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April 8, 2019

Ms. Debra A. Howland
Executive Director
New Hampshire Public Utilities Commission
21 South Fruit Street, Suite 18
Concord, New Hampshire 03301

Re: Docket No. IR 15-296
Investigation into Grid Modernization
Comments on Staff Recommendation on Grid Modernization of Jan. 31, 2019

Dear Ms. Howland:

This letter is the City of Lebanon's (City) supplemental response to the invitation issued in the above-referenced docket by the Commission, via its secretarial letter of March 13, 2019, to submit comments on the January 31, 2019 report entitled "Staff Recommendation on Grid Modernization" (Staff Report). The City also joins in the comments being submitted by the Office of the Consumer Advocate (OCA) as its primary response.

The City commends the Commission Staff in moving Grid Modernization forward with its report. In many respects grid modernization began in New Hampshire in the mid 1990's with the enactment of RSA 374-F, Electric Utility Restructuring, in which the paradigm of a vertically integrated electric utility in which all electric services, from generation to delivery to demand response programs are provided by a regulated monopoly shifted to a paradigm based on maximizing the role of competitive markets to foster customer choice, innovation, and economic efficiency in electricity supply, while recognizing the continued role of regulated monopolies in the delivery of electric power. The City urges the Commission to evaluate grid modernization strategies in light of the core purposes of RSA 374-F and, in particular, the 2nd and 14th policy principles concerning customer choice and administrative processes, which are recounted below for convenient reference, with emphasis added:

> **374-F:1 Purpose. –**
> I. The most compelling reason to restructure the New Hampshire electric utility industry is to reduce costs for all consumers of electricity by harnessing the power of competitive markets. The overall public policy goal of restructuring is to develop a more efficient industry structure and regulatory framework that results in a more productive economy by reducing costs to consumers while maintaining safe and reliable electric service with

> minimum adverse impacts on the environment. **Increased customer choice and the development of competitive markets for wholesale and retail electricity services are key elements in a restructured industry** that will require unbundling of prices and services and at least functional separation of centralized generation services from transmission and distribution services.
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> II. A transition to competitive markets for electricity is consistent with the directives of part II, article 83 of the New Hampshire constitution which reads in part: "Free and fair competition in the trades and industries is an inherent and essential right of the people and should be protected against all monopolies and conspiracies which tend to hinder or destroy it." **Competitive markets should provide electricity suppliers with incentives to operate efficiently and cleanly, open markets for new and improved technologies, provide electricity buyers and sellers with appropriate price signals**, and improve public confidence in the electric utility industry.
> . . .
> **374-F:3 Restructuring Policy Principles. –** . . .
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> II. Customer Choice. Allowing customers to choose among electricity suppliers will help ensure fully competitive and innovative markets. **Customers should be able to choose among options such as** levels of service reliability, **real time pricing, and generation sources, including interconnected self generation**. . . .
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> XIV. Administrative Processes. The commission should adapt its administrative processes to make regulation more efficient and to enable competitors to adapt to changes in the market in a timely manner. **The market framework for competitive electric service should, to the extent possible, reduce reliance on administrative process. New Hampshire should move deliberately to replace traditional planning mechanisms with market driven choice as the means of supplying resource needs.**

The US Department of Energy's approach to grid modernization, reflected in Staff's recommendations, necessary includes recommendations that are perhaps more appropriate to vertically integrated utilities along with some that perhaps better fit restructured utilities and state policy frameworks promoting market driven choices and solutions. Where possible New Hampshire's efforts should lean into the policy choices set forth in RSA 374-F with emphasis on animating a retail market and customer choice for electricity services, providing appropriate price signals, and reducing reliance on administrative processes. Below are a few specific comments to supplement those expressed in the OCA's comments.

1. **Appropriate Price Signals and Advanced Metering Functionality (AMF)**

Appropriate price signals or rates, that reflect marginal costs in some way, are key to good price formation and optimal response of demand (load) to temporal supply costs. While locational price signals (beyond the granularity of LMPs used in wholesale market settlements by ISO New England) may one-day be an important part of retail electricity markets, especially for locational deployment of DERs, strong temporal marginal cost price signals dominant in the wholesale markets for energy, generation capacity, and the allocation of transmission charges. The later two of which are based on share of hourly coincident peak demand. Most of the embedded costs

in generation, transmission, and distribution of electricity are based on sizing the capacity of each part of the system to accommodate temporal coincident peak demand. However, few if any of these temporal price signals are being translated or are accessible to retail load due. The lack of interval metering and customer access to such data is obviously a foundational issue for developing appropriate retail price signals, retail choice, and retail market animation. For nearly 23 years New Hampshire law has called for retail customer access to real time pricing (RTP), yet in over two decades only the largest C&I customers have achieved such. Staff's recommendations put the completion of advanced customer metering out in the longer-term timeframe of 6 to 10 years (Staff Report at 39), although they do support development of a customer technology opt-in for AMF.

The City, working with Liberty Utilities, hopes to help demonstrate a business case for AMF and TVR with net positive benefits through its municipal aggregation pilot to enable customer access to and choice of RTP and perhaps other TVR options, such as the 3-period-2-season TOU rates recently approved for use in Liberty's battery pilot in DE 17-289.[1] Affordable access to AMF has been a key barrier to advancing our proposed pilot. However, we hope to soon propose that the City purchase LED streetlights with networked control nodes to form a backbone in Lebanon to support an affordable communication system for interval meters with AMF for our pilot and possibly as lower cost means for interval metering for Liberty's battery pilot, at least in Lebanon. Market driven innovation has lowered the cost of AMF in recent years to the point where near real time access to meter data as frequently as once per minute, can be had from meters that cost as little as $110 for a residential meter to $250 for polyphase meter for large C&I customers with affordable secure meter data collection and storage.

It is worth noting that access to big data from AMI interval meters in Illinois has provided the basis for several studies by the Illinois Citizens Utility Board (CUB) and Environmental Defense Fund[2] finding large potential benefits of dynamic pricing (RTP) to residential customers, benefiting 97% of sampled residential customers (300,000 data sets) in 2016 to the tune of nearly $30 million in savings, without a change in load shape.[3] Another study based on 2016 and 2017 interval meter data found that Electric Vehicle (EV) owners could save from 52% to 59% with RTPs compared with flat-rate tariffs.[4]

Besides the 1996 legislative call for retail customer access to real time pricing, the notion that NH electric utilities should be preparing for and planning to implement AMI/AMF and TVR is not new to this Commission or the Grid Modernization proceeding. On April 24, 2006, the

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[1] See "Technical Statement on Time-of-Use (TOU) Model" at https://www.puc.nh.gov/Regulatory/Docketbk/2017/17-189/LETTERS-MEMOS-TARIFFS/17-189_2018-11-19_GSEC_TECH_STATEMENT_TOU.PDF

[2] https://www.citizensutilityboard.org/welcome-big-energy-data-center/

[3] THE COSTS AND BENEFITS OF REAL-TIME PRICING: An empirical investigation into consumer bills using hourly energy data and prices, CUB & EDF, November 14, 2017, https://www.edf.org/media/new-smart-meter-data-shows-potential-real-time-pricing-lower-electric-bills and http://citizensutilityboard.org/wp-content/uploads/2017/11/FinalRealTimePricingWhitepaper.pdf.

[4] Charge for Less: An Analysis of Hourly Electricity Pricing for Electric Vehicles, CUB, January 17, 2019, https://citizensutilityboard.org/wp-content/uploads/2019/01/charge-for-less-final-published-paper.pdf.

Commission opened DE 06-061[5] to consider adoption of PURPA standards for Time-Based Metering and Interconnection. The Order of Notice[6] described the topic as follows:

> The fourth standard for consideration, under Section 1252 of EPAct, concerns Time-Based Metering and Communications or "Smart Metering". The EPAct requires that each state regulatory authority conduct an investigation and determine whether it is appropriate for electric utilities "to provide and install time-based meters and communications devices for each of their customers which enable such customers to participate in time-based pricing rate schedules and other demand response programs." The EPAct requires state commissions to commence investigation of Smart Metering no later than August 8, 2006, and make a final determination no later than August 8, 2007.

Order No. 24,763 (DE 06-061, 6/22/07)[7] regarding AMI and TOU rates noted the following (at 24):

> **D . Time-of-Day Rate Structures**
>
> Staff noted in its reply comments that ISO-New England has recommended that the conventional peak/off-peak time-of-use rate structure be modified to provide customers a reasonable opportunity to shift load from peak period. Specifically, ISO-New England recommended a structure that includes a minimum of three periods: peak, shoulder and off-peak. The peak period would be shorter than the peak period in conventional time-of-use rates, which for some utilities extends from 7:00 a.m. until 8:00 p.m., Monday through Friday. Reducing the number of hours in the peak period and adding a shoulder period would, according to ISO New England, provide customers a much greater incentive for customers to shift load out of the peak period because the shorter peak period produces a higher cost-based peak rate, while the shoulder period provides a convenient home for the load shifted out of the peak period. We find these arguments persuasive as a policy matter and will consider how to implement three-period, time-based rate structures for both small and large default service customers. Further, we will require that the time-of-day periods be based on an analysis of hourly market price variations in ISO-New England's day-ahead and real-time markets.

That order went on to direct Staff & the utilities to prepare tariffs and AMI plans to support TOU for all customers, as well as optional real-time pricing and critical peak pricing options. However this order was stayed upon request for rehearing, which proceeded into a fully litigated case with pre-filed testimony and evidentiary hearings. Although the stay was never lifted the final relevant order in that case (Order No. 24,819, DE 06-061, 1/22/08 at 15-16)[8] concluded with the following, more than a decade ago:

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[5] https://www.puc.nh.gov/Regulatory/Docketbk/2006/06-061.htm.

[6] https://www.puc.nh.gov/Regulatory/CaseFile/2006/06-061/ORDERS/OON%20Scheduling%20PHC%20on%20May%2016,%202006%2004-24-06.pdf.

[7] https://www.puc.nh.gov/Regulatory/CaseFile/2006/06-061/ORDERS/Order%20No.%2024,763%20%20Regarding%20the%20Adoption%20of%20Standards%20for%20Time-Based%20Metering%20and%20Interconnection%20-6-22-07.pdf

[8] https://www.puc.nh.gov/Regulatory/CaseFile/2006/06-061/ORDERS/06-061%202008-01-22%20Order%20No%2024,819%20Following%20Hearing%20(15).pdf.

> In short, we are concluding today that as a general policy matter it is appropriate to implement some form of smart metering and time-based rates as set forth in the federal standard in the instant docket.
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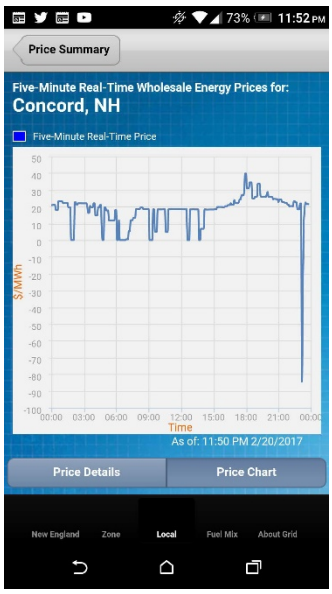
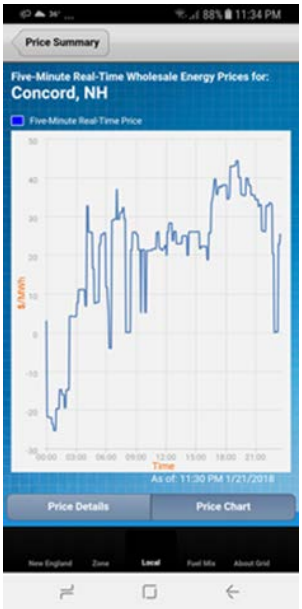
> . . .
>
> ORDERED, that it is appropriate to implement time-based metering standards; and it is
>
> FURTHER ORDERED, that the details, including cost-benefit analyses, form of rate design, time of implementation and applicable customer classes shall be determined in a separate proceeding or proceedings to be initiated by the Commission.

The City specifically supports Staff concurrence with the Grid Mod Working Group's recommendation that "behind-the-meter technologies should be considered as a viable option for providing customer interval load data and power quality characteristics, such as voltage, in the absence of advanced metering infrastructure." (Staff Report at 53.) The City specifically disagrees with Staff's recommendation of "maintaining remote disconnect functionality" (*Id* at 55) to the extent it may be intended to apply to AMF customer opt-in where the customer is paying for a new meter and where such functionality does not exist today. Most Liberty and Eversource customer meters do not now have such functionality and if the customer is paying for a new meter on an opt-in basis it should not have to bear any cost for added utility functionality, especially one that is fraught with additional cybersecurity concerns. (There is a difference between a bad actor just hacking into a meter data stream and seeing the data and hacking in for the purpose of turning off electric supply that is unauthorized and unexpected.)

The City also disagrees with Staff's position that interval metering opt-in should be limited to installation of 15-minute interval meters. (*Id* at 55.) As noted in footnote 12 of the Grid Modernization Working Group report at p. 23, ISO New England now settles the energy market at 5-minute intervals. Generation metering is generally reported and compensated based on 5-minute intervals, while hourly load data is flat profiled into 5-minute blocks for load settlement. ISO New England streams RTPs based on 5-minute interval data as can be seen from a couple of ISO to Go app screenshots. Note that price spikes and dips down to or below zero usually occur in 5-minute blocks that are rarely static over an hour.





We should anticipate that someday, within the life of new meters, load may be able to settle at the same actual 5-min intervals as supply. Furthermore as a result of nearly 2 years of considering interval metering options with Liberty for our proposed pilot, the City believes that most advancing metering is now capable of collecting data at 5-minute intervals just as easily as 15-minute or hourly intervals, at little or no incremental cost, including for basic data collection. How long highly granular data is stored is another question, but hardly critical at this point.

The City understands that Unitil already has a commitment to and an investment in meters that are only capable of a granularity of 15-minute intervals, so it makes sense for them to be able to stick with such a limitation. However, where Eversource and Liberty customers don't even have access to hourly interval data, it just makes common sense for customers who may pay to opt-in to interval metering capability that they be allowed to take advantage of the latest metering capabilities, which typically even allows for 1-minute granularity in interval data, even if the data is not initially collected and stored at such a granularity.

2. Conservation Voltage Reduction and Volt/Var Management

One of the major objectives of Grid Mod is to increase reliable operational efficiency of the distribution grid and one of the specific functionalities is to enable better Volt/Var control including conservation voltage reduction (CVR). Electric utilities are required by Puc 304.02 to deliver power where the utility regulates voltage within plus or minus 5% of specification. Traditionally (without grid edge sensors) voltage is pushed out from substations and utility transformers at greater than the target voltage to ensure, based on engineering models involving consideration of size and length of circuit conductors, load along the way, and overall impedance that supply to the most distant load meter receives power that is not less than 5% of the target voltage. Each 1% increase or decrease in voltage from the source typically results in a 1% increase or decrease in the overall amount of power generated and billed for. Thus if voltage at the source can be decreased by, say, 2% to 3%, while maintaining minimum voltage at the grid edge, then that could result in 2% to 3% savings in energy, FCM, and transmission charges.

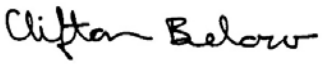
When this writer was serving as a PUC Commissioner on the Electric Power Research Institute (EPRI) Smart Grid and Energy Efficiency Public Advisory Group and had the opportunity to tour one of the nation's early pilots of smart metering and smart grid in Boulder, CO, the utility was asked what their biggest surprise was when they first started collecting highly granular advanced metering data in near real-time. The answer was how much over voltage most of their distribution system was running most of the time. Their engineering models did not take into account the amount of solar PV and energy conservation going on at the grid edge. They pretty much immediately were able to turn down the supply voltage by about 3% resulting in significant immediate energy savings, but also a slower rate of transformer failure due to overloading from excessively high voltages.

Staff recommends that the time frame for completion of such capability is in the mid-term of 4-5 years, some years ahead of AMF. (Staff Report at 40.) However, to effectively engage in volt/var control including CVR, sensors at the edge of grid are needed to read voltage levels (and power factor) in near real-time such as from highly granular interval meter data. With revenue grade metering installed directly behind Liberty's meter at my home and place of business, with near real time access to 1-minute granular data, based on tens of thousands of reads over that past

couple of years, I've found that my electric service was over 120 volts RMS about 92% to 99% of the time sampled, suggesting a significant opportunity for CVR. However, since both these meters are not at the end of the circuit, they only suggest the opportunity without quantifying it. It seems likely that AMF, with near real time access to highly granular meter data on power quality, may be the least cost means to realize the considerable savings and value from dynamic volt/var control and CVR and improved power quality, while creating a value synergy by animating retail electricity service markets and customer choice, including TVR options.

The City looks forward to working with the Commission, Staff, the OCA, Liberty Utilities, and other stakeholders to accelerate the promise and opportunities of wise and cost-effective grid modernization.

Yours truly,



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