England and National Grid, thus resulting in lower overall transmission costs for all customers.

Q. Why is it important for Liberty Utilities to proactively reduce transmission costs?

A. The Company does not own transmission so it has no control over transmission costs aside from assisting customers with reducing their peak load and realizing savings in doing so.

Q. Has Liberty chosen a battery and software platform yet?

A. No. Liberty is in the process of reviewing battery manufacturers, provided in Appendix 1, and once a contract is executed, the Company will provide an update to this filing.

Q. Has Liberty hired a consultant to facilitate the purchase, installation, and data collection of the batteries?

A. Yes. Granite State Electric has entered an agreement with Alectra Energy Solutions ("Alectra"), a company that provides enabling technologies services for utility microgrids, C&I microgrid solutions, and energy storage solutions, and has deployed similar battery aggregation programs in Ontario. Alectra will provide consulting services for vendor selection, benefit/cost analyses, marketing assistance, and technical assistance for data gathering once the batteries are installed.

Q. What meters will the Company use for customers that participate in the pilot?

A. The meters used for the pilot will be similar to the meters that Liberty Utilities now uses for customers taking service under its alternative net metering tariff effective September 1, 2017. The main difference will be programming to allow for billing of TOU rates. However, Liberty will have to read the meters manually, rather than remotely, as is done with other AMR meters, because of the TOU periods.

Value Proposition

Q. Please explain the value proposition of battery storage aggregation for Liberty Utilities.

A. In its most recent Least Cost Integrated Resource Plan, the Company described how it would evaluate a non-wires alternative ("NWA"). The process was developed by a cross-functional planning team to evaluate potential projects as shown below:

Exhibit 2
Liberty's Non-Wires Alternative Evaluation Process

	Step	Description
1.	Review Demand Forecast	Review demand forecasts prepared for each substation, sub-transmission line, and feeder under extreme weather scenarios to determine if capacity is adequate to meet demand under normal and contingency configurations
2.	Review T&D Deficiencies	Develop a list of distribution deficiencies based on planning criteria.
3.	Screen Projects based on Screening Criteria	Screen project options based on the list of distribution deficiencies according to Company's Screening Criteria.
4.	Evaluate NWA solutions for technical feasibility	Review potential NWA solutions for technical feasibility: alternatives that have successfully reduced, avoided or deferred a wires solution in the region
5.	Perform Cost-Benefit Analysis for NWA solutions	Evaluate cost effectiveness of NWA solutions according to Commission-approved TRC test.
6.	Finalize NWA program recommendations	Finalize NWA recommendations and present for approval in capital and operating expenditures plans.

Q. Did the Company use its evaluation process to determine where to target the batteries?

A. Yes. Our engineering department reviewed multiple projects planned over the next five years and found there are two feeders in West Lebanon, one with 81 residential customers and the other with 1,412 residential customers that will have criteria violations. A new Slayton Hill distribution feeder will be required by 2021 without further reduction of peak load. The violations include loading above 75% of summer peak demand by 2020-2021, which is the equipment rate limit on transformers and feeders that Liberty Utilities uses to determine whether a system upgrade is needed. The potential for a NWA is feasible as it will shave peak demand on the feeders and offset the Slayton Hill feeder

upgrade at least a year or two, depending on the rate of adoption of the batteries by customers. The cost of a traditional upgrade is $640,000. The Company is recommending the battery storage pilot as an NWA because there is also an opportunity to reduce transmission costs and therefore provide added value to customers.

Q. Will the Company offer the batteries exclusively to customers on these circuits?

A. No. The Company will market to those customers first, with the option to open the pilot to all customers if it cannot recruit enough customers to install the 1,000 batteries along those circuits. As the pilot proceeds and data is collected, there may be opportunities to fine-tune the pilot to ensure it is meeting customer needs as well as system design objectives.

Q. Will there be an overall system benefit to reducing regional transmission costs?

A. Possibly. If other utilities in New England adopt the same type of program, then New England as a whole will reduce its need to continuously build transmission infrastructure, as well as reduce its dependence on fossil fuel generation.

Q. Is there any other value to customers?

A. Yes. Customers can use the batteries as backup generators during short-duration power outages caused by events such as pole accidents and short-duration outages caused by storms. Customers will also benefit from the data collection and subsequent study undertaken by Liberty Utilities to learn more about how batteries interact with the distribution system, how to efficiently utilize the stored energy, and the overall savings in avoided distribution system upgrades.

Customer Engagement

Q. What is the benefit to customers who enroll in the pilot?

A. Customers will be engaged in their energy usage because there will be an incentive through the TOU rate to modify their usage patterns. They will be provided periodic reports showing how their battery is operating in their home. Depending on the battery provider, there may be a cell phone app that customers can download to see the real-time dispatching of their battery. Customers will also be educated on how to most efficiently use the batteries through literature and technical assistance.

Q. Will the customer have any financial responsibility for the batteries?

A. Yes. The customer will sign a contract with the Company to use the batteries for ten years and requiring them to pay either an upfront contribution towards the cost of the battery or a monthly fee for the ten years.

Q. Has the Company designed time-of-use (TOU) rates for customers in the pilot program?

A. Yes. Customers who elect to have the batteries installed in their homes will take service under a TOU rate schedule whereby there will be three pricing periods for the distribution and transmission charges. The rate will provide for critical peak, on-peak, and off-peak periods. The hours for each period are as follows:

- Critical peak: 2 PM through 7 PM
- On-peak: 7 PM through 8 AM
- Off-peak: 8 AM through 2 PM

These hours will apply for weekdays only. Weekends and holidays are considered off-peak periods.

Q. How did you determine what hours would make up the periods?

A. First, I reviewed ISO-New England's and Liberty Utilities' peak hours for 2016. Those peaks occurred on August 2, 2016, at 2 PM and 3 PM, respectively. I also reviewed hourly interval data for our residential customers who participate in our load research group. The group has four blocks: highest usage, medium-high usage, medium-low usage, and low usage. By reviewing this information, I found that the residential customer class's usage was heaviest between the hours of 3 PM through 9 PM.

Q. If the residential class's usage was heaviest between the hours of 3 PM and 9 PM, why did you choose 2 PM through 7 PM for critical peak?

A. There are two reasons for choosing those critical peak hours. First, critical peak should only last for the hours needed to accomplish the goal, which is to reduce the system peak. With the Liberty Utilities and ISO-New England peaks only one hour apart, both peak hours need to be included in the critical peak hours. However, the critical peak period should not last too many hours because that would defeat the purpose of a short period where customers could curtail their usage and use the battery to serve their load. With that in mind, it was determined appropriate to include the 2 PM hour in the critical peak period. The second reason is that this program is new to customers. As they do not have experience with TOU rates, providing critical peak hours for only two to three hours of the day would not provide the customer with satisfaction that their investment is paying off. It may be difficult for customers to change their behavior for activities like drying

laundry, so by ending the critical peak period at 7 PM on weekdays, customers are still afforded the opportunity to change behavior, but not so much that they must dramatically alter their lifestyles.

Q. Will the customer be able to export the power from the batteries?

A. No. The customer will not be able to export the power stored in the batteries, but only to use the capacity and energy to offset their internal load. If a peak is predicted for the following day, the customer will be notified the day before that a peak may occur and their access to the battery will be limited. On the peak day, the Company's planning engineer and dispatch department will monitor conditions and will assess when the batteries are best suited to discharge. Because the customer's load will be offset by the discharge of the battery, any capacity of the battery not being used to offset at that time will be discharged by the Company to the grid. As noted earlier, as customer needs and the Company's knowledge of the capabilities of the batteries increases over time, this structure may change.

Q. Will customers with solar installations be the only customers allowed to participate in the pilot?

A. No. Customers will be allowed to participate in the pilot even if they do not have solar generation. Customers without solar will have the incentive to charge the batteries in the off-peak period when rates are very low, and dispatch the battery during the critical peak period when rates are very high. Customers with solar will have the opportunity to do the same. In fact, customers with solar could choose to charge the batteries overnight via the grid, dispatch during the critical peak period, and export any solar generation to the grid

to receive export credit towards their bill for the month. Customers may also choose to charge the battery during the on-peak period from the solar installation.

Q. Will customers participating in the pilot with grandfathered solar installations continue service under the grandfathered tariff?

A. No. Customers with solar who wish to participate in the pilot program will need to take service under the alternative tariff that was effective September 1, 2017.

Q. Why is the Company requiring these customers to move to the alternative tariff?

A. Liberty Utilities' billing system cannot accommodate the proposed TOU rate structure, specifically the banking of kilowatt-hours (kWh), but can accommodate monetary credits, which is one of the differences between the grandfathered tariff and the alternative tariff.

Q. How will the Company treat exports of power for customers without solar?

A. When the customer's access to the battery is restricted, the customer will have an incentive to lower their internal load because the Company will pay the customer for any kWh exported for utility dispatch purposes. The Company will pay for those exported kWh in the same manner as the net metering tariff effective September 1, 2017.

Q. How will customers with solar installations be treated with respect to exported kWh?

A. Customers with solar installations will be compensated for exports in the same manner as customers without solar. Those customers will be required to move to the new net metering tariff and will receive monetary credit for their exports. Customers will also be

credited for any kWh discharged from the batteries to the grid if Liberty Utilities dispatches the batteries on its own to reduce load at peak.

Q. Considering the changes to the alternative net metering tariff, will customers who move lose any compensation they would have received in their grandfathered tariff?

A. No. Customers who utilize the batteries in combination with solar generation may actually get an added monetary benefit by switching from the grandfathered tariff. As shown in Schedule HMT-1, the distribution and transmission rates for the critical peak period are more than three times the rates for a residential customer under Rate D. Under the alternative tariff, the customer receives full energy service and transmission credit, and 25% of the distribution rate credit on exported kWh. By using the battery energy to supplement the solar generation, the customer will offset their internal load and export more power to the grid, providing them with more exported kWh compensated at higher rates than under the current net metering tariff.

V. RATE STRUCTURE

Q. Have you calculated rates for TOU periods?

A. I have calculated illustrative rates in Schedule HMT-1 based on the rates approved in the Company's most recent distribution rate case, Docket No. DE 16-383, and the most recent transmission rate filing, Docket No. DE 17-049, both having rates that were effective May 1, 2017. The Company will have distribution rate changes effective May 1, 2018, for its annual Reliability Enhancement Plan/Vegetation Management Program and a step increase based on the Settlement Agreement in DE 16-383. Liberty Utilities

will also request approval of new transmission rates effective May 1, 2018. These new rates will be used to calculate new TOU rates for this program.

Q. Please explain how you determined what costs associated with the pilot would be included in rate calculations.

A. To calculate distribution rates, I used the most recently approved revenues from our last distribution and transmission rate changes, effective May 1, 2017, to determine revenues that will be included in this pilot. For transmission rates, I calculated an average cost per kilowatt based on actual transmission costs from July 1, 2016, through June 30, 2017. I then allocated the dollars using the weighted coincident peak usage based on our last retail rate filing, DE 17-049, Schedule HMT-3, page 1 of 8.

Q. Please explain the percentages you used to determine the costs for each period.

A. Since the distribution and transmission systems are designed for peak conditions, essentially 100% of all costs are associated with peak. It would be unreasonable to allocate all costs to the critical peak hours, because doing so would result in extremely high prices for that period. In order to provide some balance between periods, I assigned 70% of costs to critical peak, 10% of costs to off-peak, and 20% of costs to on-peak.

Q. Please explain why using those percentages for each period is appropriate.

A. Customers need an incentive to use power off-peak and avoid critical peak. When designing the rates, I considered different percentages and found that using the splits previously mentioned provided customers with on-peak rates very close to the current rates for distribution and transmission, and believe that is the appropriate test as

customers are essentially paying an on-peak flat rate today because the system's costs are associated with peak periods.

VI. TIMELINE

Q. What is the Company's proposed timeline for approval of this filing and pilot program?

A. The Company will be selecting a vendor in mid-January while moving through the adjudicative process to get the pilot program approved. Liberty Utilities requests that the Commission approve the pilot by June 30, 2018. The next step will be to have customers enrolled by August 31, 2018, with battery installations starting around November 1, 2018.

VII. CONCLUSION

Q. Does this conclude your testimony?

A. Yes it does.