STATE OF NEW HAMPSHIRE
BEFORE THE
PUBLIC UTILITIES COMMISSION

In the matter of

Docket No. **DE 19-057**

REQUEST FOR PERMANENT RATES

DIRECT TESTIMONY

OF

PAUL J. ALVAREZ

ON BEHALF OF

THE OFFICE OF THE CONSUMER ADVOCATE

December 20, 2019

TABLE OF CONTENTS

I. INTRODUCTIONS 3

II. PSNH HAS NOT DEMONSTRATED THAT METER REPLACEMENT WAS NECESSARY 6

III. WHILE THE METERS PSNH INSTALLED ELIMINATED MANUAL METER READING, THE TECHNOLOGY DEPLOYED WAS NOT LEAST COST 8

IV. IF METERS WERE TO BE REPLACED, PSNH SHOULD HAVE USED INDUSTRY STANDARD TECHNOLOGY (AMI) OFFERING INTERVAL USAGE DATA 12

V. PSNH'S DECISION TO REPLACE METERS WITH OUTDATED TECHNOLOGY WAS BIASED AND CALCULATED TO FORESTALL INTERVAL USAGE DATA AVAILABILITY 19

VI. PSNH'S DECISION TO REPLACE METERS WITH NON-STANDARD TECHNOLOGY HARMED CUSTOMERS AND MARKETS IN DEFIANCE OF NEW HAMPSHIRE LAW AND POLICY 28

VII. REVIEW AND RECOMMENDATIONS 31

APPENDIX AND SCHEDULES 34

Appendix

APPENDIX A	CURRICULUM VITAE OF PAUL J. ALVAREZ

Schedules

Schedule PJA-1	Staff DR TS-011. Attachment TS 1-011A
Schedule PJA-2	Staff DR 10-003
Schedule PJA-3	OCA DR TS 1-003
Schedule PJA-4	OCA TS 1-004
Schedule PJA-5	OCA DR TS 1-001(a-d)
Schedule PJA-6	Staff DR 10-004, Attachment Staff 10-004
Schedule PJA-7	OCA DR 6-087(a)
Schedule PJA-8	Letter from Thomas Frantz of Staff to Dan Comer of PSNH dated July 24, 2017 regarding a meeting held July 17, 2017. Provided by PSNH in response to OCA DR 6-084.
Schedule PJA-9	OCA DR 6-085
Schedule PJA-10	OCA DR 6-082(b)
Schedule PJA-11	OCA DR TS 1-007, Attachment OCA TS 1-007 A

I. INTRODUCTIONS

Q. Mr. Alvarez, would you please state your name, business address, and occupation?

A. My name is Paul J. Alvarez. My business address is Post Office Box 620756, Littleton, Colorado 80162. I am president of The Wired Group, a consultancy dedicated to maximizing the value of utility distribution grids and businesses to customers.

Q. On whose behalf are you testifying in the case?

A. I am testifying on behalf of the Office of Consumer Advocate (OCA) in this case.

Q. Please describe your formal education and professional experience.

A. I received a bachelor's degree in business administration from the Kelley School of Business at Indiana University in 1984 and a master of management degree from the Kellogg School of Management at Northwestern University in 1991. After 15 years in Fortune 500 product development and product management, I entered the utility industry in 2001 with responsibilities that focused on demand-side management and renewable energy program development and rate design, marketing, and impact measurement. These experiences led to two unique projects involving the measurement of grid modernization costs and benefits, which revealed the limitations of current utility

regulatory and governance models.[1,2] I formed the Wired Group in 2012 to focus exclusively on consumer and business advocates' need for expertise in grid modernization and utility performance measurement. I have since testified in, or served as consultant to clients in 18 states in support of cases before utility regulatory commissions regarding distribution (including meters) planning, investment, and performance measurement.

I am the author of *Smart Grid Hype & Reality: A Systems Approach to Maximizing Customer Return on Utility Investment*, a book originally published in 2014 and revised for its second edition published in 2018. I am also the developer of the Utility Evaluator, an Internet-based application which benchmarks investor-owned utility performance on 30 different financial and operating metrics from publicly-available data (FERC Form 1, EIA Form 861, JD Power and Associates, state regulatory filings, etc.).

Q. Have you previously testified before this Commission?

A. I submitted Comments on September 6, 2019 jointly with my associate, Dennis Stephens, in IR 15-296 regarding distribution planning process recommendations. My full Curriculum Vitae, which briefly describes all appearances before U.S. state utility regulators, is provided as Appendix A to this testimony.

[1] Colorado PUC 11A-1001E. *SmartGridCity Project Evaluation Summary*. Exh. MGL-1. Dec. 14, 2011.

[2] Ohio PUC 10-2326-GE-RDR. *Duke Energy Smart Grid Audit and Assessment*. June 30, 2011

Q. What is the purpose of your testimony?

A. The OCA has engaged me to review PSNH's investment in traditional meters equipped with automated meter reading (AMR) technology, for which PSNH is requesting a return of and on costs in this case.

Q. Please preview your testimony.

A. I believe PSNH's investment in traditional meters equipped with AMR technology, to have been imprudent, and that cost recovery should therefore be denied. My testimony is organized as follows:

- PSNH has not demonstrated that meter replacement was necessary.
- While the meters PSNH installed eliminated manual meter reading, the technology deployed was not the least cost means to do so.
- If PSNH were to replace its meters, it should have used industry standard technology (advanced metering infrastructure) offering interval usage data.
- PSNH's decision to replace meters with non-standard technology was biased and calculated to forestall interval usage data availability.
- PSNH's decision to replace meters with non-standard technology harmed customers and markets in defiance of New Hampshire law and policy.

II. PSNH HAS NOT DEMONSTRATED THAT METER REPLACEMENT WAS NECESSARY

Q. When did PSNH replace its meters with those for which it is requesting cost recovery in this Case?

A. PSNH replaced its meters in 2013.[3]

Q. Why did PSNH replace its meters?

A. PSNH justifies replacing its meters through the cost savings associated with the elimination of the physical meter reading operations in existence at the time.[4] In discovery, PSNH described additional benefits associated with the elimination of physical meter reading operations, including improvements in employee safety and reductions in estimated and errant meter readings.[5] However, PSNH did not estimate any economic benefits from these features. PSNH provided no evidence that employee safety incidents, or estimated and errant meter readings, were on the rise,[6] or that they constituted priority problems necessitating replacement of existing meters.

[3] Direct testimony of Penelope McClean Connor at 47 (Bates 000785), line 7.
[4] Schedule PJA-1.
[5] Schedule PJA-2.
[6] Schedule PJA-3.

Q. Did PSNH provide any evidence that its meters required replacement?

A. Not in direct testimony. In discovery, PSNH added that its meters were aging, but described no customer consequences associated with this fact. PSNH also noted in discovery that hand-held meter reading devices used by meter readers to record meter data, which at the time numbered 100, were failing and no longer being supported by available meter data collection software.[7] However, PSNH provided no hand-held meter reading device failure rates, nor described any consequences associated with a lack of software support. Additionally, to the best of my recollection, 100 new handheld devices and software could have been had for only about $100,000 in 2013.

Q. In your opinion, could PSNH have continued to provide adequate service using the electric meters and metering systems in place in 2012?

A. Yes.

[7] Schedule PJA-2.

III. WHILE THE METERS PSNH INSTALLED ELIMINATED MANUAL METER READING, THE TECHNOLOGY DEPLOYED WAS NOT LEAST COST

Q. To summarize, PSNH claims it replaced its electric meters to secure the benefits associated with the elimination of physical meter reading operations, correct?

A. Correct.

Q. **What options did PSNH evaluate in the pursuit of physical meter reading operations elimination?**

A. PSNH evaluated three options to eliminate physical meter reading operations. These included replacing the electric meters with 1) traditional meters featuring automated meter reading (AMR) functionality; 2) "Bridge" meters, which function as AMR meters but are upgradable to advanced metering infrastructure (AMI); and 3) a full AMI metering system (including a two-way wireless communications system).

Q. How did PSNH justify the selection of AMR meters?

A. PSNH justified the selection of AMR meters as the lowest-cost method to eliminate physical meter reading operations.

Q. Was the replacement of existing electric meters with AMR meters the lowest-cost method to eliminate physical meter reading operations?

A. No. If PSNH's primary goal was to eliminate meter reading operations, the least cost way to do so in 2013 would have been to add radio modules to the existing meters. These modules allow meters to be read by vehicles which drive through neighborhoods in exactly the same manner as the AMR meters PSNH installed, collecting data from thousands of meters per vehicle per day, but without the cost of replacing the entire electric meter. The radio modules are retrofitted to existing meters, and typically consist of a round transistor board which fits under the meter glass. Though they have fallen out of favor today, in 2013 there were likely millions of mechanical meters retrofitted with AMR in service in the US. Retrofit options were offered by major manufacturers like Sensus and Itron. In fact, in Connecticut and Massachusetts, PSNH affiliates use Itron's Field Service Collection System, a drive-by system using AMR modules in a variety of meters.[8] Given that the company has several types of mechanical meters still in service in

[8] Schedule PJA-4.

those states,[9] it is likely at least some of those meters were retrofitted with AMR modules in exactly the manner I describe.

Q. Did PSNH evaluate the drive-by meter retrofit option?

A. No.[10]

Q. Did PSNH explain why not?

A. PSNH explained that the cost of the new meters, at about $33, was likely not much more than the cost of retrofitting traditional meters with the drive-by radio option.[11] In addition, PSNH claimed that the drive-by retrofits are not a substitute for meter replacement,[12] inferring that the two options weren't comparable.

Q. Do you concur with these assessments?

A. No. The total cost of the AMR meters PSNH chose to install was $70.55 per meter,[13] not $33. By comparison, including installation, the cost of retrofitting a drive-by

[9] *Id.*
[10] Schedule PJA-2 (a).
[11] *Id.*, (c).
[12] *Id.*, (b) and (d).
[13] Schedule PJA-1. Attachment Q-TS011A. Page 4, column "AMR", line "Average Installed Cost Per Meter."

system in 565,000 existing meters would probably have been less than $20 per meter. The cost of associated IT systems, $3.3 million,[14] as well as vehicle equipment, would have been the same under either full meter replacement or retrofit scenarios for drive-by meter reading. Finally, since PSNH provided no rationale for meter replacement, any claim that drive-by retrofits are not a substitute for meter replacement is irrelevant. Either replacing old meters with AMR-equipped meters, or retrofitting meters with AMR modules, delivers the same result: the elimination of physical meter reading operations. PSNH should have evaluated the benefits and costs of all potential options available for eliminating physical meter reading, and selected the option offering the greatest benefits for the least cost.

Q. To clarify, your testimony is that PSNH changed out its entire installed base of meters to eliminate physical meter reading operations, even though it could have simply retrofitted those meters at a much lower cost. You also testify that PSNH did this despite the fact that PSNH is likely to have retrofitted old meters with AMR in Connecticut and Massachusetts. Is that correct?

A. Yes, that's correct.

[14] Schedule PJA-6. P. 2.

Q. Do you have any theories as to why PSNH would have done this?

A. Of course, I can only hypothesize as to why PSNH would have replaced electric meters to automate meter reading, when it could have simply retrofitted those meters. But, I do have some theories. One theory is that PSNH was interested in growing its rate base, motivated by capital bias as all investor-owned utilities are. Another theory is that PSNH intentionally installed meters without the interval data capabilities required to offer time-varying rates. This theory maintains that one of PSNH's goals was to delay the onset of time-varying rates by installing new meters which could not offer the interval usage data required to bill such rates. I will provide support for this theory in the balance of my testimony.

IV. IF METERS WERE TO BE REPLACED, PSNH SHOULD HAVE USED INDUSTRY STANDARD TECHNOLOGY (AMI) OFFERING INTERVAL USAGE DATA

Q. How long have you been in your current line of work?

A. As indicated in the Introduction and Appendix A (my Curriculum Vitae) to this testimony, I have been evaluating grid modernization plans, investments, and results, including advanced metering infrastructure (AMI) deployments, since 2010.

Q. So, utilities have been deploying AMI since before 2010?

A. Yes. In 2008, AMI deployments accelerated rapidly as a result of the American Reinvestment and Recovery Act (ARRA), enacted by Congress to stimulate the economy during the Great Recession. The Smart Grid Investment Grant program (SGIG, part of ARRA) offered utilities $4 billion in matching grants, and was designed to get utilities to invest a lot in their grids extremely quickly. As AMI deployments are quick to plan compared to other electric distribution technologies, a large amount of utility applications for SGIG matching grants featured AMI. In just a few years the SGIG prompted the installation of over 10 million AMI meters, and they quickly became the industry standard for new meters. Before the SGIG programs, electric utilities typically replaced old meters with new ones on a premise-by-premise basis, and only when individual meters which failed were deemed beyond repair. Utilities largely began "en masse" (all at once) replacements of old meters with AMI meters coincident with the SGIG. To my knowledge, all "en masse" meter replacements since 2010 have featured AMI meters. By July 2013, when PSNH installed traditional meters equipped with AMR, the Edison Foundation estimated that 46 million AMI meters had already been installed in the US.[15]

[15] Cooper A., *Electric Company Smart Meter Deployments: Foundation for a Smart Grid*. Institute for Electric Innovation, Edison Foundation. October, 2016. Figure 1, page 2.

Q. Since 2010, other than PSNH, do you know of any utility which has completed an "en masse" replacement of all old meters with new meters which were not AMI meters?

A. No.

Q. What are the advantages of AMI meters over the traditional type PSNH installed?

A. In my experience, the advantages of AMI meters are highly variable, and depend to an almost exclusive degree on how a utility chooses to employ them. I have seen investor-owned utilities minimize AMI capabilities which cause them economic harm under the current ratemaking model, including time-of-use rate capabilities designed to reduce peak demand (due to utility capital bias) and grid and customer efficiency capabilities (due to the utility throughput incentive). In primary and secondary research I've led, I've found demand reduction and energy conservation potential to represent between 35 and 50 percent of the total economic benefits utilities could deliver to customers from AMI, with most of the rest coming from the elimination of physical meter reading operations, revenue assurance, and outage restoration, in rough order of magnitude.

Q. What is it about AMI meters which provides large demand reduction and energy conservation potential?

A. AMI meters record both the amount and the timing of customer energy use. Utilities set the timing parameters, called intervals, used to track energy use over time. Must utilities set timing parameters in blocks of 5, 10, or 15 minutes. Knowledge of usage with this level of granularity relative to time can help educate consumers, as it helps them equate the use of certain loads (air conditioning, clothes dryers, etc.) to time-based energy records. Interval usage data can also enhance conservation through usage alerts, which notify consumers of high usage throughout a month, rather than having to wait for the receipt of a bill after the month is over.

Interval data can also be used to bill time-of-use rates designed to reduce coincident system peak demand. Once usage is associated with time intervals, electricity can be priced differently for different times. By offering rebates to customers who conserve during system peaks, for example, system peaks can be reduced. In Maryland, all electricity customers billed under the standard service offer have an opportunity to earn such rebates with no sign-ups required.

Interval data has been put to other good uses in retail choice markets like New Hampshire's. In Texas, ERCOT requires energy charges to each retail energy supplier to be settled by hour, based on market prices and the aggregated actual usage of all individual customers the competitive energy retailer serves. As one might imagine, holding each retailer economically responsible for its customers' use of energy during high-priced times has spurred lots of innovations. Retail

energy suppliers in Texas offer rate discounts for installing controllable thermostats, real-time pricing, and other innovations. In Ohio, regulators have established a policy that not only energy costs, but also capacity costs, be settled for retail energy suppliers (and, presumably, community choice aggregators) based on customer-specific interval usage data measured by AMI meters.[16] (ERCOT does not have a capacity market.)

Q. Can the AMR meters PSNH installed record energy usage by interval?

A. No.[17]

Q. So, until the AMR meters are replaced, no PSNH customer will be able to take advantage of interval data capabilities, energy conservation features, demand response rebates, or other market innovations such as those available in Maryland, Texas, or Ohio?

A. That is correct, and more than just unfortunate. Since 1996, New Hampshire state laws and policy, as well as rules and policies established by this Commission, have declared that electricity should be subject to market forces to as great an extent as possible. Through its failure to adopt industry standard AMI technology, PSNH

[16] *PowerForward: A Roadmap to Ohio's Energy Future.* Public Utilities Commission of Ohio. P. 32.
[17] Schedule PJA-7.

has effectively denied market innovation and animation in New Hampshire in clear and direct defiance of state law and policy. I will return to the subject of New Hampshire state law and policy related to energy later in this testimony.

Q. Is it your belief that PSNH intentionally installed meters which could not bill time-of-use rates to forestall such innovations?

A. Yes, and I offer two sets of direct evidence in support of this belief, as well as circumstantial evidence I'll describe in the next section of testimony. The first set of direct evidence which indicates PSNH used its metering technology choice to forestall innovations related to interval usage data is found in PSNH's 2013 Least Cost Integrated Resource Plan (LCIRP) proceeding. In a technical session on January 27, 2014, Russell Johnson, PSNH's Manager of System Planning and Strategy at the time, stated that meters were not part of the (LCIRP) planning process. OCA witness James Brennan testimony in that case cites the statement,[18] which was not challenged by PSNH in discovery or in hearings. PSNH attorney Matthew J. Fossum confirmed PSNH's intention to divorce distribution investment choices, like meters, from resource planning, stating at hearing: "I would want to make clear that PSNH's distribution and transmission planning is planning for distribution and transmission. It is not planning based on its

[18] NH OCA DE 13-177. Direct testimony of James Brennan. February 21, 2014. Page 14 at 1.

generation needs."[19] From this statement it is clear PSNH had no interest in using standard AMI meter capabilities to manage customer energy use or demand. In other words, PSNH made its decision about meter investment without regard to how the choice would affect the deployment of bill-reducing innovations – a determination that not only flies in the face of New Hampshire's LCIRP principles[20] but also has profound implications when the question is whether the Company made a prudent investment decision.

The second instance of direct evidence is a letter from PUC Staff (Thomas Frantz) to PSNH (Dan Comer) summarizing a meeting between the two on July 17, 2017. In the letter dated July 24, 2017, Mr. Frantz quoted from the meeting: "[Y]ou (referring to Mr. Comer) stated that it is a 'corporate decision' to not move to AMI."[21] I believe the 'corporate decision' to not move to AMI was motivated by an interest in forestalling market innovations available from interval usage data. I note that the 83 percent of the electric meters PSNH's affiliate installed in Connecticut and 87 percent of the electric meters PSNH's affiliate installed in Massachusetts are also unable to provide interval usage data.[22]

[19] NH PUC DE 13-177. Transcript of Hearings held on April 2, 2014. Page 60 at 21.
[20] As specified in RSA 378:38 and :39, the purpose of PUC review of utility least-cost integrated resource plans is to assess the extent to which the utility's capital deployment decisions are consistent with the state energy policy enshrined in RSA 378:37. Section 37 "declares that it shall be the energy policy of this state to meet the energy needs of the citizens and businesses of the state" – i.e., in the electric context, all of the costs reflected on a customer's electricity bill – "at the lowest reasonable cost" while, *inter alia*, "maximize[ing] the use of cost-effective energy efficiency and other demand side resources."
[21] Schedule PJA-8, at 8.
[22] Schedule PJA-9, unnamed table, at 2.

While this direct evidence appears to make clear that PSNH installed meters in 2013 with the express intention of forestalling market animation and innovations associated with interval usage data available from AMI meters, I will discuss circumstantial evidence in the next section of this testimony.

V. PSNH'S DECISION TO REPLACE METERS WITH OUTDATED TECHNOLOGY WAS BIASED AND CALCULATED TO FORESTALL INTERVAL USAGE DATA AVAILABILITY

Q. Why do you believe PSNH's decision to replace meters with outdated technology which could not provide interval data or bill time-varying rates was biased and calculated?

A. By 2013, when PSNH made the decision to install meters that could not provide interval usage data, it was clear that such data presented several types of economic harm to PSNH. For example, research indicates that the time-varying rates AMI meters make possible can reduce both system peak demand and energy use.[23] PSNH profits increase when the Company invests in the transmission and distribution infrastructure required to satisfy system peak demand, biasing the Company against time-varying rates and peak-time

[23] King C. and Delurey D. *Efficiency and Demand Response: Twins, Siblings, or Cousins?* Public Utilities Fortnightly. March, 2005.

rebate programs. PSNH profits decrease when energy sales volumes fall between rate cases, biasing the Company against the conservation potential offered by AMI meters.

By 2013, there was also evidence from other retail choice markets that AMI meter data was being used successfully by retail energy suppliers to increase their market shares. In Texas, as just one example, retail energy suppliers have used "Free Tuesdays" and "Free Saturdays" offers to grow market share. (Such rates cannot be offered without the interval usage data available from AMI meters.) Retailers in the Houston and Dallas/Fort Worth markets have been offering such rates since AMI meters were first installed by the electric distribution companies serving those markets (CenterPoint and Oncor, respectively) from 2008-2012. It is certainly possible, if not likely, that PSNH felt threatened by retail energy suppliers, and wanted to restrict their opportunities to grow market share at the expense of PSNH market share.

Events since 2013 have only increased PSNH's bias against AMI-related demand response and energy efficiency successes. I note the developments in New Hampshire's Energy Efficiency Resource Standard (EERS) programs as an example. As described in the Commission's Order approving the Settlement Agreement in DE 15-137, New Hampshire utilities can earn incentives, and compensation for lost revenues, based on the level of utilities' EERS program successes.[24] However, when demand response and conservation occur outside of such programs, as would be the case for time-varying rates and programs offered by retail energy suppliers, PSNH has no opportunity to earn incentives or lost revenue compensation.

[24] NH PUC DE 15-137. Order No. 25,932 dated August 2, 2016.

A second example is PSNH's response to Chapter 286 of the 2019 New Hampshire Laws (SB 284), a statute adopted by the General Court at the request of the OCA. SB 284 paves the way for the development of a statewide utility customer data platform, which will use the Green Button "Connect My Data" standard to give every utility customer in New Hampshire the ability to share granular usage data with non-utility providers of innovative energy services that would inevitably chip away at PSNH's business dominance. PSNH has made clear its intent to resist such an innovation, filing comments at the PUC in September stating that "having a single statewide repository for such information seems unnecessary and certainly presents challenges" whereas "having utilities retain the obligation to collect, store, and manage customer data . . . on an individual utility basis would be the better course."[25] At the risk of stating the obvious, the efficacy of such a data platform is reduced to the extent that New Hampshire's largest utility succeeds in perpetuating the absence of the kind of granular usage data that AMI meters produce.

Q. Did PSNH provide justifications for its decision to replace its meters with meters unable to provide the interval usage data required for time-varying rates and other market innovations you describe?

A. Yes, PSNH provides several justifications for replacing its meters with meters unable to provide interval usage data, which I'd like to address in turn. These include 1) that New Hampshire law requiring customer permission for smart meter gateway installation

[25] Joint Utility Comments filed by PSNH in NH PUC IR 15-296 (Investigation into Grid Modernization) on September 9, 2019 at 8.

effectively precluded AMI deployment; 2) that an AMI deployment would not have been cost-effective; and 3) that the communications network required for AMI would be difficult to design and operate given New Hampshire's mountainous topography.

Q. Describe the New Hampshire law requiring customer permission for smart meter gateway installation.

A. SB 266, passed in 2012, requires electric utilities to obtain customer permission before installing any smart meter gateway device. In the law, "smart meter gateway device" is defined as "any electric utility meter . . . which serves as a communications gateway or portal to electrical appliances, electrical equipment, or electrical devices within the end-user's residence or business, or which otherwise communicates with, monitors, or controls such electrical appliances, electrical equipment, or electrical devices".[26]

Q. How does PSNH suggest this law effectively precluded AMI installation?

A. PSNH contends that requiring customer permission to install AMI meters would have resulted in low adoption rates and higher costs. Higher costs would result from the need to maintain two metering systems, one for customers giving approval for gateway devices and one for customers for which such approval could not be obtained. While I agree with this contention in principle, I note that PSNH ignored a much simpler solution which would have allowed PSNH to comply with the law and avoid the requirement to secure

[26] RSA 374:62.I.(a).

customer permission while still deploying AMI meters on a universal basis. The simple solution is to purchase AMI meters without the technology required to communicate with customers' electrical appliances/equipment/devices, thereby making it impossible for such AMI meters to serve as gateway devices. The technology required to turn an AMI meter into a gateway device is offered as an extra-cost option by AMI meter manufactures. PSNH needed only to decline the extra-cost option for the gateway technology, which is generally a communications chip compliant with the ZigBee short-range wireless communications standard, to purchase AMI meters which would have been physically unable to perform the gateway function for which New Hampshire law requires customer permission. PSNH could have easily installed AMI meters without the gateway function to both comply with the law and avoid obtaining customer permission.

Q. Please address PSNH's claim that an AMI deployment would not have delivered benefits in excess of costs.

A. In discovery, PSNH provided cost estimates for the three meter replacement options it considered, as I noted earlier: 1) traditional meters featuring automated meter reading (AMR) functionality; 2) "Bridge" meters, which function as AMR meters but are upgradable to advanced metering infrastructure (AMI); and 3) a full AMI metering system (including a two-way wireless communications system). While the traditional meters featuring AMR functionality fared best in the comparison, an option not considered -- to retrofit existing meters with AMR modules -- would have eliminated physical meter reading operations at a lower cost. As I testified earlier, the absence of a viable option

from PSNH's decision-making process is a critical deficiency when assessing prudency. But there is another critical deficiency in PSNH's decision-making process: PSNH made no attempt to consider the potential benefits of an AMI deployment. For a fully-informed decision, PSNH should have considered the benefits and costs of each meter replacement option, selecting the one which delivered the highest level of customer benefit relative to customer costs. The potential benefits from AMI I described earlier, from demand response and conservation to market innovations likely from enhanced retail energy supplier cost assignment, are nowhere to be found in PSNH's decision-making process.

Q. Did PSNH explain why it failed to consider the potential benefits from AMI in its meter replacement decision?

A. Yes. In discovery, PSNH explained that it failed to consider the potential benefits from AMI for two reasons: 1) that the potential for time-varying rates to deliver value is low, as indicated by a study PSNH conducted in Massachusetts in 2012;[27] and 2) that PSNH would have had to make too many assumptions, making the results of any benefit estimates unreliable.[28]

Q. Do you believe these explanations to have merit?

A. No. In reviewing the 2012 study results, I noted that customers on time-of-use rates with a critical peak price feature reduced average peak period load by 15 percent, whereas

[27] Schedule PJA-2, at 5.
[28] Schedule PJA-10.

customers on the standard rate reduced their load by only half as much.[29] (The fact that both groups' load fell could be due to weather variation, but is beside the point, which is that customers on time-of-use rates do reduce their loads relative to those not on such rates). Customers with automated control of central air conditioning reduced demand by roughly 20-25 percent during critical peak price events.[30] I consider these impacts significant, particularly considering that 38 percent of PSNH's residential customers have central air conditioning.[31] The impacts are certainly large enough to merit quantification in any evaluation of a potential AMI deployment. Regarding the need to make assumptions, I note that this is the case in any benefit estimation exercise. Furthermore, the 2012 study provided information that could have been used to reduce variability in any assumptions PSNH would have made in estimating AMI benefits. Moving forward with a $38 million decision to install meters without industry-standard interval data capabilities, without at least considering the benefits that might have been available from such capabilities, is inexcusable.

Q. Did PSNH provide other evidence indicating that an AMI deployment would not have been cost-effective?

A. Yes. PSNH claims that an AMI deployment in New Hampshire would only be feasible if accompanied by AMI deployments in Connecticut and Massachusetts, citing IT system costs.[32] In its business case, PSNH estimated the IT costs of a "New Hampshire-only"

[29] Schedule PJA-11, at 5.
[30] *Id.*
[31] *Id.* at 7.
[32] Schedule PJA-2, at 5.

AMI deployment to be $25 million.[33] While I agree this is a significant number, it is impossible for PSNH to conclude that a New Hampshire-only AMI deployment would be infeasible if it hasn't quantified, let alone considered, the potential benefits of interval usage data made available by AMI meters. Further, I believe PSNH's claim reinforces my testimony that PSNH should not have replaced its meters at all, particularly with no evidence that such a replacement was needed. If faced with a situation in which a New Hampshire AMI deployment were only feasible when combined with similar deployments in Connecticut and Massachusetts – which PSNH has not proven – the prudent course of action would have been to avoid replacing New Hampshire meters at all, waiting until all three jurisdictions were ready. As I testified earlier, retrofitting AMR modules to existing meters would have delivered the benefits of physical meter reading elimination without replacing the meters at a much lower cost, with the added benefit of increased time available for rendering a more thoughtful decision on AMI meters as conditions in other Eversource jurisdictions developed.

Q. Your testimony appears to indicate that you would have preferred that PSNH had deployed AMI meters. However, your body of work has been consistently critical of utility AMI benefit-cost analyses. Please explain this apparent contradiction.

A. I am not in favor of, or against, AMI meters. I believe each AMI plan or deployment should stand on its own merits as objectively evaluated. I am against bias in AMI meter decisions, either for or against. It is true that, in multiple cases before regulators across

[33] Schedule PJA-1, at 4.

the US, I have argued that AMI deployment plans be rejected, or that AMI cost recovery be denied, due to a lack of demonstrated cost-effectiveness. My testimony generally claims that the benefits of an AMI deployment would be unlikely to deliver (in the case of deployment plans) or did not deliver (in the case of requested cost recovery) benefits to customers in excess of costs to customers. However, my testimony in these cases does not indicate a belief that AMI meters cannot in any circumstances deliver benefits in excess of costs. On the contrary, my public position on AMI has been clear and consistent, in my book, testimony, articles, and public presentations: AMI can deliver benefits in excess of costs in the right circumstances, and with concerted, post-deployment efforts by regulators, utilities, and customers. In every case in which I have recommended against approval of an AMI deployment plan or cost recovery, such recommendations were based on an absence of plans or actions required for AMI meters to deliver the level of customer benefits required to exceed customer costs.

Q. Have you submitted testimony in other jurisdictions in which you've indicated that a utility's AMI benefit-cost analysis was unduly pessimistic?

A. Yes. In a case in Massachusetts, I testified that Eversource's benefit-cost analysis of a full AMI deployment understated benefits and overstated costs,[34] making it unduly pessimistic. Eversource's Massachusetts AMI benefit-cost analysis appears consistent with a pattern of behavior in which Eversource affiliates actively forestalled interval usage data availability and its potential benefits through meter technology choices.

[34] Massachusetts DPU 15-122/123. Direct testimony of Paul Alvarez. March 10, 2017. Pages 10-17.

Q. What is your reaction to PSNH's claim that the development and operation of an AMI meter communications network would be difficult given New Hampshire's mountainous topography?

A. I think topography is a non-issue, for two reasons. First, I am familiar with AMI deployments in other mountainous areas, including the Sierra-Nevada Mountains, the Rocky Mountains, and the Appalachian Mountains. The communications network engineering discipline exists in large part to solve topographical challenges to wireless communications, and it does so very well. Second, there is no requirement for a utility to develop and operate its own communications network to implement AMI. Public networks, such as those available from AT&T and Verizon, are more than adequate to securely and reliably communicate data from meters to utilities, and have been used by non-profit utilities for that purpose for over a decade.

VI. PSNH'S DECISION TO REPLACE METERS WITH NON-STANDARD TECHNOLOGY HARMED CUSTOMERS AND MARKETS IN DEFIANCE OF NEW HAMPSHIRE LAW AND POLICY

Q. Why do you believe PSNH's decision to replace meters with non-standard technology harmed customers and markets in defiance of New Hampshire law and policy?

A. First, PSNH provides no evidence that the meters needed to be replaced. As I've testified, AMR retrofits are available for old meters to eliminate physical meter reading operations (PSNH's stated goal). So PSNH's decision to replace the meters harmed customers through unnecessary increases of rate base and rates. But PSNH added insult to injury by ensuring the new meters were unable to make interval usage data available. If PSNH were to replace its old meters at all, it should have replaced them with industry standard AMI meters offering interval usage data capabilities.

Q. How does the failure to offer interval usage data capabilities constitute a harm to customers?

A. As described in this testimony, interval usage data capabilities can enhance demand reduction and energy conservation capabilities and stimulate market innovations. By increasing the rate base by $38 million for meters which don't offer this potential, PSNH has effectively raised a barrier to such potential for a long time. Any future consideration of AMI will have to contend with a large existing metering asset, which would have to be abandoned to accommodate an AMI installation. Absent specific action by the Commission in the future, customers may one day be paying for two metering assets – those installed in 2013, and new AMI meters. This makes the cost-effectiveness of any future AMI deployment that much harder to achieve, and therefore less likely. Future consideration of AMI will also have to deal with the fact that manual meter reading expenses, which are a critical benefit in most AMI business cases, will

have already been eliminated, and cannot therefore be used to justify AMI costs. To me, any reduction in future flexibility constitutes a harm to customers.

Q. Why do you believe PSNH's decision to replace meters with those which do not have interval usage data capabilities to be in defiance of New Hampshire law and policy?

A. Since at least 1996, New Hampshire has enacted legislation and pursued policies intended to foster vibrant and competitive energy markets. The first line of electric utility restructuring legislation passed in 1996 states: "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."[35] The legislation cites Part II, Article 83 of the New Hampshire Constitution, which reads in relevant 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."[36] Though I am not an attorney, I infer from this that any action a monopoly takes to restrain competition could be interpreted as unlawful.

More recently and specifically, New Hampshire statewide energy plans, from the first one in 2002 to the most recent in 2018, describe the economic and environmental value to New Hampshire citizens of energy conservation and demand response. As I've testified, energy conservation and demand response potential is enhanced through the

[35] RSA 375-F:1.I.
[36] RSA 375-F:1.II.

interval usage data made available by AMI meters. The 2018 State Energy Strategy specifically endorses market innovation, stating: "New Hampshire stakeholders should seek to empower competitive wholesale electricity markets in order to protect New Hampshire energy infrastructure investments, incentivize low-cost energy, and guard against cost-raising policy impacts from neighboring states."[37] I believe PSNH's decision to install meters without industry-standard interval usage data capabilities stifles, rather than empowers, competitive electricity markets and market innovation.

VII. REVIEW AND RECOMMENDATIONS

Q. Please review your testimony.

A. This testimony provides support for several arguments relevant to PSNH's request for a return of and on its 2013 metering investment:

- PSNH has not demonstrated that meter replacement was required.
- While the meters PSNH installed eliminated manual meter reading, the technology deployed to do so was not the least cost available.
- If PSNH were to replace its meters, it should have used industry standard technology (advanced metering infrastructure) offering interval usage data.

[37] Ten-Year State Energy Strategy, Office of Strategic Initiatives (April, 2018) at 23.

- PSNH's decision to replace meters with non-standard technology was biased and calculated to forestall interval usage data availability.
- PSNH's decision to replace meters with non-standard technology harmed customers and markets in defiance of New Hampshire law and policy.

Q. Given this testimony, what are your recommendations to the Commission?

A. I recommend the Commission find that PSNH's investment in meters was imprudent. Further, I recommend the assets be removed from the rate base, and associated reductions to the requested revenue ordered. I believe an imprudence finding is justified due to the fact that meter replacement was 1) unnecessary; 2) not the least costly way to accomplish PSNH's goal (the elimination of physical meter reading operations); and 3) intended to forestall market innovations, harming consumers and defying New Hampshire law and policy. I refer the Commission to the testimony of OCA witness John LeFever for the exact amounts of rate base and revenue reductions associated with my recommendation.

Q. What are the benefits to New Hampshire if the Commission follows your recommendations?

A. In the short term, the State will benefit by avoiding unnecessary rate increases. Rate increases without corresponding value act as a drag on the New Hampshire economy, and are therefore to be discouraged. In the longer term, removing the assets from rate base provides future flexibility to install AMI meters. Without the albatross of a $38

million asset in rate base, the potential cost effectiveness of a future AMI investment will be enhanced, facilitating AMI deployment and the market innovations interval usage data will prompt. Finally, a finding of imprudence will put New Hampshire utilities on notice, serving as a stern communication from this Commission that investments in distribution grids and businesses which do not serve the interests of customers and the public, as stated in New Hampshire law and policy, are not acceptable.

Q. Does this conclude your testimony?

A. Yes, it does.