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DEPARTMENT OF PUBLIC UTILITIES

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Investigation by the Department of Public Utilities on its own Motion into Modernization of the Electric Grid.

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I. INTRODUCTION

With this Order, the Department launches a new energy future for Massachusetts. The modern electric system that we envision will be cleaner, more efficient and reliable, and will empower customers to manage and reduce their energy costs. The modern electric system will build on the Patrick Administration's progress towards our clean energy goals by maximizing the integration of solar, wind, and other local and renewable sources of power. It will minimize outages by automatically re-routing power when lines go down, and immediately alert the utility when customers have lost power. Because customers will have new tools and information to enable them to use less electricity when prices spike, the electric system will be appropriately sized and less expensive.

Very few decades ago, when we all used rotary phones, we could not have imagined smartphones. Similarly, it is difficult to imagine a world in which everyone plugs their electric cars into an electric grid powered by renewables, charging them when prices are low and feeding power back into the grid when prices are high—and getting paid for it. It is difficult to imagine a world in which we can take advantage of the latest technology to make our own electricity, thereby relieving pressure on the electric grid on the hottest days of the year—and saving everyone money. Like smartphones, the modern electric system will bring untold benefits to us all.

We cannot know today all the advances and technological breakthroughs that will occur in the electricity sector over the next decades. This Order establishes the platform and the incentives for utilities and other businesses to innovate and invest in new technology, to

continue to upgrade our current infrastructure, and to increase the use of renewable energy, electric cars, energy storage, and microgrids. Together with the companion Order we are issuing today on time varying rates (“TVR”) (D.P.U. 14-04), and an Order we will issue shortly on electric vehicles (“EVs”) (D.P.U. 13-182), this Order will minimize customers’ energy costs, protect the environment, and expand our economy.

II. EXECUTIVE SUMMARY

This Order requires each electric distribution company to submit a ten-year grid modernization plan (“GMP”) outlining how the company proposes to make measureable progress towards the following grid modernization objectives: (1) reducing the effects of outages; (2) optimizing demand, which includes reducing system and customer costs; (3) integrating distributed resources; and (4) improving workforce and asset management.

In their GMPs, companies must outline their timing and priorities for all their grid modernization planning and investment over the ten-year period. In addition, a company’s GMP must include a marketing, education, and outreach plan with a component that is common to all the companies, as well as a company-specific, local component; a research, development, and deployment plan; and proposed infrastructure and performance metrics to measure progress in achieving grid modernization objectives, including common statewide and also company-specific metrics. Because customer education, marketing, and outreach are crucial to enabling the successful implementation of grid modernization, companies’ marketing and outreach should begin early in the grid modernization process.

In its first GMP filing, a company also must include a five-year short-term investment plan (“STIP”), which applies only to a company’s capital investments. A company’s STIP must include an approach to achieving advanced metering functionality¹ within five years of the Department’s approval of the GMP. Capital investments included in the STIP must be supported by a comprehensive business case analysis. If the business case analysis does not justify deployment of advanced metering functionality within five years, the company may include an alternative proposal to achieve that functionality within a longer timeframe, together with a business case analysis that justifies the alternative. This is a departure from the Straw Proposal (D.P.U. 12-76-A), which required that a company’s GMP contain a plan to achieve advanced metering functionality within three years of the plan’s approval, with some provision for flexibility. The STIP may include a proposal for grid modernization capital investments other than those associated with advanced metering functionality, again including a business case analysis.²

Investments contained in the STIP, that is, capital investments made during the first five years of the GMP, are eligible for pre-authorization. Pre-authorization involves a review

¹ Advanced metering functionality is defined as: (1) the collection of customers’ interval usage data, in near real time, usable for settlement in the ISO-NE energy and ancillary services markets; (2) automated outage and restoration notification; (3) two-way communication between customers and the electric distribution company; and (4) with a customer’s permission, communication with and control of appliances.

² The STIP replaces what the Department referred to in the Straw Proposal as the comprehensive advanced metering plan (“CAMP”). The substitution of STIP for CAMP reflects the decision to make preferential regulatory treatment available to all grid modernization-related capital investments rather than just to investments associated with advanced metering functionality.

of the company's cost estimates for a project, such that the Department will not revisit in later filings whether the company should have proceeded with these investments. The Department will, however, review the prudence of the company's implementation of these investments.

In order to remove what may be impediments to some grid modernization investments, the Department concludes that a capital expenditure tracking mechanism should be available for *incremental* capital investments included in the STIP. The Department finds that this targeted cost recovery mechanism appropriately provides more favorable cost recovery for the companies and reduces their risk associated with grid modernization investments. The Order addresses, but rejects adoption of a future test year approach, observing that although there are credible arguments in its favor, its disadvantages predominate.

The STIP investments that are eligible for targeted cost recovery are those incremental capital investments made within five years of approval of a company's GMP *and* made for (1) advanced metering functionality or (2) other incremental grid modernization capital investments, but the latter only as part of a STIP that *also* addresses advanced metering functionality. In other words, targeted cost recovery will not be available for other investments if the company is not also investing in advanced metering functionality.

To be eligible for targeted cost recovery, although investments associated with advanced metering functionality must be made within five years, they need not be used and useful by the year for which cost recovery is sought. The Department recognizes that the deployment of advanced metering functionality could require significant investments that, for a variety of reasons, might not satisfy a strict application of the used and useful standard for

some time after the investment is made. If a company can demonstrate that this is the case, the Department will permit recovery via the targeted cost recovery mechanism. By contrast, investments made for grid modernization capital projects other than those associated with advanced metering functionality must be used and useful within the five-year period and by the year for which cost recovery is sought, pursuant to the Department's usual ratemaking policy.

In the Straw Proposal, the Department proposed requiring each electric distribution company to develop and submit its first GMP within six months of a final Order in this proceeding. However, the Order concludes that the companies need more than six months to develop and present meaningful GMPs, as well as further guidance from the Department regarding the implementation of TVR and how companies should present the business case for capital expenditures in their GMPs. By contrast, the Department determined that the companies' ability to file meaningful GMPs is not contingent on prior completion of our EV proceeding (D.P.U. 13-182) or resolution of issues related to cybersecurity, privacy, or access to meter data. We note that while resolution of these issues is not necessary for companies to file meaningful GMPs, the Department intends to address privacy, data access, and the use of aggregated interval data in more detail well before any wide-scale collection of interval data takes place.

Electric distribution companies must file their first GMPs within nine months of the later of (1) the Department's final Order in Time Varying Rates, D.P.U. 14-04; and (2) the Department's final directive to companies regarding the presentation of their GMP business cases for capital expenditures. Companies should ensure stakeholder input into their GMP

development. Once the companies file their GMPs, the Department will review each filing in a separate adjudicatory proceeding to ensure that each GMP is consistent with the Department's directives set forth in this Order.

III. SUMMARY OF PROCEEDINGS

On October 2, 2012, the Department of Public Utilities ("Department") issued a Notice of Investigation ("NOI") into the modernization of the electric grid. Modernization of the Electric Grid, D.P.U. 12-76 (2012). We hosted a workshop ("Workshop") the next month, attended by over 125 stakeholders, launching a collective effort to develop a vision of grid modernization. Following the Workshop, we created a stakeholder working group³ ("Working Group") to: (1) inform the Department's approach to grid modernization over the short, medium, and long terms; and (2) provide input on the sequence and pace of grid modernization infrastructure investments. From November 2012 through June 2013, stakeholders discussed a full range of issues relating to modernization of the grid.⁴ On July 2, 2013, the Working

³ Led by a facilitator, the Working Group's steering committee included 25 member organizations from consumer and environmental groups, the electric distribution companies, ISO New England Inc. ("ISO-NE"), the Department of Energy Resources ("DOER"), the Attorney General of the Commonwealth ("Attorney General"), competitive suppliers, and representatives from a wide range of clean energy companies and organizations, as well as ex officio members from the Department, the Massachusetts Executive Office of Energy and Environmental Affairs, and the Massachusetts Department of Telecommunications and Cable.

⁴ The Working Group process consisted of 14 all-day meetings and several conference calls in which participants shared knowledge and opinions on grid modernization topics and developed the Report. The process was supported by a public website to share ground rules, agendas, meeting summaries, presentations, working documents, and background/research materials at: <http://magrid.raabassociates.org/index.asp>.

Group submitted a report to the Department that contained information, principles, and recommendations on a wide array of grid modernization issues: “Report to the Department of Public Utilities from the Steering Committee,” D.P.U. 12-76 (“Report”). The Department solicited comments on the Report and, on December 23, 2013, issued an Order setting forth a two-part proposal for achieving grid modernization, Modernization of the Electric Grid, D.P.U. 12-76-A (2013) (“Straw Proposal”). The first component of the Straw Proposal was a directive to each electric distribution company to submit a GMP. The filing of a GMP was to be a new and recurring requirement for each electric distribution company, occurring no less often than every five years. The second component of the Straw Proposal involved addressing a number of grid modernization topics outside of this proceeding. These topics include: (1) TVR (also referred to as “dynamic pricing”); (2) cybersecurity, privacy, and access to meter data; and (3) EVs. The Department received initial comments in January 2014, conducted panel hearings on February 24, 25, 26, and 27, 2014, and received reply comments in March 2014.⁵

The Department is grateful for the dedication and insights of the Working Group members and other stakeholders. They have made an extraordinary contribution to this process.

IV. GOALS OF GRID MODERNIZATION

As we said in the Straw Proposal, grid modernization will empower customers to better manage their use of electricity and save money, and enhance the reliability of electricity

⁵ A summary of the comments is provided as Appendix 1 to this Order.

service in the face of increasingly extreme weather.⁶ Straw Proposal at 1. In the face of rising costs, we need ways to help customers minimize what they pay for electricity. In the face of potentially catastrophic climate change, we need a grid designed to maximize the integration of renewable power, much of which is intermittent.

The Patrick Administration has been at the forefront nationally of championing the development and deployment of clean energy resources.⁷ To quote Governor Patrick's University of Massachusetts Amherst commencement address on May 9, 2014:

[T]he time has come to set a new standard that ensures that, at every point in time, at every moment, we are getting the cleanest energy possible. It means energy efficiency first. It means zero-emission electricity next—solar, wind,

⁶ A recent federal study estimated that the average annual cost of weather-related outages nationally between 2003 and 2012 was between \$18 billion and \$33 billion. Executive Office of the President, *Economic Benefits of Increasing Electric Grid Resilience to Weather Outages* (August 2013), available at http://energy.gov/sites/prod/files/2013/08/f2/Grid%20Resiliency%20Report_FINAL.pdf.

⁷ See, e.g., An Act Relative to Green Communities, St. 2008, c. 169; An Act Relative to Competitively Priced Electricity in the Commonwealth, St. 2012, c. 209; An Act Establishing the Global Warming Solutions Act, St. 2008, c. 298, codified as G.L. c. 21N, § 3; Executive Office of Energy and Environmental Affairs, *Massachusetts Clean Energy and Climate Plan for 2020* (December 29, 2010) (“Massachusetts Clean Energy and Climate Plan for 2020”), available at <http://www.mass.gov/eea/docs/eea/energy/2020-clean-energy-plan.pdf>.

Pursuant to the Massachusetts Clean Energy and Climate Plan for 2020, the Commonwealth is *required* to reduce its greenhouse gas emissions relative to 1990 levels by at least 80 percent by 2050 and by 25 percent by 2020. The Administration also has a number of other clean energy goals, including the interconnection of 1,600 megawatts of solar resources by 2020 and 2,000 MW of wind resources by that same date. 225 C.M.R. § 14.00; Massachusetts Department of Energy Resources, *Wind Energy in Massachusetts: 2000 MW by 2020*, available at <http://www.mass.gov/eea/docs/doer/renewables/wind/wind-energy-ma-2020.pdf>.

and hydro. It means lower-emission electricity last—natural gas, an imperfect choice but best of the fossil fuels. And it means high-emissions sources never.⁸

Grid modernization is an important means for advancing the statutory requirements and policy goals of further development of energy efficiency, renewable energy resources, demand response, electricity storage, microgrids, and EVs.⁹ Straw Proposal at 1-2.

We adopt the Straw Proposal's definition of grid modernization as functions that fall within four broad objectives, and require the electric distribution companies to make measurable progress on all four of them: (1) reducing the effects of outages; (2) optimizing demand, which includes reducing system and customer costs; (3) integrating distributed resources; and (4) improving workforce and asset management. Straw Proposal at 10-11. The Straw Proposal also emphasized the centrality to a modern grid of advanced metering functionality, which we reiterate here and address in further detail below.

The Department recognizes that some aspects of grid modernization may not be under the direct control of the electric distribution companies. However, the companies bear responsibility for enabling achievement even of those to the maximum extent possible.

⁸ Governor Deval L. Patrick, University of Massachusetts Amherst Commencement Address (May 9, 2014), available at <http://www.mass.gov/governor/pressoffice/speeches/0509-governor-patrick-delivers-umass-amherst-commencement.html>.

⁹ The Massachusetts Global Warming Solutions Act 5-Year Progress Report at 46-47 (December 30, 2013), available at <http://www.mass.gov/eea/docs/eea/gwsa/ma-gwsa-5yr-progress-report-1-6-14.pdf> (identifying grid modernization as a “supplemental strategy” for meeting the 2020 greenhouse gas emissions reduction requirements).

A. The Four Objectives

1. Objective 1: Reducing the Effects of Outages

It is essential that electric distribution companies maximize their use of technologies to reduce outages and speed restoration, especially after major weather events. Companies should prioritize technologies that will: (1) make further progress in meeting the Department's service quality goals;¹⁰ (2) reduce the numbers and duration of outages due to extreme weather,¹¹ which are largely excluded from service quality metrics; and (3) enhance resiliency in the face of climate change.¹²

2. Objective 2: Optimizing Demand, Including Reducing System and Customer Costs

To ensure reliability, the electricity system must be built to meet peak demand, which typically occurs on a hot summer day. In fact, in 2013, more than a third of New England's

¹⁰ The Department is currently reviewing its service quality metrics in Service Quality Standards, D.P.U. 12-120. The service quality standards are designed to measure day-to-day performance rather than performance in extreme weather. See Service Quality Standards, D.T.E. 04-116-A at 10-11 (2006); Service Quality Standards, D.T.E. 99-84, Att. A at 7-8 (2000).

¹¹ Severe outage events, such as those caused by major storms, are evaluated pursuant to the Department's emergency response plan processes and are evaluated on a case-by-case basis.

¹² See, e.g., Executive Office of Energy and Environmental Affairs and the Climate Adaptation Advisory Committee, Massachusetts Climate Change Adaptation Report at 57 (September 2011), available at <http://www.mass.gov/eea/docs/eea/energy/cca/eea-climate-adaptation-report.pdf>; Press Release, Governor Deval L. Patrick, Governor Patrick Announces \$50M for Comprehensive Climate Change Preparedness Initiatives (January 14, 2014), available at <http://www.mass.gov/governor/pressoffice/pressreleases/2014/0114-climate-change-preparedness-investment.html>.

capacity existed just to make sure that we had power for ten percent of that year.¹³ This is eight times the capacity of New England's largest fossil-fueled power plant, Brayton Point. Ninety percent of the time we do not need this amount of capacity—but electricity customers are paying for it. The magnitude of this problem is exacerbated by the fact that most customers have electric rates that are flat, even though the cost of electricity fluctuates throughout the day and year and is much higher when demand is high.

Through mechanisms such as TVR and, with customers' permission, monitoring and control of customer appliances or equipment, a modernized grid will facilitate the reduction of peak demand by allowing retail customers to respond to price signals, as they currently do for airline tickets, hotel reservations, and other purchases. Empowered to shift their demand to off-peak periods, customers will be able to decrease their bills by avoiding the use of electricity when it is most expensive. In so doing, customers will decrease both their own electricity bills and even the bills of others who did not shift their load, by reducing the need for new generation, transmission, and distribution investments.

In addition to opportunities at customers' premises, there are also technology-based demand optimization opportunities on the distribution grid itself. A primary example of this is

¹³ See ISO New England Inc, ISO New England CELT Report, 2013-2022 Forecast Report of Capacity, Energy, Loads, and Transmission at 1.1.1-1.2.1 (May 1, 2013), available at http://www.iso-ne.com/trans/celt/report/2013/2013_celt_report.pdf; ISO New England Inc, ISO New England – Hourly Zonal Information, 2013 SMD Hourly Data, at sheet ISONE CA (May 6, 2014), available at http://www.iso-ne.com/markets/hstdata/znl_info/hourly/2013_smd_hourly.xls.

volt-VAR optimization ("VVO"),¹⁴ which increases grid efficiency and reliability, reduces distribution losses, and reduces the amount of energy demand and consumption by regulating the flow of power in the distribution system.¹⁵ VVO has the potential to provide significant benefits for customers by reducing the need for generation and, therefore, lowering costs and reducing pollution. Therefore, we expect VVO technologies to be a critical part of the distribution companies' plans for grid modernization.

3. Objective 3: Integrating Distributed Resources

Integrating distributed resources, such as renewables, EVs, microgrids, and storage, is key to achieving the Commonwealth's climate and resiliency goals and statutory requirements. Distributed resources contribute to the diversity of generation on the grid, thereby increasing its reliability. Further, grid modernization investments, including in VVO and other technologies, effectively address system imbalances caused by intermittent resources. Grid

¹⁴ According to the Report at 15, volt-VAR optimization is the term for technology that measures voltage and power factor on the electric distribution system and corrects imbalances.

¹⁵ See, e.g., Advanced Energy Economy, Advanced Energy Technologies for Greenhouse Gas Reductions, 40 Solutions for Cutting Carbon Emissions from Electricity Generation (2014), available at <http://info.aee.net/epa-advanced-energy-tech-report>; U.S. Department of Energy, Application of Automated Controls for Voltage and Reactive Power Management—Initial Results (December 2012) ("DOE Report"), available at <http://www.smartgrid.gov/sites/default/files/doc/files/VVO%20Report%20-%20Final.pdf>.

modernization will enable the safe interconnection and full integration of greater quantities of intermittent distributed resources.¹⁶

4. Objective 4: Improving Workforce and Asset Management

The efficient management of an electric distribution company's workforce and assets is another important objective of grid modernization. Grid modernization can provide substantial benefits in this area, such as reduced costs of operations and maintenance and more effective deployment of resources for storm response and other outage events. We anticipate that companies will continually improve their operational efficiency and will use all available resources to that end. We recognize that most progress related to this objective is likely to result from efforts towards meeting the first three objectives described above.

B. Advanced Metering Functionality

In our Straw Proposal, the Department characterized advanced metering functionality as the basic technology platform for grid modernization and required the electric distribution companies to achieve seven associated identified functionalities. Straw Proposal at 11-13. Advanced metering functionality includes two-way communication between customers and distribution companies, enables a more flexible and reliable grid with attendant cost savings,

¹⁶ The Interstate Renewable Energy Council ("IREC") and DOER proposed mapping and proactive system planning as a means of promoting the integration of distributed resources at sites where interconnection costs may be relatively low or where distributed resources can provide the greatest benefit to the electric distribution system (IREC Comments at 9-10; DOER Reply Comments at 2-3). DOER intends to begin this process with electric distribution companies on a voluntary basis (DOER Reply Comments at 2-3). The Department supports this initiative, and directs the electric distribution companies to participate in the process with DOER.

and provides customers with the ability to make informed decisions about energy use and adopt cost-saving technologies and services. We continue to view advanced metering functionality as the basic technology platform for grid modernization. We conclude that it will further all four of our grid modernization objectives and that it should be a priority area for investment in the companies' GMPs. Moreover, it continues to be the Department's position that our role is to determine an appropriate level of functionality, rather than to specify advanced metering infrastructure ("AMI") or some other technology or suite of technologies.

However, we are persuaded to revise our definition of advanced metering functionality. First, though the Department still views VVO as an important component of GMPs, we are persuaded to remove two related functions—VVO and measurement of customers' power quality and voltage—from our definition of advanced metering functionality, since VVO can be instituted independent of advanced metering functionality (Tr. 1, at 114-118).¹⁷

Second, one particular metering functionality—remote connect/disconnect—may not be cost effective in Massachusetts given the state's consumer protections and other policies (Tr. 1, at 96-98). Specifically, according to the Department's regulations, a representative of a company must physically visit a residential customer prior to termination for non-payment. 220 C.M.R. § 25.03(7). In addition, some electric distribution companies in Massachusetts do not turn off electric service when a customer cancels service, instead leaving it on for the

¹⁷ In our Straw Proposal we refer to conservation voltage reduction ("CVR") as one of the required advanced metering functionalities. Straw Proposal at 11. CVR is a voltage management tool and references here to VVO include, but are not limited to, CVR.

convenience of the next customer at that location (Tr. 1, at 96-97). Therefore, if an electric distribution company finds that the remote connect/disconnect function would require additional investment without benefits to justify the costs, the company may propose not to deploy this functionality, provided the company includes an analysis of the costs and benefits of its decision in its GMP. We emphasize strongly that the Commonwealth is absolutely committed to current consumer protection policies, and we will sanction no degradation of those policies.

Therefore, we revise our definition of advanced metering functionality as: (1) the collection of customers' interval usage data, in near real time, usable for settlement in the ISO-NE energy and ancillary services markets; (2) automated outage and restoration notification; (3) two-way communication between customers and the electric distribution company; and (4) with a customer's permission, communication with and control of appliances.

V. THE GRID MODERNIZATION PLAN

As we said in the Straw Proposal, each electric distribution company must submit a GMP with a ten-year strategic plan outlining how it proposes to make measureable progress towards the four grid modernization objectives identified above, with proposed timing and prioritization of activities. Straw Proposal at 16. The GMP is the company's roadmap for grid modernization, covering *all* grid modernization planning and investment, not only investments that are incremental, and not limited to capital investments.

In the Straw Proposal, we indicated that certain types of preferential regulatory treatment would be available for grid modernization investments, but only for those investments designed to achieve advanced metering functionality. Straw Proposal at 18. We have been persuaded by stakeholders' comments to change that approach, and to make preferential treatment available to all grid modernization-related *capital* investments. We discuss below the nature of that treatment and the circumstances under which it will be available. We agree with stakeholders that our initial framing could unduly limit companies' flexibility and lead to an approach that is too narrowly focused on metering.

Although the GMP covers ten years, we require each company to include in its initial GMP a five-year short-term investment plan ("STIP"),¹⁸ which we discuss below. In addition to the STIP, a company's GMP must cover its grid modernization planning for the entire ten years, including a marketing, education, and outreach plan; a research, development, and deployment ("RD&D") plan; and proposed infrastructure and performance metrics to measure progress in achieving grid modernization objectives. We discuss these elements of a GMP in greater detail in the sections that follow.

¹⁸ The STIP replaces what we referred to in the Straw Proposal as the comprehensive advanced metering plan ("CAMP"). The substitution of STIP for CAMP reflects our decision to make preferential treatment available to all grid modernization-related capital investments rather than just to investments associated with advanced metering functionality, as discussed above.

A. The Short-Term Investment Plan (“STIP”)

1. Business Case Analysis

As we have said, the GMP covers *all* grid modernization planning and investments for a ten-year period, while the STIP applies only to a company’s *capital* investments for the first five years of its GMP. Capital investments included in the STIP must be supported by a comprehensive business case analysis. The business case analysis should include: (1) a detailed description of the proposed investments, including scope and schedule; (2) the rationale and business drivers for the proposed investments; (3) identification and quantification of all quantifiable benefits and costs associated with the STIP; and (4) identification of all difficult to quantify or unquantifiable benefits and costs.¹⁹ When evaluating a STIP, the Department intends to look to the distribution company’s business case analysis as the primary lens for deciding whether to accept, reject, or require modifications to the STIP.

A company’s STIP must include an approach to achieving advanced metering functionality within five years of the Department’s approval of the GMP. If the business case analysis does not justify deployment of advanced metering functionality within five years, the company also may include an alternative proposal that would achieve that functionality within a longer timeframe, together with a business case analysis that justifies the alternative. The company must provide sufficient information to allow for an adequate comparison of the plans. This is also a departure from the Straw Proposal, in which we required that a company’s GMP

¹⁹ See Report at 80.

contain a plan to achieve advanced metering functionality within three years of the plan's approval. Straw Proposal at 12-13. Stakeholders have persuaded us that the longer period is appropriate, in light of the magnitude of the enterprise.²⁰

Additionally, the STIP, including the required business case analysis, may include a proposal for grid modernization capital investments other than those associated with advanced metering functionality. As we have mentioned, this is a departure from the Straw Proposal.

The Department has initiated a benefit-cost analysis working group, whose deliberations are on-going. Modernization of the Electric Grid, D.P.U. 12-76, Hearing Officer Memorandum (February 21, 2014). That group is considering the stakeholders' comments related to the business case analysis, including but not limited to the benefit-cost framework; the treatment of undepreciated investments; common assumptions; and the role and details of possible sensitivity analyses. For that reason, we will not elaborate further on the business case analysis at this point. However, recognizing that the electric distribution companies make investment decisions by reference to a range of priorities and evaluation frameworks, we emphasize that the benefit-cost framework is only one aspect of the business case analysis.

²⁰ We note that the actual date for achieving advanced metering functionality will be significantly longer than five years, due to: (1) the nine-month time period for GMP development (discussed in Section VIII.A, below); (2) the time required for interim steps before the nine-month timeline is triggered (*i.e.*, completion of the Department's benefit-cost analysis working group and issuance of a final Order in the TVR proceeding, as discussed in Section VIII.A); and (3) the time required to review and adjudicate GMPs.

2. Cost Recovery

a. Pre-authorization

Investments contained in the STIP, that is, capital investments to be made during the first five years of the GMP, are eligible for pre-authorization. Pre-authorization involves a review of the company's proposed investments and cost estimates, as supported by the business case. Department pre-authorization means that the Department will not revisit whether the company should have proceeded with these investments. The Department will, however, review the prudence of the company's implementation of these investments. We discuss the Department's prudence standard in the section on the targeted cost recovery mechanism, below.

b. Targeted Cost Recovery—Eligibility

While we continue to believe that grid modernization investments should become a company's normal business practice, as in the Straw Proposal we find that some type of targeted cost recovery should be available for grid modernization investments included in a company's STIP. We are concerned that, under conventional cost-of-service ratemaking, electric distribution companies may not have the proper incentives for making investments to attain our grid modernization objectives. We are persuaded that short-term targeted cost recovery treatment is required to remove impediments to some grid modernization investments.

Only investments that are *incremental* relative to a company's current investment practices and that are eligible for pre-authorization will be eligible for targeted cost recovery. By "incremental" we mean either new types of technology or the level of investment a

company proposes relative to its current investment practices. In other words, such investments may be treated as incremental if they accelerate progress in achieving the grid modernization objectives. We recognize that applying the standard of “incremental” may be challenging, but conclude, on balance, that this approach is appropriate.

We emphasize that to be eligible for targeted cost recovery, investments must be made within five years of approval of a company’s GMP. Thus, if the Department approves an alternative proposal to achieve advanced metering functionality within a longer timeframe, only investments made for that purpose during the first five years will be eligible for targeted cost recovery.

Additionally, the investment must be made for (1) advanced metering functionality or (2) other incremental grid modernization capital investments, but the latter only as part of a STIP that *also* addresses advanced metering functionality. In other words, targeted cost recovery will not be available for other capital investments if the company is not also investing in advanced metering functionality.

c. Future Test Year

It is well established Department precedent that base rate filings are based on an historic test year. See Eastern Edison Company, D.P.U. 1580, at 13-17, 19 (1984); Massachusetts Electric Company, D.P.U. 136, at 3 (1980). This approach is based on the theory that the revenue, expense, and rate base figures during a recent year, adjusted for known and measurable changes, provide the most reasonable representation of an electric

distribution company's present financial situation, and fairly represent its cost to provide service.

The Department has struggled long and hard in this proceeding with the question of whether to depart from our historic practice and adopt a cost recovery mechanism embedded within future test year ratemaking, as urged by some stakeholders. We decline to do so at this time, although we acknowledge credible arguments in favor of a future test year. Among other reasons, we are concerned that ratemaking based on a future test year would involve uncertain projections, thereby exposing ratepayers to unwarranted risk.²¹ We are also concerned about the time and resources needed to litigate all projected costs and revenue, as well as the forecasting methods used to determine such projections. Rate Structures that will Promote Efficient Deployment of Demand Resources, D.P.U. 07-50-A at 51 (2008). Furthermore, use of projected spending results in an information imbalance and imposes a burden on the Department as well as on parties to a rate proceeding. Without micromanagement of a company's day-to-day management decisions, the Department would be challenged in evaluating whether prospective company investment estimates were appropriate and sufficiently focused on cost containment.

Finally, a shift to future test year ratemaking would require a prolonged adjustment period for all concerned. Although we can see the appeal of making multiple significant

²¹ See, e.g., Rate Structures that will Promote Efficient Deployment of Demand Resources, D.P.U. 07-50-A at 52 (2008); Boston Gas Company, D.P.U. 18264, at 2 (1975); New England Telephone & Telegraph Company, D.P.U. 18210, at 2-3 (1975).

changes at one time, we opt, instead, for adopting the grid modernization changes outlined herein without moving to a future test year.

d. Recovery through Capital Expenditure Tracker Mechanism

As we have said, we are persuaded that some form of targeted cost recovery treatment is appropriate to eliminate barriers to grid modernization. We find that a capital expenditure tracker mechanism is the appropriate means for companies to recover eligible STIP investments. The fundamental purpose of a capital tracker is to provide a company with more timely recovery of costs associated with capital expenditures than would be available through our typical ratemaking practice. See, e.g., Massachusetts Electric Company/Nantucket Electric Company, D.P.U. 09-39, at 81-84 (2009); D.P.U. 07-50-A at 49-50; Boston Edison Company/Cambridge Electric Light Company/Commonwealth Electric Company/NSTAR Gas Company, D.T.E. 05-85, at 10 (2005). Capital trackers have been used in the past to recover through rates the revenue requirement associated with a company's capital projects.²² We conclude that this mechanism is appropriate in that it provides more advantageous cost recovery for companies and reduces a company's risk associated with grid modernization investments, while avoiding the adoption of a ratemaking approach—that is, a future test year—that in our view brings with it significant disadvantages.

To recover expenditures through the tracker mechanism, STIP capital investment must:

(1) be pre-authorized by the Department; (2) meet the criteria outlined in Section V.A.2.b

²² See, e.g., Boston Gas Company/Essex Gas Company/Colonial Gas Company, D.P.U. 10-55, at 119-120 (2010); Bay State Gas Company, D.P.U. 09-30, at 133 (2009).

above; (3) be incremental to costs recovered in base rates;²³ and (4) be prudently incurred.

See, e.g., NSTAR Electric Company, D.P.U. 10-163-B/11-92-A at 9-10 (2012);

D.P.U. 09-39, at 84; NSTAR Electric Company, D.P.U. 09-33, at 66-68 (2010).

Regarding the third requirement, that costs must be incremental to those recovered in base rates to be recovered in a capital tracker, the Department recognizes that companies will likely find it necessary to expand their workforce in order to install and implement capital investments, and that a portion of the associated expenses would be capitalizable under standard Department practice. See Aquarion Water Company of Massachusetts, D.P.U. 11-43, at 31-32 (2012); Nantucket Electric Company, D.P.U. 88-161/88-168, at 63-64 (1989); Reclassification of Accounts of Gas and Electric Companies, D.P.U. 4240, Introductory Letter (May 19, 1941) (Plant Investment—General Equipment Note 9). We note that, because a representative level of labor costs is already included in base rates, capitalized STIP costs based upon labor costs associated with the STIP could allow a company to recover a portion of those costs more than once, which is prohibited by ratemaking principles. D.T.E./D.P.U. 06-82-A at 39-40; see D.P.U. 09-33, at 66-68. This rationale applies with equal force to non-labor STIP costs that are already being recovered in base rates, such as materials and fleet costs. D.T.E./D.P.U. 06-82-A at 40. Companies will be required to demonstrate that such costs are not already included in rates. See, e.g., D.P.U. 10-55, at 74-76, 142-143; D.P.U. 09-33, at 66.

²³ Boston Edison Company/Cambridge Electric Light Company/Commonwealth Electric Company, D.T.E./D.P.U. 06-82-A at 38 & n.38 (2010).

Regarding the fourth requirement, prudence, the company will bear the burden of demonstrating that all of the costs it seeks to recover through its tracker were undertaken in a prudent manner. The Department's standard of review on prudence involves a determination of whether the company's actions, based on all that it knew or should have known at that time, were reasonable and prudent in light of the existing circumstances. Such a determination may not properly be made on the basis of hindsight judgments, and it is not appropriate for the Department to substitute its own judgment for the judgments made by the management of the company. Attorney General v. Department of Public Utilities, 390 Mass. 208, 229 (1983).

To the extent that actual costs materially exceed the company's estimates, the company will need to demonstrate that the cost increases were outside of its control. We expect the company to apprise the Department before making commitments to proceed with an investment if the company determines that costs are likely to materially exceed the estimates presented in the STIP. See, e.g., Massachusetts Electric Company/Nantucket Electric Company/Boston Gas Company/Essex Gas Company, D.P.U. 09-38, at 26 (2009).

Typically, the Department applies a standard of "used and useful" to determine whether a plant investment is appropriately included in rate base, and evaluates whether the plant is in service and is providing net economic benefits to ratepayers. Western Massachusetts Electric Company, D.P.U. 85-270, at 60-107 (1986). For grid modernization capital projects other than those associated with advanced metering functionality, this standard will continue to apply. That is, the investment must be made and used and useful by the year for which cost recovery is sought within the five-year period. However, for investments associated with

advanced metering functionality, the investment must still be made within the five-year period, but need not be used and useful by the year for which cost recovery is sought. We believe that this distinction is warranted because the deployment of advanced metering functionality could require significant investments that, for a variety of reasons, might not satisfy a strict application of the used and useful standard for some time after the investment is made. If a company can demonstrate that this is the case, the Department will permit recovery via the targeted cost recovery mechanism if the investment qualifies as construction work in progress (“CWIP”).^{24,25}

Finally, we caution companies that failure to provide clear, cohesive, and reviewable evidence increases the risk that the Department will disallow the expenditures in question.

Massachusetts Electric Company, D.P.U. 95-40, at 7 (1995); Boston Gas Company, D.P.U. 93-60, at 26-27 (1993); The Berkshire Gas Company, D.P.U. 92-210, at 24 (1993).

The Department emphasizes the importance of developing and maintaining systematic, ample, and contemporaneous documentation of all projects included in a STIP.

²⁴ The capital expenditure tracking mechanism will reconcile annually and end with the conclusion of a company’s STIP. After conclusion of the STIP, STIP investments may be eligible for entry into rate base following a company’s next distribution base rate filing, contingent upon Department approval. All investments must be deemed used and useful prior to inclusion in rate base, except as provided in this Order. See Boston Gas Company, D.P.U. 93-60, at 38-39, 40 n.14 (1993); Bay State Gas Company, D.P.U. 92-111, at 67-69 (1992); D.P.U. 85-270, at 20.

²⁵ To the extent that a company seeks to include CWIP in the targeted cost recovery mechanism, the company will not accrue any allowances for funds used during construction on these CWIP balances.

B. Marketing, Education, and Outreach Plan

In the Straw Proposal, the Department noted that the successful implementation of grid modernization will require fundamental changes in the relationship between the companies and their customers, because customer participation is necessary to realize many of the benefits of grid modernization. Straw Proposal at 19. Marketing, education, and outreach are vital to ensuring that customers are well informed about and engaged in: (1) their options for managing their energy consumption; (2) the tools and technologies that will assist them; and (3) the benefits associated with reductions in consumption and/or shifting consumption away from high-cost times. Straw Proposal at 19-20.²⁶

Illustrating customers' current lack of engagement, commenters referenced a report indicating that residential customers typically spend about nine minutes per year engaged in some fashion with their electric company (Tr. 4, at 837-838; Northeast Utilities Reply Comments at 5). Regardless of whether the exact number is correct, we emphasize that customer education, marketing, and outreach are absolutely crucial to enabling the successful implementation of grid modernization, and should begin early in the grid modernization process. Each electric distribution company should include a marketing, education, and outreach plan in its GMP, with a timeline and strategies, for educating customers and motivating them to become full participants in grid modernization.

²⁶ See, e.g., Massachusetts Electric Company/Nantucket Electric Company, D.P.U. 11-129, at 73-74 (2012).

Each company's plan should consist of a component that is common to all of the companies as well as a company-specific, local component. The common component should reflect a collaborative effort resulting in a uniform approach for all the electric distribution companies. The GMPs should include the companies' plans for cooperatively marketing and educating customers about grid modernization. Recognizing that we are at the outset of a multi-year process, this component should include a timeline setting forth milestones. We note that the companies' cooperative, statewide marketing campaigns for energy efficiency programs provide a useful model, and we direct the companies to consider best practices from this experience in developing the statewide plan.

The company-specific, local component should reflect each company's relative starting point in the grid modernization process. Although the particulars of each company's local component will vary, we encourage the companies also to collaborate in developing their individual plans in order to promote maximum uniformity. Consistent with its uniform counterpart, the local component should include a timeline describing expected major marketing, education, and outreach milestones.

C. Process for Adoption of New Technologies

In the Straw Proposal, the Department noted that a modernized grid depends upon continuous, measureable progress in the adoption of new technologies and technology-related processes. Straw Proposal at 32. Accordingly, we solicited input on: (1) the electric distribution companies' current research and development ("R&D") budgets, activities, and projects; and (2) the Department's role in facilitating the adoption of new technologies. Straw

Proposal at 32-33. Additionally, we requested comment on how the Department might facilitate R&D investments by the companies through a structured investment, R&D, and piloting strategy. Straw Proposal at 32-33.

In order to facilitate the deployment of new technologies, the Department requires the electric distribution companies, as a part of their GMPs, to propose research, development, and deployment (“RD&D”) efforts that focus on the testing, piloting, and deployment of new and emerging technologies to meet our four grid modernization objectives. We decline to provide specific direction as to the nature of these efforts, either as to the type or level of effort, which is more appropriately determined by company management. However, each electric distribution company should propose a portfolio of projects that could include, but is not limited to smart inverter systems, energy storage, vehicle-to-grid, and software and hardware tools that optimize system planning and management. Further, we direct the electric distribution companies to participate as appropriate in relevant state and regional efforts to advance such technologies. We expect that this approach will lead to a significant increase in RD&D efforts for new technologies relative to current efforts and, as a result, considerable benefits to ratepayers.

In their proposals to address RD&D within the GMPs, the electric distribution companies may propose an additional funding mechanism to support increased RD&D activities. We expect that the electric distribution companies will seek to leverage outside

funding, in addition to ratepayer funding, to support these projects.²⁷ In their proposals, the companies should specify: (1) the proposed funding mechanism; (2) the proposed funding level; (3) a process among the companies for collaborative learning, both from each other and more broadly; and (4) a decision-making process that outlines how the companies will conduct RD&D and identify promising new technologies. We will review these proposals as part of our review of the companies' GMPs.

If a company's RD&D proposal is approved, in subsequent GMPs the company should report on progress, including: (1) levels of ratepayer and other funding; (2) the status of RD&D efforts; (3) results from RD&D projects, including potential larger deployments of piloted technologies; and (4) lessons from collaborative efforts. We stress our view that collaboration among the state's electric distribution companies and other stakeholders should inform the companies' efforts.

We observe that some RD&D efforts will fail to produce results, or may indicate that other pathways are more appropriate. In those situations we will not deny cost recovery merely because of a lack of success, and recognize that the Department's "used and useful" standard does not apply to such efforts. However, electric distribution companies must, of course, prudently manage RD&D efforts.

Finally, we recognize that the Department has not supported RD&D types of proposals in the past. D.P.U. 10-55, at 154-158; Boston Gas Company, D.T.E. 03-40, at 428-430

²⁷ Outside funding could potentially come from the Commonwealth's other energy agencies, the federal government, other private industry, and regional, national, and international research organizations.

(2003). Distribution company RD&D proposals should address the concerns raised by the Department in earlier cases, while recognizing that attaining the benefits of the modern grid may require reconsideration of our precedent.

D. Metrics

In the Straw Proposal, the Department emphasized the importance of targeted, well designed metrics to enable evaluation of an electric distribution company's implementation of its GMP and progress towards the four grid modernization objectives. Straw Proposal at 29. Thus, the Department proposed that each electric distribution company develop and propose metrics tied to the company's GMP goals.

In order to measure a company's progress during the ten-year GMP implementation period toward the Department's grid modernization objectives, the Department directs each company to develop and propose in its GMP a robust set of company-specific metrics. Each electric distribution company must propose two types of company-specific metrics:

(1) infrastructure metrics that track the implementation of grid modernization technologies and systems; and (2) performance metrics that measure progress towards the objectives of grid modernization. Straw Proposal at 29-30.

In addition to the company-specific metrics, we direct the electric distribution companies to jointly propose a common list of statewide metrics. Each company must include the statewide metrics in its GMP. To assist in the timely development of statewide metrics, the Department provides the following illustrative list of possible (but not exhaustive) statewide

metrics (see Table 1) for the companies to review and refine, several of which were proposed by electric distribution companies.

Table 1. List of Statewide Metrics

Grid Modernization Objectives	Statewide Metrics
Reducing the effects of outages ²⁸	<ol style="list-style-type: none"> 1. Total number of customer outage minutes avoided as a result of GMP investments (duration) at system or circuit level 2. Total number of customer interruptions avoided as a result of GMP investments (frequency) at system or circuit level
Optimizing demand, including reducing system and customer costs	<ol style="list-style-type: none"> 1. System peak demand 2. Reduction in peak demand from GMP investments 3. System load factor and load factor by region and by customer rate class 4. Reductions in system line losses (for transmission and distribution) from GMP investments 5. Total number and percent of customers on TVR (company administered or other) 6. Total number and percent of customers using web-based portal to access energy usage information or to enroll in energy information

²⁸ The Department acknowledges our existing service quality metrics that measure reliability (including outages), safety, and customer satisfaction, and notes that we are in the process of updating these metrics. D.P.U. 12-120; Service Quality Standards, D.T.E. 04-116-C (2007); Service Quality Standards, D.T.E. 99-84 (2000). In this table, we propose two GMP-specific statewide outage metrics.

	<p>programs (company administered or other)</p> <p>7. Total number of successful (verified) peak shaving attempts and reductions in peak demand by customers during a given peak event</p>
<p>Integrating distributed resources</p>	<p>1. Total number of grid-connected distributed generation facilities, nameplate capacity and estimated output of each unit, and type of customer-owned or operated units²⁹</p> <p>2. Baseline distributed generation hosting capacity that companies can accommodate at each circuit and at the system level</p> <p>3. Incremental increase in hosting capacity as a result of GMP investments</p>
<p>Improving workforce and asset management</p>	<p>1. Total number of sensors in distribution system (<u>e.g.</u>, voltage or current)</p> <p>2. Total number and percent of distribution system circuits/ feeders equipped with automation or remote control equipment</p> <p>3. Total number and percent of substations equipped with automation or remote control equipment, including supervisory control and data acquisition (<u>i.e.</u>, SCADA) systems</p>

In its GMP, each electric distribution company should include a description of the process it used to develop both the company-specific and statewide metrics, the common

²⁹ Data for this metric are currently collected under 220 C.M.R. § 8.00, which governs the rates, terms, and conditions of sales of electricity by qualifying facilities and on-site generating facilities to electric distribution companies.

definitions and formulas employed, and an explanation of how each metric relates to the grid modernization objectives.

While some metrics may measure outcomes that are beyond a company's complete control, it is important for companies to collect this information to determine benefits, understand consumer behavior, measure the success of company efforts in a number of respects, and gauge the ability of electric distribution companies to successfully integrate third-party facilities into their systems. Also, as we have said, although we recognize that some aspects of grid modernization may not be under the direct control of the electric distribution companies, they bear responsibility for enabling achievement of those objectives to the maximum extent possible. Therefore, when developing metrics to measure progress towards meeting grid modernization objectives, companies should include metrics that measure outcomes that may not be within the companies' complete control. Further, the Department directs the electric distribution companies to develop metrics for grid modernization goals that are not easily quantified, such as improving customer satisfaction, in order to account for these benefits.

Additionally, we direct each electric distribution company to solicit stakeholder input in developing both the statewide and company-specific metrics. Specifically, a company must: (1) establish a clear and effective process to solicit stakeholder input during metrics development; (2) clearly communicate this process to stakeholders; and (3) include in its GMP a summary of the solicitation process, the stakeholder input provided, and the integration of

stakeholder input into the company's metrics. Stakeholders also will have the opportunity to comment on the proposed metrics during individual company GMP proceedings.

Consistent with the Straw Proposal, the Department finds that, for now, the purpose of GMP metrics will be to record and report information, and that the metrics will not at present be tied to incentives or penalties. Straw Proposal at 29. In our review of the GMPs, the Department will determine next steps in the further development of metrics and the reporting of progress towards the achievement of metrics.

VI. CYBERSECURITY, PRIVACY, AND METER DATA ACCESS

As we make further advancements in modernizing the electric grid, we cannot lose sight of critical issues that must be addressed to help ensure that the security of the electric system and the privacy of customer information are maintained. The Department recognizes that customers will need to have a high level of confidence in the security of the system and their individual data before they will engage in, and thereby benefit from, the opportunities presented by a modernized grid. To that end, the Department emphasizes that cybersecurity is a critical component of grid modernization and that electric distribution companies must continually assess and upgrade their defenses against cyberattacks.

With respect to privacy and meter data access, the Department understands that in order for the benefits of grid modernization to be fully realized data will have to be available to customers as well as to authorized competitive electricity suppliers and other service providers. We cannot allow this availability, however, to compromise privacy. We note that, in part to help promote the competitive electricity market, the Department has already mandated certain

practices concerning the protection and release of customer electricity usage data. These procedures are designed to ensure customer privacy and allow for customers to request the collection of their interval usage data.³⁰ We must now enhance these practices and procedures and adapt them to ensure that, with the modernization of the grid, customer information remains private.

To help ensure consumer confidence, we expect electric distribution companies to integrate into their existing processes any cybersecurity considerations that are raised by modernizing the grid. Further, as we said in the Straw Proposal, we require the companies to address in their GMPs how they will prevent unauthorized access to control systems, operations, and data in accordance with existing and emerging best practices, national standards, and state and federal laws. Straw Proposal at 31. We note that grid modernization activities are beginning in other states and, therefore, that companies in Massachusetts will likely not be the first to address cybersecurity measures related to these activities and should learn from other states' experience. We also caution that, to the extent that public dissemination of cybersecurity proposals might compromise cybersecurity efforts, companies should seek protective treatment for any sensitive information in their GMPs.

The advanced metering functionalities that will be implemented through grid modernization will result in the existence of more detailed usage information. Such information will allow customers to see their electric consumption patterns, better understand

³⁰ Competitive Market Initiatives, D.T.E. 01-54-A at 9-13 (2001); Installation of Advanced Metering Equipment for Residential Customers, D.T.E. 01-28, at 8 (2001).

their electricity use, identify energy and cost saving opportunities, and take advantage of energy efficiency programs and TVR. While we recognize that meter data access for third parties is an important component of maintaining and supporting the competitive electricity market, customer-specific data cannot be shared without customer approval. Customer aggregate data may be shared but only after Department-approved procedures are in place to ensure that such data cannot be linked to specific customers. Access to data will allow third parties, whether competitive electricity suppliers, demand response aggregators, or other service providers, to develop and market innovative products to offer to consumers and allow ISO-NE to evaluate and manage the regional electric system more effectively. Accordingly, in their GMPs, electric distribution companies should address: (1) how customers will be provided access to consumption data that can be easily understood; (2) the procedures for allowing an authorized third party to access customer usage data with the customer's permission; and (3) procedures for making aggregate usage data available to third parties and ensuring that it cannot be linked to any individual customer.

VII. CONCERNS ABOUT HEALTH EFFECTS AND OPT-OUT PROVISIONS

Many grid modernization technologies involve the wireless transmission of data using radio frequencies ("RF"). In considering the use of such technologies, the Department has weighed: (1) our strong belief that in order for all customers to enjoy the numerous benefits of grid modernization, the electric distribution companies must achieve advanced metering functionality, which likely will include broad deployment of advanced meters that transmit data

wirelessly (“advanced meters”);³¹ (2) the credible, peer-reviewed scientific studies that find no direct human health risk from advanced meters; and (3) our recognition that some individuals feel strongly that advanced meters will have a negative impact on their health. After careful review of all the information, scientific research, and data presented in this proceeding, and consideration of other jurisdictions’ studies, reports and approaches,³² we conclude that the best balance of these factors is to allow electric distribution companies to include in their plans to achieve advanced metering functionality the broad deployment of advanced meters, but to require the companies to provide customers with an option to decline the installation of advanced meters.

A. Concerns about Health Effects

1. Studies and Human Health Impacts

The Department takes seriously the testimony and comments that express concern about potential health effects resulting from exposure to RF emitted by certain electric meters.

However, after thorough review and consideration of the issue, the Department is unaware of

³¹ Advanced meters are often referred to as “smart meters.” However, emission by electric meters of RF energy is not limited to meters traditionally called “smart meters,” and “smart meters” may in fact use a non-wireless communication system, thus not emitting RF energy. In this section we use the term “advanced meters” to reflect what many commenters refer to as “smart meters,” *i.e.*, meters with functionality beyond a basic revenue meter and that involve RF transmission.

³² Commenters provided the Department with numerous reports, studies and other information. The Department has also reviewed additional materials, including the studies, reports and orders of other state and international agencies. A list of the additional references is provided at Appendix 2.

any credible, peer-reviewed scientific studies that demonstrate a direct human health risk from exposure to the low-level RF signals from advanced meters.³³

Commenters opposed to advanced meters refer to studies that they contend provide evidence of associated negative health impacts. Another commenter argues that national and international studies have not shown a conclusive causal link between RF exposures and detrimental health effects. In assessing such arguments and the cited evidence, we consider whether the studies: (1) have been peer reviewed; (2) are applicable to the current proceeding,

³³ See, e.g., Tr. 4, at 943, 986, 1069 (national and international studies have not shown a causal link between RF exposure and any detrimental health effects); California Council on Science and Technology, Health Impacts of Radio Frequency Exposure from Smart Meters (2011) (“CCST Report”) (evidence does not support a causal link between RF emissions and non-thermal health impacts); Texas Public Utilities Commission, Health and RF EMF from Smart Meters (2012) (“the large body of scientific research reveals no definite or proven biological effects from exposure to low-level RF signals”) (“Texas Commission Report”); Michigan Public Service Commission, U-17000 Report to the Commission (2012) (health risks from smart meters are insignificant); Maine Public Utilities Commission, Docket No. 2011-00262 Examiners Report at 2, 44 (March 25, 2014) (“Examiners Report”) (there are no credible, peer reviewed studies that demonstrate a direct human health risk from AMI RF emissions); Health Canada, It’s Your Health - Smart Meters (2011) (“Health Canada Report”) (RF energy from smart meters does not pose a public risk); Danish Health and Medicines Authority, Swedish Radiation Safety Authority, Norwegian Radiation Protection Authority, and Iceland Radiation Safety Authority, Exposure from Mobile Phones, Base Stations and Wireless Networks: a Statement by the Nordic Radiation Safety Authorities (2013) (“Nordic Statement”) (data to date do not indicate adverse health effects from radiofrequency electromagnetic fields below the guidelines or limits adopted in the Nordic countries); Australian Radiation Protection and Nuclear Safety Agency, Fact Sheet 16: Smart Meters or Advanced Metering Infrastructure (AMI) (2013) (“the scientific evidence does not support that the low level RF EMR [i.e., electromagnetic radiation] emitted from smart meters causes any health effects”); Public Health England, Smart Meters (2013) (“Public Health England”) (“the evidence to date suggests exposures to the radio waves produced by smart meters do not pose a risk to health”).

i.e., to advanced meters; (3) are supported by the weight of scientific evidence; and (4) have been examined, and their arguments supported, by other entities considering the issue.

The primary mechanism for ensuring the quality, utility, objectivity, and integrity of scientific evidence is an objective peer-review process in which independent experts evaluate research for quality, considering the appropriateness of methods and strength of a researcher's inferences.³⁴ This review may occur through publishing findings in well recognized scientific literature that is subject to a peer-review process or through an independent, transparent, and objective peer-review process by recognized experts. See, e.g., Office of Management and Budget, Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information, 67 Fed. Reg. 8452 (February 22, 2002); Office of Management and Budget, Final Information Quality Bulletin for Peer Review, M-05-03 (December 16, 2004).³⁵ We find that many studies referenced by commenters asserting health impacts from advanced meters do not meet this standard and, therefore, cannot be considered credible. For example,

³⁴ Carnegie Commission on Science, Technology, and Government, Risk and the Environment: Improving Regulatory Decision Making, Carnegie Commission at 85 (1993).

³⁵ Many United States government agencies, including the Department of Energy, the Center for Disease Control and Prevention, and the Environmental Protection Agency, follow these guidelines. See, e.g., Department of Energy, Peer Review (2014), available at <http://energy.gov/eere/buildings/peer-review>; Centers for Disease Control and Prevention, OMB Information Quality Peer Review Agenda (2014), available at <http://www.cdc.gov/od/science/quality/support/peer-review.htm>; Environmental Protection Agency, Office of the Science Advisor, Peer Review Program (2012), available at <http://epa.gov/peerreview/>. The National Academies of Science follow similar peer review guidelines and informed the development of OMB Peer Review Guidelines. See National Academies, Study Process (2014), available at <http://www.nationalacademies.org/studyprocess/index.html#st4>.

many commenters cite the 2007 BioInitiative Report and its update, the 2012 BioInitiative Report.³⁶ Neither of these reports has been objectively peer reviewed, as noted by international health agencies criticizing them for not being an objective reflection of the current state of scientific knowledge.³⁷ Similarly, several commenters reference a case series study to support their arguments regarding adverse health impacts from advanced meter emissions (AAEM Comments at 1; MACI Reply Comments at 2). However, these commenters do not provide this study in the record, nor discuss it in-depth and, as a result, it cannot be determined to meet the objective peer-review standard and cannot be considered credible evidence.

The applicability of research is another critical factor the Department considers when evaluating arguments and evidence. The 2007 BioInitiative Report and the 2012 BioInitiative

³⁶ BioInitiative Report, BioInitiative Report: A Rationale for Biologically-based Public Exposure Standards for Electromagnetic Fields (ELF and RF) (2012), available at <http://www.bioinitiative.org/>.

³⁷ Sections of the 2007 BioInitiative Report have been published as journal articles in the peer-reviewed journal Pathophysiology. See, e.g., Martin Blank et al., Electromagnetic Fields Stress Living Cells, 16 Pathophysiology 71 (2009); J.L. Phillips et al., Electromagnetic Fields and DNA Damage, 16 Pathophysiology 79 (2009). These were published as a separate single issue, guest-edited by an author of the BioInitiative Reports. Regarding the 2007 BioInitiative Report, The Health Council of the Netherlands concluded that the report is not an objective and balanced reflection of the current state of scientific knowledge. See Health Council of the Netherlands, BioInitiative Report Review (2008). Regarding the 2012 BioInitiative Report, The Indian Council of Medical Research found that the report is not based on multi-disciplinary weight, does not provide scientifically sound judgment, and is not an objective and balanced reflection of the current state of scientific knowledge. See India Ministry of Information and Broadcasting, Study on Radiation from Mobile Towers and Cell Phones (2013), available at <http://inbministry.blogspot.in/2013/02/study-on-radiation-from-mobile-towers.html>.

Report, along with some of the comments made in this proceeding, reference published scientific literature that may meet an objective peer-reviewed standard. While some of this literature indicates potential adverse health effects from long-term, close proximity, high-power exposure, we find that the studies do not support opponents' arguments and are not applicable to this proceeding, as the studies do not address RF exposure from advanced meters.^{38,39,40} Rather, these studies are largely specific to long-term RF exposure from wireless

³⁸ See, e.g., Shangcheng Xu et al., Exposure to 1800 MHZ Radiofrequency Radiation Induces Oxidative Damage to Mitochondrial DNA in Primary Cultured Neurons, 1311 *Brain Research* 189, at 189-196 (2010) (authors observed effects at a level 25 times the FCC limit and a frequency similar to wireless phones); Lennart Hardell et al., Epidemiological Evidence for an Association Between Use of Wireless Phones and Tumor Diseases, 16 *Pathophysiology* 113 (2009) (evaluating long-term cellular phone exposure (> 10 years), indicating an increased risk for glioma and acoustic neuroma).

³⁹ Memorandum from Roger Levy and Janie Page, Smart Grid Technical Advisory Project, Lawrence Berkeley National Laboratory, to Patrick Hudson, Michigan Public Service Commission at 3 (April 12, 2012) (reviewing the January 13, 2012 County of Santa Cruz Health Services Agency memorandum entitled Health Risks Associated with Smart Meters), available at <http://smartresponse.lbl.gov/reports/schsa.pdf> ("Levy/Page Memorandum").

⁴⁰ Another study cited by smart meter opponents addresses levels of exposure above that of smart meters, and further, does not find a causal relationship with cancer or other adverse health effects. See, e.g., International Agency for Research on Cancer, Interphone Study Reports on Mobile Phone Use and Brain Cancer Risk (2010) (authors of the Interphone study, a study across 13 nations, found no increased risk of the brain cancers glioma, meningioma, or acoustic neuroma with regular wireless phone use and concluded bias and error prevent a causal relationship between heavy wireless phone use and cancer); World Health Organization, Fact Sheet No. 193: Electromagnetic Fields and Public Health: Mobile Phones, <http://www.who.int/mediacentre/factsheets/fs193/en/> (last visited June 11, 2014) (to date, no adverse health effects have been established as being caused by mobile phone use).

phones and wireless phone base stations, which operate at different frequencies from RF-emitting meters, with associated exposure levels that are orders of magnitude higher.⁴¹

In assessing arguments and cited studies, we also consider their consistency with the weight of scientific evidence and determinations made by other jurisdictions. Other jurisdictions that have considered potential health impacts of RF, including regulatory bodies and public health organizations, do not find that RF exposure from advanced meters, operating under established U.S. and international exposure limit guidelines, leads to adverse health effects.⁴²

Commenters assert that studies cited by the Department in the Straw Proposal and studies cited by other U.S. and international jurisdictions that find no evidence of health effects from RF rely on research funded by industry and government institutions and are therefore biased and unreliable (see, e.g., Tr. 4, at 946, 954, 983, 1060; EMRPI Reply Comments at 2). In applying the aforementioned standard for evaluating arguments and associated evidence we do not find this argument persuasive.

⁴¹ Key distinctions between wireless phones and RF-emitting meters include proximity to the body, duty cycle, and RF frequency. Levy/Page Memorandum at 1-3. RF field strength declines rapidly from the source and is extremely small at any reasonable distance from the advanced meter. Taking into account the duty cycle of the meter (below one percent), this results in 90 percent of measured RF values being less than 0.1 percent of the FCC Maximum Permissible Exposure (“MPE”). Electric Power Research Institute, Characterization of Radio Frequency Emissions from Two Models of Wireless Smart Meters at 6.3, 7.1 (2011) (“EPRI Study”).

⁴² See sources cited supra note 33.

In sum, considering the well accepted standards for review of scientific arguments and associated evidence we find that the studies cited by opponents of smart meters do not amount to credible evidence of health impacts.

2. Adequacy of Existing Exposure Limits

Some commenters assert that national and international exposure limits, including, specifically, the guidelines established by the Federal Communications Commission (“FCC”),⁴³ are inadequate to protect the public from the effects of electric meter RF exposure, especially non-thermal effects. Another commenter disagrees and asserts that existing standards adequately protect public health, arguing that a number of national and international standards bodies agree on the adequacy of existing RF exposure limits, and that a number of these bodies have recently reviewed their limits. Evidence from peer-reviewed studies, determinations by standards bodies, and conclusions from other jurisdictions do not support a finding that the FCC guidelines are inadequate to protect against either thermal or non-thermal effects of RF emissions.⁴⁴

⁴³ The FCC regulates communications by radio, television, wire, satellites, and cable within the United States and its territories. 47 U.S.C. §§ 151, 154. Under the National Policy Act of 1969, the FCC has responsibility for the development and enforcement of the federally mandated RF exposure limits. 42 U.S.C. § 4321 et seq.

⁴⁴ See, e.g., Tr. 4, at 945, 977-979, 1012 (existing exposure limits adequately protect public health; national and international standards bodies agree on the adequacy of existing RF limits); California Council on Science and Technology, Health Impacts of Radio Frequency Exposure from Smart Meters at 2, 5 (2011) (FCC guidelines provide an adequate factor of safety against RF health impacts of smart meters; evidence does not support a causal link between RF emissions and non-thermal health impacts); Maine Examiners Report 44 (there is no basis for finding that the FCC limits inadequate for both thermal and non-thermal effects); Colorado Department of Public Health and

3. Cumulative Impacts

Some commenters suggest that electric meter RF emissions add to the background level of RF fields in an environment in which a number of other RF-emitting devices operate, such as cell phones, household appliances, and wireless communications devices and networks, furthering the potential health issues for the public. However, advanced meter RF emissions, as studied in reports evaluating their compliance with FCC and other limits, are far below emissions levels associated with these other devices under both peak and time-averaged exposure.⁴⁵ Even under conservative estimates, RF emissions from advanced meters are less than one percent of FCC and other limits relative to time-averaged exposures and less than four percent relative to peak exposures.⁴⁶

4. Multiple Meters/Meter Banks

Some commenters assert that studies that evaluate compliance with FCC and other limits are inadequate as they do not examine meters in an installed state and do not account for combined exposure from multiple meters. Meter manufacturers must have their devices independently tested by certified laboratories using approved methodologies and file the

Environment, Fact Sheet on Smart Meters and Associated Health Concerns at 3 (2012) (“[o]verall, based on the current knowledge, additional standards are not needed to protect public health”).

⁴⁵ British Columbia Center for Disease Control, Measurement of Radiofrequency (RF) Emissions from BC Hydro’s Itron Smart Meters at 6-7 (2012) (“BCCDC Report”); Vermont Department of Health, Scientific and Public Health Agency Perspectives on Radio Frequency Fields Related to Smart Meters, at 18-22, prepared by Exponent, Inc. (2014) (“Exponent Report”).

⁴⁶ BCCDC Report at 6-7; Exponent Report at 21.

associated measurement report with the FCC. See 47 C.F.R. § 2.1033. In addition, a number of independent studies have verified the compliance of advanced meters with FCC and other national and international limits.⁴⁷ These reports evaluate electric meter RF emissions under multiple installation scenarios, including individual and aggregate installations with multiple meters.⁴⁸ Finally, the FCC has indicated that banks of RF-emitting electric meters fall below FCC public exposure limits. Letter from Julius Knapp, Chief, Federal Communications Commission Office of Engineering and Technology, to Cindy Sage, Sage Associates Environmental Consultants (August 6, 2010) (“FCC/OET Letter”).⁴⁹ Specifically, the FCC stated that “[i]rrespective of duty cycle, based on the practical separation distance and the need for orderly communications among several devices, even multiple units or ‘banks’ of meters in the same location will be compliant with the public exposure limits.” FCC/OET Letter at 2.

⁴⁷ Cascadia PM, LLC, Report of Results of Smart Meter RF Testing – Maui at 10 (2014) (“Maui Report”) (meter readings at no time exceeded .015 percent of the general population exposure limit); EPRI Study at 7-1 (showing that the subject smart meter emissions are small in comparison to the applicable FCC limits for exposure; this finding of compliance with the MPE holds true whether or not the peak measured fields are corrected for meter duty cycles, whether spatial averaging or any other factor that reduces RF fields such as the construction materials of homes is considered, or whether the meters exist in a large group, or whether individuals are outside near the smart meter or inside their residence); City of Naperville Smart Grid Initiative, Pilot 2 RF Emissions Testing – Summary Report – V2.0, at 26 (2011) (“NSGI Report”) (even under the worst case scenario, the instantaneous peak measurements observed from a smart meter are far below the FCC MPE limit).

⁴⁸ Maui Report; EPRI Study; NSGI Report.

⁴⁹ This letter was issued in response to a letter from Cindy Sage of Sage Associates Environmental Consultants requesting that the FCC review compliance with FCC RF exposure limits for “smart meters,” in particular, the installation of multiple adjacent “smart meters” and the associated exposure effects.

5. Electromagnetic Hypersensitivity

Some commenters assert that advanced meters pose a particular health threat to individuals with electromagnetic hypersensitivity. We recognize that certain individuals report a heightened sensitivity to RF emissions and attribute illness or other physical symptoms to RF exposure. While we appreciate that their symptoms are serious, based on all of the testimony and the materials we have reviewed we are unable to conclude that RF exposure and, specifically, RF from electric meters, is the cause of those symptoms.⁵⁰

6. IARC Classification

Some commenters reference the International Agency for Research on Cancer (“IARC”), an agency of the World Health Organization (“WHO”), classification of RF electromagnetic fields as Group 2B, “possibly carcinogenic to humans.” International Agency for Research on Cancer, IARC Monograph, Volume 102: Non Ionizing Radiation, Part 2: Radiofrequency Electromagnetic Fields (2012) (“IARC Monograph 102”). The IARC uses a Group 2B classification when it considers a causal association with carcinogenicity credible, but when chance, bias, or confounding cannot be ruled out with reasonable confidence. IARC Monograph 102, at 30. The IARC’s classification does not alter our conclusion regarding the lack of evidence of a causal link between advanced meters and adverse health effects for several reasons. First, the IARC recognizes that there is limited evidence in both humans and

⁵⁰ See, e.g., Tr. 4, at 986; World Health Organization, Electromagnetic Fields and Public Health: Electromagnetic Hypersensitivity, <http://www.who.int/peh-emf/publications/facts/fs296/en/> (last visited June 11, 2014); Texas Commission Report at 55-57 (2012); Exponent Report at 35.

animals to indicate that RF energy is carcinogenic. IARC Monograph 102, at 419. Second, the IARC based its Group 2B classification on studies associating long-duration exposure of wireless phones in humans to brain cancers such as glioma and acoustic neuroma. IARC Monograph 102, at 33, 419. Wireless phones have much higher RF exposure levels than advanced meters and are in much closer proximity to their users.⁵¹ Third, the Group 2B classification represents only a suggestion of a possible causal relationship to carcinogenic effects, i.e., chance, bias, or confounding not being reasonably ruled out.

7. Conclusion

In the absence of credible evidence of harm to human health from advanced meters, we will allow electric distribution companies to include the broad deployment of advanced meters in their plans to achieve advanced meter functionality. However, as discussed further below, companies will be required to provide customers with an option to decline the installation of an advanced meter.

B. Opt-Out Provisions

In determining how to implement customer choice regarding potential deployment of advanced meters, the Department considered both opt-out and opt-in approaches. An opt-out approach means that, assuming a company's approach to grid modernization included wide deployment of advanced meters, all customers would receive such a meter except for those customers who notify the company that they wish to be exempted. Conversely, an opt-in

⁵¹ BCCDC Report at 4-6; Exponent Report at 18-21; NSGI Report at 26-28.

approach would require any customer who wants an advanced meter installed to affirmatively request the meter.

A targeted opt-in approach to advanced metering functionality, as suggested by Northeast Utilities and the Attorney General, would not maximize customer participation and, as a result, would diminish the benefits of grid modernization. An opt-out approach advances the objectives of grid modernization, while still enabling a customer who has health or other concerns to decline the installation of an advanced meter. The Department concludes that an opt-out approach provides appropriate flexibility to customers while still advancing our grid modernization objectives.

Thus, we direct each electric distribution company that proposes to install new advanced meters⁵² as part of its plan to achieve advanced metering functionality to include in its GMP an illustrative opt-out tariff,⁵³ an explanation for the company's proposed opt-out approach and any proposed opt-out charges (including cost assumptions), and a description of the company's proposed customer communication plan.⁵⁴ Any proposed opt-out charges must

⁵² This opt-out requirement applies to new advanced metering infrastructure as a part of a company's GMP. If a company wishes to file an opt-out tariff to address existing infrastructure, it may do so in a separate Department proceeding.

⁵³ The electric distribution companies are encouraged to confer with each other in developing opt-out tariffs.

⁵⁴ Some public utility commissions have allowed customers to opt out of advanced meters and to take service with a non-RF emitting meter with an associated charge. *See, e.g., Elisa Boxer-Cook, et al., Docket No. 2010-345, Order I at 2 (Maine Public Utilities Commission 2011) (directing electric distribution companies to assess opt-out customers an initial charge and a monthly charge); Potomac Electric Power Company, et al., Order No. 86200, at 5, 30-34 (Public Service Commission of Maryland 2014)*

adhere to traditional ratemaking principles of cost causation. Electric distribution companies may determine the appropriate time to submit their opt-out tariff for Department approval, but such tariff must be in effect before any deployment of advanced meters under the companies' GMPs.

VIII. TIMING AND PROCESS

A. Timing for Filing First GMP

In the Straw Proposal, the Department proposed requiring each electric distribution company to develop and submit its GMP within six months of a final Order in this proceeding. Straw Proposal at 3. In now determining the appropriate timeframe for electric distribution companies to file their first GMPs we consider the following factors: (1) additional guidance the companies may need from the Department to allow them to develop their GMPs; (2) the time that the companies need to develop their GMPs; and (3) the need to move grid modernization forward as expeditiously as possible.

After reviewing the comments and testimony, we are persuaded that the electric distribution companies need more than six months to develop meaningful GMPs. We also are persuaded that, in order to present meaningful GMPs, the electric distribution companies need further guidance from the Department regarding the implementation of TVR and how

(establishing initial and monthly charges for opt-out customers). Recently, the Department approved the opt-out service tariffs proposed by National Grid to allow its customers to opt out of automatic meter reading ("AMR") meter installation, subject to a meter change-out charge and a monthly manual meter reading charge. Massachusetts Electric Company/Nantucket Electric Company/Boston Gas Company/Colonial Gas Company, D.P.U. 13-83-A at 19 (April 30, 2014).

companies should present the business case for capital expenditures in their GMPs. By contrast, we have determined that the companies' ability to file their GMPs is not contingent on prior completion of our EV proceeding (D.P.U. 13-182) or resolution of issues related to cybersecurity, privacy, or access to meter data. Resolution of these issues is not necessary for companies to file their GMPs, and the Department intends to address privacy, data access, and the use of aggregated interval data in more detail well before any wide-scale collection of interval data takes place.

We also will not delay the filing of GMPs until all the electric distribution companies have completed their smart grid pilot programs. We note that Unitil and NSTAR have completed their pilots. See Fitchburg Gas and Electric Light Company, D.P.U. 09-31 (three-month smart grid pilot program completed in August 2011; Pilot Program Evaluation Report submitted to the Department on January 30, 2012); NSTAR Electric Company, D.P.U. 09-33 (two-year smart grid pilot program completed December 2013; Pilot Program Evaluation Report expected in summer of 2014). The results of Unitil's and NSTAR's pilots plus National Grid's research and experience in planning for and implementing its on-going two-year pilot will help inform the companies' GMP filings. Massachusetts Electric Company/Nantucket Electric Company, D.P.U. 11-129 (two-year smart grid pilot program with a dynamic pricing program commencing in October 2014). In addition, in developing

their GMPs, the companies will have the benefit of a large number of smart grid deployment studies and experiences from other jurisdictions.⁵⁵

We conclude that electric distribution companies should file their first GMPs within nine months of the later of: (1) the Department's final Order in Time Varying Rates, D.P.U. 14-04; and (2) the Department's final directive to companies regarding their presentation of costs and benefits in their GMP business case for capital expenditures.

B. Process

1. Stakeholder Engagement in Developing GMPs

To ensure stakeholder input into GMP development, the Department directs each electric distribution company to: (1) establish a clear and effective process to solicit stakeholder input during GMP development; (2) clearly communicate this process to stakeholders; and (3) include in its GMP a summary of the solicitation process, the stakeholder input provided, and the integration of stakeholder input into the company's GMP.

2. Department Review of GMPs

Once the electric distribution companies file their GMPs, the Department will review each filing in a separate adjudicatory proceeding to ensure that each GMP is consistent with the Department's directives set forth in this Order. Such adjudications will include the opportunity

⁵⁵ See, e.g., Faruqui et al., Time-Varying and Dynamic Rate Design (July 2012), available at <http://raponline.org/document/download/id/5131>; U.S. Department of Energy, Smart Grid Investment Grant Program, Progress Report II (October 2013), available at http://www.smartgrid.gov/sites/default/files/doc/files/SGIG_progress_report_2013.pdf; Electric Power Research Institute, Smart Grid Demonstration Initiative 5-Year Update (August 2013), available at <http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002000778>.

for public comment, intervention, submission of party-sponsored testimony, discovery, evidentiary hearings, and briefs.

Companies must update their GMPs in subsequent base distribution rate cases, which by statute must occur no less often than every five years.⁵⁶ Such updates should describe GMP implementation to date, report on progress relative to developing and meeting metrics, describe changes to the GMP, and include a new ten-year GMP. An electric distribution company may seek to amend its GMP in between base rate case filings.

⁵⁶ General Laws c. 164, § 94, as amended by the Electricity Act, requires that “electric companies shall file with the [D]epartment schedules not less frequently than every five years . . . under a filing schedule as prescribed by the [D]epartment and in such form as the [D]epartment shall prescribe.” St. 2012, c. 209, § 18.

In the event that companies file their initial GMPs before their next rate cases such that the timing of their GMP filings are no longer likely to be coordinated with their rate case filings, they should confer with the Department well before the expiration of five years about the exact timing of subsequent GMPs.

An appeal as to matters of law from any final decision, order or ruling of the Commission may be taken to the Supreme Judicial Court by an aggrieved party in interest by the filing of a written petition praying that the Order of the Commission be modified or set aside in whole or in part. Such petition for appeal shall be filed with the Secretary of the Commission within twenty days after the date of service of the decision, order or ruling of the Commission, or within such further time as the Commission may allow upon request filed prior to the expiration of the twenty days after the date of service of said decision, order or ruling. Within ten days after such petition has been filed, the appealing party shall enter the appeal in the Supreme Judicial Court sitting in Suffolk County by filing a copy thereof with the Clerk of said Court. G.L. c. 25, § 5.

APPENDIX 1—SUMMARY OF THE COMMENTSI. GOALS OF GRID MODERNIZATIONA. The Four Objectives

In the Straw Proposal, the Department proposed that grid modernization be defined as functions that fall within four broad objectives: (1) to reduce the effect of outages; (2) to optimize demand, which includes reducing system and customer costs; (3) to integrate distributed resources; and (4) to improve workforce and asset management. Straw Proposal at 10. The Department also stated that an electric distribution company’s grid modernization plan (“GMP”) must lay out a strategy for measureable progress in all four of the grid modernization objectives. Straw Proposal at 11.

There was broad support for the Department’s definition of grid modernization as measurable improvement in the four objectives (Tr. 1, at 14, 19, 20, 28-29, 33-34; Fitchburg Gas and Electric Light Company d/b/a Unitil (“Unitil”) Comments at 2; Massachusetts Electric Company and Nantucket Electric Company each d/b/a National Grid (“National Grid”) Comments at 12).

In addition, commenters address key factors for achieving these stated objectives. The Department of Energy Resources (“DOER”) asserts that measureable metrics will be critical to guaranteeing that the electric distribution companies are following the terms of their GMP’s and meeting the objectives of grid modernization (DOER Comments at 5). Unitil asserts that the four objectives can be divided into those that are directly under its control to implement, and those that are Unitil’s responsibility to enable, but a third party’s job to implement and meet (Tr. 1, at 43; Unitil Comments at 4-5). Unitil contends that the electric distribution companies should only be responsible for achieving measureable progress in those areas that

are directly under their control (Tr. 1, at 37-39, 42-43; Unitil Comments at 5). New England Clean Energy Council (“NECEC”) acknowledges that the manner in which some of the objectives are met would involve the actions of customers or third parties such as technology companies (Tr. 1, at 40).

Several commenters recommend that the Department provide more direction concerning the four grid modernization objectives (DOER Comment at 2-3; Unitil Reply Comments at 14; Tr. 1, at 34-35). DOER contends that the four objectives as presented in the Straw Proposal are too vague to provide a framework for the electric distribution companies in preparing their GMPs (DOER Comments at 2). The Interstate Renewable Energy Council, Inc. (“IREC”) agrees, stating that the Department should establish clear, concrete goals for the four grid modernization objectives to help the electric distribution companies in developing their GMPs (Tr. 1, at 34-35). In addition, Unitil asserts that more clarity regarding the four grid modernization objectives would help to create a targeted approach to achieving the objectives in a timely and efficient manner (Unitil Reply Comments at 3). Similarly, NSTAR Electric Company (“NSTAR Electric”) and Western Massachusetts Electric Company (together “Northeast Utilities”) state that it would be beneficial for the Department to identify the “future end-state” of grid modernization to aid the companies in focusing their GMPs to achieve these goals (Northeast Utilities Reply Comments at 15).

The Attorney General of the Commonwealth (“Attorney General”), Associated Industries of Massachusetts (“AIM”), and the Low Income Network state that the Straw Proposal provides adequate direction regarding the four objectives and asserts that the Department should not be overly prescriptive (Attorney General/Low Income Network/AIM

Reply Comments at 6). These commenters argue that while the four grid modernization objectives are broad, the Department should leave implementation details to the electric distribution companies (Tr. 1, at 61; Attorney General/Low Income Network/AIM Reply Comments at 6-7). In addition, the Attorney General, AIM, and the Low Income Network state that it is the responsibility of the companies to set “clear and measurable targets” when developing their GMPs (Attorney General/Low Income Network/AIM Reply Comments at 7).

B. Advanced Metering Functionality

In the Straw Proposal the Department defined advanced metering functionality as:

(1) the collection of customers’ interval usage data, in near real time, usable for settlement in the ISO New England Inc. (“ISO-NE”) energy and ancillary services markets;¹ (2) automated outage and restoration notification; (3) two-way communication between customers and the electric distribution company; (4) with a customer’s permission, communication with and control of appliances; (5) large-scale conservation voltage reduction (“CVR”) programs; (6) remote connection and disconnection of a customer’s electric service (while maintaining the Department’s consumer protections); and (7) measurement of customers’ power quality and voltage. Straw Proposal at 11-13. We stated that advanced metering functionality is a basic technology platform for grid modernization and must be in place before all of the benefits of grid modernization can be fully realized. Straw Proposal at 12. As such, the Department proposed requiring electric distribution companies to include in their GMPs a comprehensive

¹ Settlement is the process by which ISO-NE determines the financial obligations of the market participants. Energy market settlements are performed by calculating the charges and credits for all of the market activity that occurs at every pricing location on an hourly basis throughout New England.

advanced metering plan (“CAMP”), to achieve advanced metering functionality within three years of the GMP’s approval, if the benefits justify the costs. Straw Proposal at 3, 12-13.

Some commenters assert that the seven advanced metering functionalities proposed by the Department are a critical element of grid modernization, and they support the requirement to achieve all seven functionalities for all customers (IREC Reply Comments at 8; Tr. 1 at 90; see also, DOER Comments at 4; Retail Energy Supply Association (“RESA”) Comments at 5). Dominion Voltage, Inc. (“Dominion Voltage”) asserts that advanced metering infrastructure² (“AMI”) has the potential to provide great benefits for grid modernization in the form of communication and transparency, as well as the potential to enable other technologies (Tr. 1, at 48-49).

Many commenters oppose the Department’s proposal to require electric distribution companies to propose implementation of all seven advanced metering functionalities for all customers (Northeast Utilities Comments at 13; Attorney General/Low Income Network/AIM Reply Comments at 3; see Unitil Reply Comments at 14). Instead they suggest that the Department should use the functionalities as guidelines and allow for flexibility within the CAMPs (Northeast Utilities Comments at 13; Attorney General/Low Income Network/AIM Reply Comments at 3; Unitil Reply Comments at 14).

² Advanced metering infrastructure is a system of smart meters, two-way communications networks, and data management systems implemented to enable metering and other information exchange between utilities and their customers. U.S. Department of Energy, Smart Grid Investment Grant Program, Smartgrid.gov, https://smartgrid.gov/recovery_act/overview/smart_grid_investment_grant_program (last visited June 11, 2014). We use the term “advanced metering functionality” to describe a level of metering functionality, and not a specific technology solution.

DOER approves of the proposal by the Department that electric distribution companies achieve advanced metering functionality within three years of GMP approval (DOER Comments at 4). Some commenters disagree, asserting that the three-year requirement for the CAMP is too short (Northeast Utilities Comments at 3-4; Unitil Reply Comments at 12). National Grid and BRIDGE Energy Group (“BRIDGE Energy”) argue that the Department should not predetermine whether three years is the appropriate timeframe for the electric distribution companies to achieve advanced metering functionality without the benefit of reviewing the benefit-cost analyses to be developed in their GMPs (National Grid Comments at 15; BRIDGE Energy Comments at 23). The Attorney General maintains that a three-year timeframe is too rigid and does not give the electric distribution companies the flexibility to achieve the modern grid in a way that is reliable and least-cost, and cautions that the Department’s three-year mandate could result in needless increases in rates (Tr. 1, at 18-19). NECEC argues that having the electric distribution companies implement any sort of system-wide change would be an immense task to achieve in only three years, and that electric distribution companies will likely stage deployment over time by prioritizing customers and targeting the “low hanging fruit” (Tr. 1, at 133; Tr. 2, at 405-406). Similarly, IREC advises that it may not be essential to achieve advanced metering functionality for all customers in three years and suggests that if an electric distribution company decides it needs more time to achieve certain functionalities it should be given an opportunity to explain why and identify how long it will take to achieve full advanced metering functionality (IREC Reply Comments at 8).

Several commenters address specific aspects of our proposed list of metering functionalities. Some argue that the ability to remotely connect and disconnect a customer's electric service could have a negative impact on customers, particularly low-income customers (National Consumer Law Center Comments at 1). The Berkshire Litchfield Environmental Council argues that without the proper safeguards, this functionality could result in mistaken shutoffs or loss of service during critical winter months (Berkshire Litchfield Environmental Council Comments at 21-22). Other commenters assert that remote connect/disconnect may not be cost effective, given our state's consumer protections and existing utility policies (see, e.g., Tr. 1, at 96-98). Unitil argues that the remote connect/disconnect functionality would require the installation on meters of a "disconnect switch" at a cost of roughly \$200-300 per meter, which would be prohibitively expensive without a commensurate benefit (Unitil Comments at 9). Further, some commenters assert that an advanced meter is not necessary to achieve CVR functionality, maintaining that a meter is only essential to measure voltages (Tr. 1, at 109-110). NECEC agrees, arguing that some of their member companies, such as Utilidata, are capable of providing CVR without the use of advanced meters (Tr. 1, at 110).

Several commenters suggest that the requirement to implement all seven advanced metering functionalities would, in essence, require the companies to fully implement AMI, a specific technology solution, within their service territories (Unitil Comments at 7; Unitil Reply Comments at 5; National Grid Comments at 3-4). Numerous commenters oppose a requirement to implement AMI (Attorney General/AIM Comments at 4-6; Northeast Utilities Comments at ii; Northeast Utilities Reply Comments at 6; National Grid Comments at 14). Some commenters argue that AMI is not a cost-effective manner of implementing the advanced

metering functionalities (see, e.g., Northeast Utilities Comments at 7; Northeast Utilities Reply Comments at 4-5). The Attorney General and AIM state that the Department should be cautious regarding AMI, and asserts that it is an expensive investment with risk of going over budget and leaving stranded costs of obsolete meters and infrastructure (Attorney General/AIM Comments at 2). Unitil states that it already has a metering system capable of many of the advanced metering functionalities, and expresses the concern that achieving all seven advanced metering functionalities in three years would require the installation of a new AMI system, which would come at a significant cost without significant customer benefit (Unitil Comments 7-8). Northeast Utilities argues that there is no cost justification for implementing AMI, and that it is currently too expensive for only a modest gain in functionality (Northeast Utilities Comments at 7). National Grid agrees that there are potential benefits associated with advanced metering functionality, but that it should not be assumed that AMI is a cost-effective method of achieving the four grid modernization objectives at this time (Tr. 1, at 14-15).

Further, several commenters argue that there are, or may be, better solutions than AMI that could achieve many of the same desired functionalities, and that the Department's Straw Proposal, which requires achieving all seven advanced metering functionalities, does not adequately allow for electric distribution companies to consider those solutions (Tr. 1, at 89-94). For example, Unitil argues that other communications systems, such as broadband, can perform the same role of communicating with consumers and allowing utility control of customer appliances with their permission (Tr. 1, at 38). Similarly, Northeast Utilities argues that many of the four grid modernization objectives can be achieved with the use of "non-metering technologies and processes" such as various grid-facing technology and direct

load control programs which do not require the installation of a new metering system (Northeast Utilities Comments at 4-5). National Grid states that it is too soon to determine the benefits of a statewide rollout of AMI and that the Department should instead provide the electric distribution companies with flexibility regarding advanced metering functionalities in filing their individual GMPs (National Grid Comments at 14).

In addition, the Attorney General states that there is no information to suggest that ratepayers desire advanced metering functionalities (Tr. 1, at 19). Similarly, Northeast Utilities contends that there is no evidence that customers are willing to pay the necessary additional cost for the seven advanced metering functionalities given the incremental benefits that they offer (Northeast Utilities Comments at 10).

II. THE GRID MODERNIZATION PLAN

A key element of the Department's Straw Proposal was the requirement for each electric distribution company to develop and submit to the Department a ten-year strategic GMP within six months of a final Order in this proceeding. Straw Proposal at 3. In the Straw Proposal we required each electric distribution company to file a revised GMP no less often than every five years. Straw Proposal at 8. According to the Straw Proposal, the GMP would describe an electric distribution company's strategy and general investment plan to make measureable progress towards achieving the Department's four grid modernization objectives over ten years. Straw Proposal at 16. Further, in its GMP, an electric distribution company would have to: (1) weigh costs, benefits, and technology maturity; and (2) include its rationale for prioritization of investments. Straw Proposal at 17.

Commenters generally support the broad outline of the Department's proposed ten-year GMP requirement (Unitil Comments at 2-3; National Grid Comments at 12; BRIDGE Energy

Comments at 6-7; Environment Northeast (“ENE”) Comments at 1; IREC Comments at 2; Utilidata Comments at 4; NECEC Comments at 5). Many commenters support requiring the electric distribution companies to develop and file long-term strategic plans outlining how they will make measurable progress towards achieving the Department’s four grid modernization objectives (Northeast Utilities Reply Comments at 1; Unutil Comments at 2-3; National Grid Comments at 12; BRIDGE Energy Comments at 7; NECEC Reply Comments at 2). The Attorney General, NECEC, National Grid, Dominion, ENE, IREC, and DOER also argue that electric distribution companies should consider non-wires alternatives as they make new capital investments in their systems, asserting that these alternatives potentially provide significant system benefits and cost savings (Tr. 1, at 63, 67, 72-75; ENE Comments at 8-9; IREC Comments at 5; DOER Comments at 2).

A. The CAMP

The Straw Proposal included a requirement for the first GMP to include a CAMP that describes how the electric distribution company would achieve advanced metering functionality no later than three years from the Department’s approval of its GMP, assuming the benefits of doing so justify the costs. Straw Proposal at 12-13. The Straw Proposal provided that the CAMP would include a marketing, education, and outreach plan with its timeline, strategies, and budget for educating customers and motivating them to become full participants in grid modernization. Straw Proposal at 19-25. In the Straw Proposal, the Department determined that advanced metering functionality warranted special regulatory treatment and that the Department intended to examine advanced metering functionality investments under a targeted regulatory framework, which would include: (1) review of a detailed plan and pre-authorization by the Department; (2) a benefit-cost analysis within a business case

approach which assesses all costs and benefits and provides its underlying assumptions; and (3) if justified, a targeted cost recovery mechanism. Straw Proposal at 18. Therefore, the Straw Proposal provided that an electric distribution company could include in its CAMP a proposal for a capital expenditure tracking mechanism for the company to recover investments related to achieving advanced metering functionality. Straw Proposal at 28.

Many commenters express concern with the Department's proposed CAMP requirements. Specifically, commenters: (1) oppose limiting the targeted regulatory framework to CAMP investments; and (2) assert that each electric distribution company should be afforded flexibility to design their GMPs and CAMPs for its specific circumstances.

Many commenters express concern that the Department's proposal to limit the targeted regulatory framework to CAMP investments designed to achieve advanced metering functionality would steer the electric distribution companies to adopt too narrow a focus on metering solutions to achieve our four grid modernization objectives (Tr. 2, at 294-295; Util Comments at 14-15; Northeast Utilities Comments at ii, 17-18; National Grid Comments at 5; NECEC Comments at 3, 18; BRIDGE Energy Comments at 9, 14; Utilidata Comments at 7-8). BRIDGE Energy, ENE, and NECEC argue that instead of focusing narrowly on metering solutions, the Department should require each electric distribution company to use the benefit-cost analysis as a guide to devise the best approach to achieve advanced metering functionality (Tr. 2, at 295; BRIDGE Energy Comments at 14-16, 22; ENE Comments at 4). Other commenters advocate giving each electric distribution company flexibility to design their CAMPs appropriate to its specific situation, taking into account existing infrastructure and

customer preferences (Tr. 2, at 405-406; Unitil Comments at 11-12; Northeast Utilities Comments at A1-A2; National Grid Comments at 3-4; BRIDGE Energy Comments at 13-15).

1. Business Case Analysis

In the Straw Proposal, the Department set forth a requirement for electric distribution companies to include a benefit-cost analysis in their CAMPs to support a request for pre-authorization of advanced metering investments. Straw Proposal at 20. The Department stated that the benefit-cost analysis would use a business case approach, which would assess all costs and benefits, including those difficult to quantify, and provide all underlying assumptions. Straw Proposal at 20. Before pre-authorizing such investment, the Department would need to determine that the benefits, quantified and unquantified, exceed the costs. Straw Proposal at 20.

As discussed further below, commenters raise several issues that would affect the benefit-cost analysis and recommend the following changes to the analysis: (1) expand application of the analysis beyond the CAMP to all proposed GMP investments; (2) require a least-cost approach; (3) include all stranded costs from existing meters; (4) first establish the benefit-cost analysis framework and require the completion of the time varying rates (“TVR”) and cybersecurity investigations before any analysis is submitted; and (5) include a sensitivity analysis.

Several commenters recommend that companies be allowed to propose a comprehensive benefit-cost assessment for all proposed investments in their GMPs rather than limiting the analysis to advanced metering investments in their CAMPs (BRIDGE Energy Comments at 21; National Grid Comments at 4; NECEC Comments at 9-10). Commenters assert that this approach would allow for an integrated and holistic view of benefits and costs (BRIDGE

Energy Comments at 21; National Grid Comments at 4; NECEC Comments at 9-10). Other commenters propose that the Department require companies to provide, as part of the benefit-cost analysis, an evaluation of the least-cost approach to meeting the Department's grid modernization objectives and functionalities (Attorney General/AIM Comments at 3-4; ENE Comments at 4).

Several commenters recommend that stranded costs from the current metering systems be included in the benefit-cost analysis (Attorney General/AIM Comments at 3-4; Northeast Utilities Comments at 16; Attorney General/Low Income Network/AIM Reply Comments at 12). ENE proposes the inclusion in the benefit-cost analysis of a sensitivity analysis that incorporates varying rates of customer participation, persistence of behavior change, and timing of implementation (ENE Comments at 3-4).

2. Cost Recovery

In the Straw Proposal, the Department proposed that grid modernization should become a part of normal business practices for electric distribution companies. Therefore, we proposed to evaluate non-advanced metering functionality related grid modernization investments for recovery in base distribution rate proceedings pursuant to our traditional ratemaking standards for capital additions. Straw Proposal at 17-18. However, in the Straw Proposal, the Department recognized that investments to achieve advanced metering functionality might warrant special regulatory treatment. Straw Proposal at 18. Specifically, the Department concluded that under the current regulatory regime, an electric distribution company may have a financial incentive to limit large investments in advanced metering functionality because the benefits will accrue in large part to customers and not to the electric distribution company. Straw Proposal at 18. Accordingly, the Department proposed to

examine advanced metering functionality investments under an alternative regulatory framework, which includes: (1) Department review and pre-authorization of an electric distribution company's CAMP; (2) a benefit-cost analysis, within a business case; and (3) if justified, a targeted cost recovery mechanism in the form of a capital investment tracker. Straw Proposal at 18. Under a targeted cost recovery mechanism, the Department would review pre-authorized CAMP investments in a subsequent cost recovery proceeding to determine whether the implementation of the investment was prudent and whether it is "used and useful"³ in service to customers. Straw Proposal at 18-19. Once the Department pre-authorized a CAMP investment, absent extraordinary circumstances, the Department would not re-examine the electric distribution company's decision or timeline for making CAMP investments. Straw Proposal at 18-19.

In response to the Department's cost recovery framework described in the Straw Proposal, commenters: (1) addressed whether grid modernization investments warrant special regulatory treatment; (2) disputed the application of different regulatory treatment to CAMP and non-CAMP investments; (3) proposed alternative regulatory models; and (4) addressed the capital investment tracker proposed in the Straw Proposal.

Commenters disagree regarding whether grid modernization investments warrant special regulatory treatment. The Attorney General, AIM, and the Low Income Network jointly assert that there is no need to abandon traditional cost recovery treatment utilizing historic test year ratemaking for grid modernization investments (Attorney General/AIM/Low Income Network Reply Comments at 7-8, 12). The Attorney General agrees with the principle

³ See, e.g., Massachusetts Electric Company/Nantucket Electric Company/Boston Gas Company/Essex Gas Company, D.P.U. 09-38, at 24-26 (2009).

the Department articulated in the Straw Proposal that the electric distribution companies should view grid modernization investments as part of their normal operations (Tr. 2, at 287-289).

However, the Attorney General and AIM oppose applying special regulatory treatment for cost recovery of investments designed to achieve advanced metering functionality (Attorney General/AIM Comments at 4, 6).

Commenters also dispute the Department's proposal to segregate regulatory treatment of CAMP and non-CAMP grid modernization investments (Unitil Reply Comments at 9; Northeast Utilities Reply Comments at 7-8; National Grid Comments at 1, 5-6; BRIDGE Energy Comments at 9, 11-14, 22; NECEC Comments at 2, 6-9). These commenters assert that the Department's decision to allow targeted cost recovery only for CAMP investments will: (1) incentivize electric distribution companies to focus too narrowly on advanced metering functionality investments; (2) yield GMPs having limited scope and breadth; and (3) undermine the achievement of the Department's broader grid modernization objectives (Unitil Comments at 15-17; Northeast Utilities Comments at ii; National Grid Comments at 5; ISO-NE Comments at 6; NECEC Comments at 5-9, 18; BRIDGE Energy Comments at 9, 13-14, 22). Northeast Utilities and National Grid argue that the process of differentiating CAMP investments designed to achieve advanced metering functionality from other grid modernization investments identified in the GMP will be challenging for all parties and could result in resource-intensive regulatory proceedings (Tr. 2, at 371-372). Similarly, the Attorney General and National Grid anticipate that determining what type and level of investments are incremental to normal grid investments, and therefore should qualify for targeted cost recovery, will also be a difficult, contentious, and time consuming process (Tr. 2, at 288, 292,

341-343, 352). NECEC observes that even after this laborious process is complete, the determination of which investments are incremental will likely change over time as technology and industry practices evolve (Tr. 2, at 344). Finally, the Attorney General and NECEC caution that approving a capital investment tracker mechanism only for the cost recovery of CAMP investments will further and overly complicate the regulatory process (Tr. 2, at 294-296, 417, 471-472).

Several commenters, including the electric distribution companies, ENE, ISO-NE, NECEC, and BRIDGE Energy, assert that traditional cost recovery utilizing historic test year ratemaking is an inappropriate model for the recovery of future grid modernization investments (Unitil Comments at 15; Northeast Utilities Comments at 18; National Grid Comments at 2, 5, 9-10; National Grid Reply Comments at 1, 4-5; ENE Comments at 5; ISO-NE Comments at 5; NECEC Comments at 13; BRIDGE Energy Comments at 7, 17-20.) These commenters contend that rates that are set based on an historic test year will not reflect the costs of future grid modernization investments and that this disconnect, compounded by regulatory lag and the need for grid modernization spending to compete for funds with more traditional capital investments to maintain grid safety and reliability, will provide a disincentive for electric distribution companies to pursue grid modernization investments (Unitil Comments at 15; Northeast Utilities Comments at 18; National Grid Comments at 2,5, 9-10; National Grid Reply Comments at 5; ENE Comments at 5-6).

Those commenters opposing the Straw Proposal's regulatory treatment of grid modernization investments offer several alternative approaches for the Department's consideration. Northeast Utilities, Unitil, NECEC and Utilidata recommend that the

Department extend targeted cost recovery to all grid modernization investments to allow electric distribution companies to identify and evaluate all relevant grid modernization projects on an integrated basis (Unitil Comments at 16-17; Northeast Utilities Comments at 17-18; NECEC Comments at 18; Utilidata Comments at 1, 7-8). ISO-NE supports this view by pointing out that the Department's plan to divorce its review and pre-authorization of CAMP investments from a later prudence review will increase grid modernization investment risk and result in the electric distribution companies proposing non-controversial and not very aggressive GMPs (Tr. 2, at 523-525). NECEC expresses a similar view and concludes that the Department should deem actual grid modernization costs that are in line with pre-authorized cost estimates as prudently incurred and recoverable in rates (NECEC Reply Comments at 7).

Northeast Utilities and Unitil additionally urge the Department to reconsider adopting the Grid Modernization Expansion - Pre-Approval Process⁴ regulatory model as described in the Working Group Report (Tr. 2, at 285-286, 438-441). Northeast Utilities states that it favors this model because its targeted cost recovery mechanism for all cost-effective grid modernization investments permits electric distribution companies to develop integrated and balanced GMPs, while also protecting customer interests (Northeast Utilities Reply Comments at 9-10). Northeast Utilities emphasizes that the Grid Modernization Expansion -

⁴ The Working Group Report describes several alternative approaches that the Department might employ for regulating electric distribution company grid modernization initiatives. Northeast Utilities and Unitil favor the Grid Modernization Expansion - Pre-Approval Process model. This model provides that: (1) electric distribution companies would file proposals with the Department that meet our grid modernization objectives in a manner suitable for the unique characteristics of each electric distribution company's system; and (2) electric distribution companies would be permitted to request recovery of grid modernization investments through mechanisms outside of base rates, as determined by the Department (see Report, at 63-64, 107-110).

Pre-Approval Process regulatory model provides more expeditious cost recovery than traditional ratemaking, but does not rely on cost projections or eliminate regulatory lag (Northeast Utilities Reply Comments at 10).

Another group of commenters urge the Department to reconsider the Utility of the Future, Today⁵ regulatory model as described in the Report, or to consider a similar approach based on future test year ratemaking to address what they perceive as flaws in the Straw Proposal's cost recovery approach (National Grid Comments at 2,10; ISO-NE Comments at 3,5-6; BRIDGE Energy Comments at 16-20, 24-25; ENE Comments at 7-8; Boston Community Capital Comments at 5; NECEC Comments at 15; National Electrical Manufacturers Association Reply Comments at 4-5).

The Attorney General, ISO-NE, and NECEC all state that under the Utility of the Future, Today regulatory model, the proposal to reconcile projected and actual costs on a routine basis would result in annual or perhaps even quarterly cost reconciliation proceedings that resemble miniature general rate cases and thus add administrative complexity to the regulatory process (Tr. 2, at 495-497). On the other hand, NECEC anticipates that the ability to end existing tracker mechanisms will provide an offsetting simplification to the regulatory process (Tr. 2, at 531-532). The Attorney General cautions that there likely would remain

⁵ National Grid and many other participants in the Working Group favor the Utility of the Future, Today model. This model discontinues historic test year ratemaking for grid modernization investments and instead provides for: (1) electric distribution companies file proposals with the Department that meet our grid modernization objectives in a manner suitable for the unique characteristics of each electric distribution company's system; and (2) the Department pre-approves grid modernization investments and provides for future cost recovery in rates utilizing performance-based ratemaking and an annual reconciliation of base rates to reflect the difference between planned and actual capital expenditures (see Report, at 67-69, 117-123).

many existing tracker mechanisms that could not be collapsed into a single reconciliation proceeding under the Utility of the Future, Today regulatory model (Tr. 2, at 534-535).

Commenters also disagree about the complexity and administrative burden associated with the need to scrutinize the accuracy of cost estimates under a future test year ratemaking model. The Attorney General anticipates a major challenge when it comes time for the Department to review and approve cost estimates, arguing that she will be at a significant disadvantage relative to the electric distribution companies who will hold all of the information and will have an incentive to inflate the estimates (Tr. 2, at 442, 454-455, 514-515). National Grid, NECEC, and ENE all counter this concern by pointing to several mitigating tools that the Department could implement with a future test year ratemaking model, including basing cost estimates on an historic baseline of expenditures, soliciting stakeholder input, employing bi-directional performance metrics and incentives, and implementing an earnings sharing mechanism (Tr. 2, at 414-415, 431, 437, 467).

Finally, several commenters voice criticism of the Department's proposed capital investment tracker mechanism for CAMP investments. NECEC, National Grid and Northeast Utilities express concern that this tool would bias electric distribution company investment planning towards customer-facing grid modernization investments, resulting in weaker benefit-cost analyses and diminished prospects for achieving the Department's four grid modernization objectives (Tr. 2, at 333-338). Similarly, the Attorney General and NECEC caution that the capital expenditure tracker may skew electric distribution companies to favor capital investments over non-capital investment activities (Tr. 2, at 484, 499).

B. Marketing, Education, and Outreach Plan

In the Straw Proposal, the Department noted that the successful implementation of grid modernization will require fundamental changes in the relationship between the companies and their customers, because customer participation is necessary to realize many of the benefits of grid modernization. Straw Proposal at 19. The Department proposed requiring each electric distribution company to include a proposed marketing, education, and outreach plan, including a timeline, strategies, and a budget, in the company's CAMP. Straw Proposal at 19-20.

Unitil, Northeast Utilities, and National Grid assert that effective marketing practices are critical to engendering support from customers and for keeping customers informed in advance about changes to company billing practices (Tr. 4, at 809; Northeast Utilities Reply Comments at 13). Commenters referenced a report indicating that residential customers typically spend about nine minutes per year interacting with their utility as illustrative of customers' current lack of engagement (Tr. 4, at 837-838; Northeast Utilities Reply Comments at 5). These commenters contend that drastically increased customer participation will be necessary to achieve the full benefits of grid modernization and that the degree of customer education required to effectuate that participation is significant (Tr. 4, at 809, 837-838; Northeast Utilities Reply Comments at 5). National Grid asserts that the scope of marketing and education needed for grid modernization to succeed is comparable to the marketing approach undertaken to promote recycling, because the successes of both programs depend on fundamental shifts in consumer behavior (Tr. 4, at 809).

The companies agree that the most effective approach for marketing to and educating customers about grid modernization consists of two components: (1) a statewide, collaborative effort among companies to explain broader grid modernization concepts to the public

generally; and (2) local, independent efforts by individual companies to educate their customers about the more specific effects grid modernization will have on their individual lifestyles (Tr. 4, at 834-836; Unitil Reply Comments at 18). Unitil references the Mass Save energy efficiency program as an example of a statewide marketing program that has effectively marketed both broadly and locally (Unitil Reply Comments at 18). Northeast Utilities and National Grid similarly point to Mass Save as a marketing model for grid modernization (Tr. 4, at 834, 849). Unitil also emphasizes the importance of individual, local marketing efforts because the companies are commencing grid modernization from varied starting places and will therefore offer their customers particular services on differing implementation schedules (Unitil Reply Comments at 18).

C. Process for Adoption of New Technologies

In the Straw Proposal, the Department solicited input on: (1) the electric distribution companies' current research and development ("R&D") budgets, activities, and projects; and (2) the Department's role in facilitating the adoption of new technologies. Several commenters argue that electric distribution companies should be involved in substantial efforts to conduct R&D that lead to the deployment of emerging technologies through collaboration and innovation with industry and assert that these efforts should leverage ratepayer funding (ENE Comments at 3-4; IREC Comments at 7; National Grid Comments at 18; NECEC Comments at 8-9; DOER Comments at 2). In contrast, Northeast Utilities, Unitil and the Attorney General argue that increased R&D should not be a part of an electric distribution company's portfolio, instead asserting that current efforts in the form of pilots and industry collaboration will provide sufficient benefits to ratepayers (Tr. 1, at 157; Northeast Utilities Comments at 22; Unitil Comments at 20).

National Grid contends that dedicated and predictable funding would enable electric distribution company R&D efforts to provide system and ratepayer benefits (National Grid Comments at 19). NECEC strongly supports the encouragement of R&D investment by electric distribution companies and argues that they must play a significant role in this effort to capture the opportunities and benefits provided by grid modernization (NECEC Reply Comments at 8-9). Further, NECEC asserts that electric distribution companies must serve as technology testers, pilot and demonstration project partners and early technology adopters (NECEC Reply Comments at 9). Unitil and National Grid emphasize the inherent risk related to R&D efforts, specifically the possibility of failure, and the need for cost recovery in such circumstances (Unitil Reply Comments at 8; National Grid Reply Comments at 12).

MassCEC asserts that microgrids could be a significant component of a modern grid, notes that microgrid capabilities and potential benefits align with the Department's grid modernization objectives, and highlights the role of a pending "Microgrid Challenge"⁶ that would advance the understanding of the benefits, costs, and business models of microgrids through pilot projects in the Commonwealth (MassCEC Reply Comments at 3-5).

D. Metrics

In the Straw Proposal, the Department emphasized the importance of targeted, well-designed metrics in evaluating an electric distribution company's implementation of its GMP and CAMP, and progress towards the grid modernization objectives. Straw Proposal

⁶ The Microgrid Challenge pilot program is an effort proposed by the MassCEC Microgrid Study to explore business models and benefits, and address technical and regulatory challenges of advanced microgrid deployment through actual projects. The MassCEC will solicit and fund selected competitive proposals using carbon reducing technologies and addressing municipal security, new municipal development, and energy reliability (MassCEC Reply Comments, Exhibit A at 10-4 through 10-5).

at 29. In addition, the Department proposed two types of metrics for the electric distribution companies to include in their GMPs for each of the four grid modernization objectives. These are: (1) infrastructure metrics that track the implementation of grid modernization technologies and systems; and (2) performance metrics that measure progress towards the objectives of grid modernization. Straw Proposal at 29-30.

Commenters express widespread support for the development and adoption of grid modernization metrics and offer suggestions on numerous topics. Comments address: (1) the purpose and scope of metrics, including whether they will apply to elements outside the scope of a company's complete control; and (2) the process for developing statewide metrics, including the integration of stakeholder input.

Most commenters, including the electric distribution companies and BRIDGE Energy, agree that the general purpose of metrics is to measure electric distribution companies' progress towards and attainment of the grid modernization objectives (Tr. 3, at 678, 695, 722, 741-742; Northeast Utilities Reply Comments at 16). However, some stakeholders request that the Department provide additional clarity and detail around the four grid modernization objectives to ensure that electric distribution companies are achieving measurable progress towards the objectives (Tr. 3, at 678, 755-756; Northeast Utilities Reply Comments at 15). Northeast Utilities argues that such guidance would help electric distribution companies to decide where to put their efforts and how to achieve particular goals (Tr. 3, at 706-707). Unitil asserts that it would be useful to know whether the purpose of a metric is to simply measure progress, create an incentive, or enforce a minimum expectation (Tr. 3, at 679-680). Unitil also asserts that it would be helpful to have a better understanding of the level of

improvement (e.g., continuous, incremental, or significant) that the companies should seek for each of the objectives (Tr. 3, at 705). Other commenters, including National Grid and the Attorney General, argue that the Department should not provide additional guidance on the grid modernization goals (National Grid Reply Comments at 13; Attorney General/Low Income Network/AIM Reply Comments at 5-7). However, the electric distribution companies and the Attorney General agree that the Department should not assign specific numerical targets for an objective, such as reducing the effect of outages by a certain percent (Tr. 3, at 706, 726; National Grid Reply Comments at 13).

Unitil supports the Department's proposal to establish progress metrics with the initial purpose of recording and reporting relevant information without a decision to connect the metrics to penalties or rewards in the future (Tr. 3, at 676-677). In contrast, National Grid and BRIDGE Energy argue that metrics should reflect a company's ability to deliver value to its customers (Tr. 3, at 673-674; BRIDGE Energy Reply Comments at 4-5). These commenters assert that the Department's grid modernization goals should be aligned with penalties and incentives as part of a regulatory model that utilizes forward-looking and performance-based ratemaking elements to encourage cost-effective grid modernization efforts (Tr. 3, at 675-677; BRIDGE Energy Comments at 22). National Grid contends that this approach of aligning goal-setting, investment planning, and cost recovery will strengthen the abilities of electric distribution companies to meet their grid modernization objectives (National Grid Comments at 24).

Unitil and Northeast Utilities assert that the scope of grid modernization metrics should only measure performance that is within an electric distribution company's complete control,

and contend that companies should not be held accountable for attaining objectives that are dependent upon the decisions and actions of other stakeholders (Tr. 3, at 679, 682). Unutil argues that the role of the utility is to enable the adoption of grid modernization services, not necessarily to provide these services to its customers (Unutil Comments at 5). Unutil further argues that while electric distribution companies have a role in helping customers to understand their energy consumption and the impacts of the energy marketplace on their bill, third-party providers in competitive markets will be best positioned to educate customers about managing their consumption through the direct marketing of their products (Tr. 3, at 764-765). In contrast, Arcmetra, Inc. (“Arcmetra”) asserts that electric distribution companies should begin reporting on metrics that measure progress on objectives tied to less mature technologies, such as peak shaving and integrating distributed generation, even if the outcomes are not entirely under an electric distribution company’s control (Tr. 3, at 748-749). Arcmetra argues that reporting on a small set of such metrics today would provide invaluable information about customer behavior that would benefit electric distribution companies and other stakeholders (Tr. 3, at 749).

Northeast Utilities states that a company’s progress should be measured using quantitative and objective, rather than subjective, criteria (Tr. 3, at 682). Others, including BRIDGE Energy, assert that there is a need for metrics for grid modernization goals to account for less tangible benefits that are not easily quantified, such as improving customer satisfaction (Tr. 3, at 729-730).

Many commenters agree that there is a benefit to establishing a set of statewide metrics that are common to all utilities (Unutil Reply Comments at 16-17; Northeast Utilities Reply

Comments at 16). Commenters, however, disagree regarding the timing and the process to develop them. The electric distribution companies and the Attorney General caution against developing statewide metrics prior to the submission of GMPs (National Grid Reply Comments at 13-14; Attorney General/Low Income Network/AIM Reply Comments at 10). The electric distribution companies propose an iterative process, where statewide metrics would develop from any common or overlapping metrics proposed within the individual GMPs (Tr. 3, at 741-745). Unitil argues that allowing each electric distribution company to propose different metrics in their GMPs would provide the opportunity to learn from each other (Tr. 3, at 695, 745). National Grid contends that selecting certain metrics upfront may dictate the outcome of a GMP and, in essence, restrict a company's ability to make decisions about how best to increase value for its customers (Tr. 3, at 749-750). Northeast Utilities argues that spending significant time talking about metrics before a company knows how it is planning to meet the objectives could lengthen the process for putting together a GMP (Tr. 3, at 746-747).

Arcmetra and NECEC advocate for the development of statewide metrics prior to the submission of GMPs. Arcmetra and NECEC assert that jointly developing a set of standardized statewide metrics early on in the process would eliminate the enormous administrative burden of data aggregation and harmonization on stakeholders, who are working to accelerate the adoption of smart grid services (Tr. 3, at 704, 743). Arcmetra urges the Department to require the electric distribution companies to track and report on a short set of customer performance metrics starting as soon as possible (Arcmetra Reply Comments at 3-4). Arcmetra contends that ensuring that the electric distribution companies collect the same data

and calculate metrics in a consistent manner early on increases the utility of the data for purposes, such as surveys on marketing, education, and outreach (Tr. 3, at 704).

Many commenters agree that integrating stakeholder input into metrics is an important and useful step in the process of developing metrics (Tr. 3, at 675, 692, 743, 789; Unitil Reply Comments at 16; Northeast Utilities Reply Comments at 6, 17; BRIDGE Energy Reply Comments at 7; Cape Light Compact (“Compact”) Reply Comments at 2; NECEC Reply Comments at 15; ENE at 2-3). However, there is some disagreement among NECEC, BRIDGE Energy, and the electric distribution companies, regarding the appropriate level of involvement and timing for integrating stakeholder participation (Tr. 3, at 637, 647, 692, 790). National Grid asserts that stakeholder outreach should focus on providing feedback on a company’s high-level goals for grid modernization and investments (National Grid Reply Comments at 9). Northeast Utilities suggests adopting an extensive stakeholder outreach process similar to the one that Northeast Utilities developed for its energy efficiency programs as a way of leveraging stakeholder input in developing its GMP (Northeast Utilities Reply Comments at 17). According to Northeast Utilities, the company would tailor its outreach and utilize tools, such as design charrettes, focus groups, informal meetings, and summits, to provide the most appropriate forum for engaging stakeholders and receiving their input (Northeast Utilities Reply Comments at 17). BRIDGE Energy suggests that electric distribution companies vet their GMPs with customers and stakeholders prior to formal submission of individual GMPs to the Department (BRIDGE Energy Reply Comments at 7). Ultimately, electric distribution companies maintain that the stakeholder process should not be overly prescriptive, and that companies should have full control over the metrics that they

ultimately include in their GMPs (National Grid Reply Comments at 9; Northeast Utilities Reply Comments at 17; Unitil Reply Comments at 13).

Some commenters expect that the Department will have an active role in guiding the stakeholder process. They suggest that the Department convene technical workshops to foster a common understanding and language about metrics, and explore appropriate statewide progress metrics that could be included in GMPs (Tr. 3, at 766; Northeast Utilities Reply Comments at 16). BRIDGE Energy envisions that the Department would open a separate proceeding to develop statewide metrics to combine existing measurement systems developed in the GMPs (BRIDGE Energy Reply Comments at 6).

III. CYBERSECURITY, PRIVACY, AND METER DATA ACCESS

In the Straw Proposal, the Department recognized that cybersecurity is critical to the operation of an electric distribution company and that an electric distribution company must continually assess and upgrade its electronic system defenses against potential cyberattacks. Straw Proposal at 35. In addition, we recognized the possibility that grid modernization initiatives could increase the vulnerability of the electric grid to cyberattacks due to:

- (1) increasing the number of digital access points within the electric distribution system;
- (2) increasing the number of and level of control by networked devices; and (3) increasing the granularity of customer usage data. Straw Proposal at 35.

The Department emphasized that protecting customer data must be a high priority for electric distribution companies. Straw Proposal at 37. At the same time, in order to realize the benefits of a modern grid, electricity usage and consumption data must be available to customers, as well as to authorized competitive electricity suppliers and other service providers. Straw Proposal at 37. Several commenters assert that the Department must

conclude a separate proceeding on cybersecurity, privacy and meter data access before electric distribution companies file their GMPs (Attorney General/AIM Comments at 15; National Grid Comments at 13; Northeast Utilities Comments at 9; Unitil Comments at 19). NECEC argues that compliance with national standards and existing best practices, and utilization of a third-party audit process in the companies' grid modernization efforts are sufficient mechanisms to ensure cybersecurity and data privacy, and that a separate proceeding may not be necessary (NECEC Comments at 21-22). EnerNOC Inc. ("EnerNOC") highlights the United States Department of Energy and National Institute of Standards and Technology's efforts at creating standards and an architecture for the smart grid, stating that such standards and products are designed to ensure security and privacy in real-time metering data delivery (Tr. 4 at 832-833). National Grid suggests building enhanced privacy plans around existing consumer privacy rules, as electric distribution companies currently do for their systems (Tr. 4, at 878-880). Similarly, the Attorney General proposes maintaining existing consumer protections regarding customer privacy and adding to these, as necessary (Tr. 4, at 822). Unitil and Northeast Utilities express concern that public dissemination of their cybersecurity and privacy proposals in their GMP filings may compromise their cybersecurity efforts (Northeast Utilities Comments at 21-22; Unitil Comments at 19).

With respect to data access, a number of commenters state that access to advanced metering data for customers and electric distribution companies is a critical component of achieving grid modernization (Tr. 4, at 831; ISO-NE Comments at 4; NECEC Comments at 20-21; Retail Electricity Supply Association ("RESA") Comments at 8-9). These commenters emphasize the importance of customer access to easy-to-understand near real-time

and real-time data, and the value of that data in a customer's understanding of his/her impact on the electric system (Arcmetra Comments at 2-3; NECEC Comments at 21). RESA argues that current data access policies prevent sufficient and adequate access for third-party service providers (RESA Comments at 9). RESA proposes adoption of a standard protocol to share data with third parties based on a common language and data standard, as well as a common customer consent process across the Commonwealth's electric distribution companies (RESA Comments at 9-14).

IV. CONCERNS ABOUT HEALTH EFFECTS AND OPT-OUT PROVISIONS

A. Concerns about Health Effects

In the Straw Proposal, the Department recognized the possibility that some electricity customers would question the effects of radio frequencies ("RF") on their health. Straw Proposal at 31. The Department received numerous comments from individuals and organizations on the potential health effects resulting from exposure to RF emitted by certain electric meters⁷ (HaltMASmartMeters Comments at 1, 3; StopSmartMetersMassachusetts Comments at 1-3; EMR Policy Institute ("EMRPI") Comments at 1-2; Massachusetts Association for the Chemically Injured, Inc. ("MACI") Comments at 1-2; American Academy of Environmental Medicine ("AAEM") Comments at 1-3; David Carpenter Comments at 4).

⁷ Commenters concerned about health effects of RF from electric meters frequently use the term "smart meters." However, the term "smart meter" may suggest a variety of characteristics, including the ability to capture granular usage information and enable two-way communication between a utility and customers. Further, the emission by electric meters of RF energy is not limited to meters traditionally called "smart meters," and "smart meters" may use a non-wireless communication system, and thus do not emit RF energy. As such, in this section, we use the term "RF-emitting meters," to reflect what these commenters refer to as "smart meters."

Additionally, many participants addressed this issue during the panel hearing session on Health and Safety held on February 27, 2014 (Tr. 4, at 935-1074).

Several commenters assert that RF-emitting meters pose a health threat to the public, and particularly to subsets of the population that report chemical and electrical sensitivity (Tr. 4, at 949, 956-958, 986, 994; MACI Comments at 1-2; AAEM Comments at 1-2; HaltMASmartMeters Reply Comments at 6). These commenters argue that sensitive populations may be unable to live in their homes with the deployment of RF-emitting meters (StopSmartMetersMassachusetts Comments at 4; HaltMASmartMeters Comments at 1; MACI Comments at 5).

Commenters contend that current Federal Communication Commission (“FCC”) standards to which RF-emitting meter manufacturers are required to adhere are outdated, and that studies that indicate meter adherence to these standards is inadequate (StopSmartMetersMassachusetts Comments at 4-5; HaltMASmartMeters Reply Comments at 5; MACI Comments at 5). These commenters argue that FCC standards only account for thermal effects and do not address non-thermal effects (Tr. 4, at 965-966; AAEM Comments at 2; HaltMASmartMeters Reply Comments at 5).⁸ Additionally, they assert that studies evaluating RF exposure, including those on which FCC bases its standards, have not looked specifically at RF-emitting meters, have rejected critical variables such as the effects of whole body exposure, have not evaluated RF exposure impacts on children, and are inherently flawed in their research methodologies (StopSmartMetersMassachusetts Comments at 3-5; HaltMASmartMeters Reply Comments at 5; MACI Comments at 5-6).

⁸ Thermal effects refer to body tissue heating and associated tissue damage, whereas non-thermal effects refer to all other biological impacts (Tr. 4, at 943).

Gradient Consulting (“Gradient”) disagrees and asserts that existing standards adequately protect public health (Tr. 4, at 945, 977-979). Gradient argues that standards bodies establish these standards through an evaluation of peer-reviewed, reproducible science, evaluating both thermal and non-thermal effects of RF exposure (Tr. 4, at 945, 977-979). Gradient also notes that a number of national and international standards bodies agree on the adequacy of existing RF standards, and that a number of these bodies have recently reviewed their standards (Tr. 4, at 978, 1012).⁹

Commenters cite a number of studies that identify both thermal and non-thermal effects of RF exposure, concluding that there is evidence for adverse health effects (Tr. 4, at 958; MACI Comments at 4; David Carpenter Comments at 2-4). MACI and HaltMASmartMeters argue that the health impacts of RF-emitting meters are not adequately settled scientifically and that further study and research are necessary (MACI Comments at 4-5; HaltMASmartMeters Reply Comments at 6). AAEM contends that studies exist that correlate RF exposure with cancer, neurological disease, reproductive disorders, immune dysfunction, and electromagnetic hypersensitivity (AAEM Comments at 1-3). Commenters also note that the World Health Organization (“WHO”) recently classified RF energy as a class 2B possible carcinogen, as evidence of the detrimental effects of exposure to emissions from RF-emitting electric meters (Tr. 4, at 947; StopSmartMetersMassachusetts Comments at 2-3; HaltSmartMetersMA Reply Comments at 5). Gradient asserts that national and international studies have not shown a

⁹ These include Health Canada in 2013; The International Commission on Non-Ionizing Radiation Protection in 2009; and The Health Protection Agency in 2012 (Tr. 4, at 1012).

causal link between RF exposures and any detrimental health effects, including those identified above (Tr. 4, at 943, 986, 1069).

MACI and David Carpenter assert that cumulative and aggregate exposure is a critical factor for which existing studies and standards do not account, and that the deployment of new RF-emitting electric meters will add to the existing RF baseline in the environment, further compromising the health of sensitive individuals (MACI Comments at 4; David Carpenter Comments at 4-6). They also maintain that RF exposure from banks of meters, such as in a large apartment building, is particularly problematic given the potential for higher levels of RF emissions and that studies have not evaluated whether this type of installation is in compliance with RF standards (Tr. 4, at 997, 1032, 1033; Fournier Reply Comments at 11). Gradient states that RF exposure from meters at a distance of four feet is hundredths of a percent of the FCC exposure standard, and thus unlikely to cause any adverse health impacts (Tr. 4, at 1005-1006).

B. Opt-Out Provisions

In the Straw Proposal, the Department proposed requiring the electric distribution companies to develop and include within their GMPs a model tariff for customers to opt out of advanced metering functionality for any reason. Straw Proposal at 32. We stated that each company should detail its opt-out approach and include cost assumptions if the company proposed to charge for opt-out. Straw Proposal at 32.

National Grid supports an opt-out approach to advanced metering functionality, stating that consumer choice and opt-out are underlying tenets of its smart current grid program, and supports a cost of service requirement for those wishing to opt-out to cover any associated costs (Tr. 4, at 807, 915-916). Northeast Utilities supports an option for customers to opt out

if the Department requires the deployment of advanced metering functionality across all customers, but does not support such a requirement, and instead argues for an opt-in approach as discussed below (Tr. 4, at 917).

Unitil argues that its existing installed AMI metering capability should not be subject to an opt-out provision as it is not an RF-transmitting technology, and allowing for opt-out would devalue its system (Tr. 4, at 914). Northeast Utilities and Unitil argue that in a situation where AMI is required across their customer bases, opt-out would result in a loss of benefits, efficiencies, and synergies associated with the AMI system and may require repeated and expensive installation and removal efforts, as well as duplicative truck rolls for meter reading (Tr. 4, at 914, 920-921).

Northeast Utilities, the Attorney General, and the Low Income Network advocate for a targeted, opt-in approach for the installation of AMI and enablement of advanced metering functionality (Tr. 2, at 375-376, 380-381; Tr. 4, at 867, 913, 917, 918; Northeast Utilities Reply Comments at 6-7). Unitil also supports a targeted opt-in approach applicable to advanced metering functionalities, but does not support an opt-in approach for its existing AMI meters (Tr. 4, at 914, 916; Unitil Reply Comments at 4, 17). Northeast Utilities and Unitil indicate that under such a targeted opt-in approach, the electric distribution companies would provide advanced metering functionalities only to those customers who are interested (Tr. 4, at 913). Northeast Utilities, the Attorney General, and the Low Income Network assert that this approach targets customers who are willing and able to invest time and money into taking advantage of the benefits of advanced metering functionality, and thus minimizes costs while

providing the benefits of advanced metering functionality for those who request it (Tr. 4, at 913, 916-918).

The Low-Income Network requests a no-cost, opt-out option for low-income customers (Tr. 4, at 824). MACI does not support the rollout of AMI meters but argues that, if the Department requires RF-emitting meters, individuals should be able to opt-out of RF-emitting meter installation without a fee (MACI Reply Comments at 9).

V. TIMING AND PROCESS

A. Timing for Filing First GMP

In the Straw Proposal, the Department proposed requiring each electric distribution company to develop and submit its GMP within six months of a final Order in this proceeding. Straw Proposal at 3. Several commenters raise concerns regarding timing and assert that the Department should delay triggering the six-month clock for electric distribution companies to develop and file their GMPs until some or all of the following related matters are complete: (1) the TVR proceeding in D.P.U. 14-04; (2) the electric vehicle (“EV”) charging proceeding in D.P.U. 13-182; (3) inquiries into cybersecurity and customer data privacy and access issues; (4) existing and proposed smart grid pilot programs;¹⁰ and (5) market and customer research.

Several commenters urge the Department to conclude its TVR proceeding in D.P.U. 14-04, before requiring electric distribution companies to file their GMPs, asserting that clarity on TVR policy would provide valuable guidance on GMP design components, particularly in the areas of advanced metering functionality and the associated benefit-cost

¹⁰ Fitchburg Gas and Electric Light Company, D.P.U. 09-31; NSTAR Electric Company, D.P.U. 09-33; Massachusetts Electric Company/Nantucket Electric Company, D.P.U. 11-129.

analysis (Attorney General/AIM Comments at 13; Unitil Reply Comments at 11; Northeast Utilities Comments at 8-9, 21, A2; Northeast Utilities Reply Comments at 10-11; ENE Comments at 2; Low Income Network Comments at 3). Similarly, Unitil argues that the Department should conclude its EV charging proceeding in D.P.U. 13-182, before commencing a timeline for submitting GMPs (Unitil Reply Comments at 11). Unitil and Northeast Utilities advise the Department to complete its investigations into cybersecurity and customer data privacy and access issues prior to GMP submittals (Unitil Comments at 19; Unitil Reply Comments at 11; Northeast Utilities Comments at 9-10, 21-22; Northeast Utilities Reply Comments at 10-11). The Attorney General and AIM, jointly, and Northeast Utilities also recommend that the Department delay GMP filing requirements until electric distribution companies conclude existing and proposed smart grid pilot programs, asserting that the pilots could provide practical information for all stakeholders (Attorney General/AIM Comments at 11-12; Northeast Utilities Reply Comments at 10). Finally, Northeast Utilities argues that it is important to allow sufficient time prior to filing a GMP for market and customer research that will influence many aspects of the plan, including overall scope, implementation strategy, and customer education and outreach strategies (Northeast Utilities Reply Comments at 12-13).

In contrast, National Grid supports the Department's proposal to require electric distribution companies to file their initial GMPs within six months of a final Order in this proceeding, but requests flexibility to revise its GMP after the Department concludes any proceedings regarding TVR, EV charging and cybersecurity (National Grid Comments at 13, 15). NECEC supports the six-month timeframe for filing GMPs, as long as the Department addresses data access issues in its final Order in this proceeding and with the understanding

that electric distribution companies may need to revise their GMPs after the Department issues an order in its TVR proceeding (NECEC Reply Comments at 12).

B. Process

Several commenters assert that the Department must protect existing due process rights for stakeholders that may desire to participate in adjudicatory proceedings regarding the development and review of GMP filings (Attorney General/Low Income Network/AIM Reply Comments at 8-9, 13). The Compact similarly asks the Department to ensure that a full process involving comment, discovery, technical session and final comments be available to stakeholders in the development and review of GMPs (Compact Reply Comments at 2). DOER requests that the Department establish a Grid Modernization Technical Committee to review new grid facing technologies that enable grid modernizing features, and encourages the Department to establish an open and transparent process for developing GMPs (DOER Reply Comments at 2, 5). NECEC recommends a less formal stakeholder input process that focuses on the high-level direction for grid modernization investments (NECEC Reply Comments at 15). National Grid generally supports this less formal process, and urges against adopting a prescriptive model, such as that of the Energy Efficiency Advisory Council (National Grid Reply Comments at 9). National Grid asserts that a prescriptive model could impede GMP implementation (National Grid Reply Comments at 9). Northeast Utilities recommends that electric distribution companies utilize their expertise to develop comprehensive GMPs and rely on best practices from interactions with stakeholders in the energy efficiency realm to actively seek and integrate stakeholder input to the GMP development process (Northeast Utilities Reply Comments at 6).

APPENDIX 2—ADDITIONAL SOURCES FOR SECTION VII.A, CONCERNS ABOUT HEALTH EFFECTS

As noted in Section VII.A, above, in addressing concerns regarding health effects, the Department reviewed a number of sources in addition to those provided by commenters. These sources are listed below.

Australian Radiation Protection and Nuclear Safety Agency, Fact Sheet 16: Smart Meters or Advanced Metering Infrastructure (AMI) (2013), http://www.arpana.gov.au/pubs/factsheets/016is_smartmeters.pdf.

British Columbia Center for Disease Control, Measurement of Radiofrequency (RF) Emissions from BC Hydro's Itron Smart Meters (2012), [available at http://www.bccdc.ca/NR/rdonlyres/43EF885D-8211-4BCF-8FA9-0B34076CE364/0/June92011_BCCDCReport_BCHydroSmartMeters.pdf](http://www.bccdc.ca/NR/rdonlyres/43EF885D-8211-4BCF-8FA9-0B34076CE364/0/June92011_BCCDCReport_BCHydroSmartMeters.pdf).

California Council on Science and Technology, Health Impacts of Radio Frequency Exposure from Smart Meters (2011), [available at https://www.ccst.us/publications/2011/2011smart-final.pdf](https://www.ccst.us/publications/2011/2011smart-final.pdf).

Cascadia PM, LLC, Report of Results of Smart Meter RF Testing – Maui (2014), [available at http://assets.fiercemarkets.com/public/sites/energy/reports/cascadiasgreport.pdf](http://assets.fiercemarkets.com/public/sites/energy/reports/cascadiasgreport.pdf).

City of Naperville Smart Grid Initiative, Pilot 2 RF Emissions Testing – Summary Report – V2.0 (2011), [available at http://www.naperville.il.us/emplibrary/Smart_Grid/Pilot2-RFEmissionsTesting-SummaryReport.pdf](http://www.naperville.il.us/emplibrary/Smart_Grid/Pilot2-RFEmissionsTesting-SummaryReport.pdf).

Colorado Department of Public Health and Environment, Fact Sheet on Smart Meters and Associated Health Concerns (2012), [available at http://navopache.coopwebbuilder.com/sites/navopache.coopwebbuilder.com/files/colorado_dept_public_health_stmnt.pdf](http://navopache.coopwebbuilder.com/sites/navopache.coopwebbuilder.com/files/colorado_dept_public_health_stmnt.pdf).

Danish Health and Medicines Authority, Swedish Radiation Safety Authority, Norwegian Radiation Protection Authority, and Iceland Radiation Safety Authority, Exposure from Mobile Phones, Base Stations and Wireless Networks: A Statement by the Nordic Radiation Safety Authorities (2013), [available at http://www.nrpa.no/dav/1ce2548717.pdf](http://www.nrpa.no/dav/1ce2548717.pdf).

Electric Power Research Institute, Characterization of Radio Frequency Emissions from Two Models of Wireless Smart Meters (2011), [available at http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000000001021829](http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000000001021829).

Electric Power Research Institute, An Investigation of Radiofrequency Fields Associated with the Itron Smart Meter (2010), available at <http://smartgridcc.org/wp-content/uploads/2012/08/000000000001021126.pdf>.

Federal Communications Commission, Docket No. FCC 13-39, First Report and Order, Proposed Rulemaking and Notice of Inquiry in ET Docket Nos. 03-137 13-84 (2013), available at https://apps.fcc.gov/edocs_public/attachmatch/FCC-13-39A1.pdf.

Federal Communications Commission, OET Bulletin 56: Questions and Answers about Biological Effects and Potential Hazards of Radiofrequency Electromagnetic Fields (1999), available at http://transition.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet56/oet56e4.pdf.

Federal Communications Commission, OET Bulletin 65: Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields (1997), available at http://transition.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet65/oet65a.pdf.

Health Canada, It's Your Health: Smart Meters (2011), available at http://www.hc-sc.gc.ca/hl-vs/alt_formats/pdf/iyh-vsv/prod/meters-compteurs-eng.pdf.

Health Council of the Netherlands, BioInitiative Report Review (2008), available at http://www.gezondheidsraad.nl/sites/default/files/200817E_0.pdf.

Health Council of the Netherlands, Mobile Phones and Cancer (2013), available at http://www.gezondheidsraad.nl/sites/default/files/201311_Mobile_Phones_Cancer_Part1.pdf.

India Ministry of Information and Broadcasting, Study on Radiation from Mobile Towers and Cell Phones (2013), available at <http://inbministry.blogspot.in/2013/02/study-on-radiation-from-mobile-towers.html>.

Institute of Electrical and Electronics Engineers, COMAR Technical Information Statement: Radiofrequency Safety and Utility Smart Meters (2013), available at [http://ewh.ieee.org/soc/embs/comar/COMAR%20Smart%20Meter%20TIS%20\(9-25-2013\).pdf](http://ewh.ieee.org/soc/embs/comar/COMAR%20Smart%20Meter%20TIS%20(9-25-2013).pdf).

International Commission on Non-Ionizing Radiation Protection, Exposure to High Frequency Electromagnetic Fields, Biological Effects and Health Consequences (100 kHz-300 GHz) (2009), available at <http://www.icnirp.de/documents/RFReview.pdf>.

Letter from Julius Knapp, Chief, Federal Communications Commission Office of Engineering and Technology, to Cindy Sage, Sage Associates Environmental Consultants (August 6, 2010),

available at <http://www.maine.gov/dhhs/mecdc/environmental-health/documents/smart-meter-fcc-letter-august-2010.pdf>.

Memorandum from Roger Levy and Janie Page, Smart Grid Technical Advisory Project, Lawrence Berkeley National Laboratory, to Patrick Hudson, Michigan Public Service Commission (April 18, 2012), available at <http://smartresponse.lbl.gov/reports/aaem041812.pdf>.

Memorandum from Roger Levy and Janie Page, Smart Grid Technical Advisory Project, Lawrence Berkeley National Laboratory, to Patrick Hudson, Michigan Public Service Commission (April 12, 2012), available at <http://smartresponse.lbl.gov/reports/schsa.pdf>.

Maine Public Utilities Commission, Docket No. 2011-00262 Examiners Report (March 25, 2014), available at <https://www2.dteenergy.com/wps/wcm/connect/1c500d03-f5b5-4788-a8bf-b5b102850584/MaineReportAMI.pdf?MOD=AJPERES>.

Michigan Public Service Commission, U 17000 Report to the Commission (2012), available at <http://efile.mpsc.state.mi.us/efile/docs/17000/0455.pdf>.

Public Health England, Smart Meters, <http://www.hpa.org.uk/Topics/Radiation/UnderstandingRadiation/UnderstandingRadiationTopics/ElectromagneticFields/RadioWaves/SmartMeters/> (last visited June 11, 2014).

Martin Rössli et al., Systematic Review on the Health Effects of Exposure to Radiofrequency Electromagnetic Fields from Mobile Phone Base Stations, 88 Bulletin of the World Health Organization 887 (2010), available at <http://www.who.int/bulletin/volumes/88/12/09-071852/en/>.

Shangcheng Xu et al., Exposure to 1800 MHZ Radiofrequency Radiation Induces Oxidative Damage to Mitochondrial DNA in Primary Cultured Neurons, 1311 Brain Research 189 (2010).

Texas Public Utilities Commission, Health and RF EMF from Smart Meters (2012), available at http://www.puc.texas.gov/industry/electric/reports/smartmeter/smartmeter_rf_emf_health_12-14-2012.pdf.

Vermont Department of Health, Radio Frequency Radiation and Health: Smart Meters (2012), available at http://healthvermont.gov/pubs/ph_assessments/radio_frequency_radiation_and_health_smart_meters.pdf.

Vermont Department of Health, Scientific and Public Health Agency Perspectives on Radio Frequency Fields Related to Smart Meters, prepared by Exponent, Inc. (2014), available at

[http://publicservice.vermont.gov/sites/psd/files/VT%20Smart%20Meter%20Health%20Report%202-10-14%20\(3\).pdf](http://publicservice.vermont.gov/sites/psd/files/VT%20Smart%20Meter%20Health%20Report%202-10-14%20(3).pdf).

World Health Organization, Electromagnetic Fields and Public Health: Electromagnetic Hypersensitivity, <http://www.who.int/peh-emf/publications/facts/fs296/en/> (last visited June 11, 2014).

World Health Organization, Fact Sheet No. 193: Electromagnetic Fields and Public Health: Mobile Phones, <http://www.who.int/mediacentre/factsheets/fs193/en/> (last visited June 11, 2014).