



The Commonwealth of Massachusetts

DEPARTMENT OF PUBLIC UTILITIES

D.P.U. 15-120

May 10, 2018

Petition of Massachusetts Electric Company and Nantucket Electric Company, d/b/a National Grid for Approval by the Department of Public Utilities of its Grid Modernization Plan.

D.P.U. 15-121

Petition of Fitchburg Gas and Electric Light Company d/b/a Unitil for Approval by the Department of Public Utilities of its Grid Modernization Plan.

D.P.U. 15-122

Petition of NSTAR Electric Company and Western Massachusetts Electric Company, each d/b/a Eversource Energy, for Approval by the Department of Public Utilities of their Grid Modernization Plan.

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TABLE OF CONTENTS

I.	EXECUTIVE SUMMARY	1
II.	INTRODUCTION	5
III.	PROCEDURAL HISTORY	8
IV.	DESCRIPTION OF PROPOSALS	13
A.	Introduction	13
B.	D.P.U. 15-120, National Grid	14
1.	Introduction	14
2.	Proposed Investments	14
a.	Field Deployment and Enabling Infrastructure	14
i.	Introduction	14
ii.	Field Deployment	15
iii.	Enabling Infrastructure	16
b.	Proposed Investment Scenarios	18
i.	Introduction	18
ii.	Balanced Plan Scenario	19
iii.	AMI-Focused	20
iv.	Grid-Focused Scenario	20
v.	Opt-In Scenario	21
c.	Cybersecurity	21
d.	Deployment Schedule and Business Case Analysis	23
e.	Distributed Energy Resources	24
f.	Research, Development, and Deployment	25
C.	D.P.U. 15-121, Unitil	25
1.	Introduction	25
2.	Proposed Investments	26
a.	Distributed Energy Resource Enablement	26
b.	Grid Reliability	26
c.	Distribution Automation	27
d.	Customer Empowerment	27
e.	Workforce and Asset Management	28
f.	Cybersecurity	28
g.	Customer Education	29
3.	Business Case Analysis	29
4.	Research, Development, and Deployment	29
D.	D.P.U. 15-122, Eversource	30
1.	Introduction	30
2.	Proposed Customer-Facing Investments	31
a.	Overview	31
b.	Customer Engagement Initiative	32

c.	Customer Education and Outreach	34
3.	Proposed Grid-Facing Investments	34
a.	Overview	34
b.	Distribution Network Systems Operations	35
i.	Distribution Network Systems Operator Initiative	35
(A)	Advanced Distribution Management Systems	35
(B)	Advanced System Load Flow	36
(C)	VVO	37
ii.	Automation Initiative	38
(A)	Automated Feeder Reconfiguration	38
(B)	Underground Automation	39
(C)	Adaptive Protection	39
iii.	Foundational Technology Initiative	40
(A)	Advanced Sensing Technology	40
(B)	Remote Fault Indicators	40
(C)	Communications Network	41
c.	Customer Engagement and Enablement	42
d.	Geographic Information System Project	42
4.	Cybersecurity	43
5.	Business Case Analysis	44
6.	Research, Development, and Demonstration Projects	44
V.	GRID MODERNIZATION INVESTMENTS	45
A.	Introduction	45
B.	Positions of the Parties	45
1.	Intervenors	45
a.	Introduction	45
b.	General Arguments	45
i.	Attorney General	45
ii.	Acadia Center	47
iii.	CLF	47
iv.	DOER	48
v.	LEAN	48
vi.	NECEC	49
c.	Plan-Specific Arguments	50
i.	D.P.U. 15-120, National Grid	50
(A)	Attorney General	50
(B)	Acadia Center	55
(C)	CLF	55
(D)	DOER	56
(E)	LEAN	59
(F)	NECEC	59
ii.	D.P.U. 15-121, Unitil	60
(A)	Attorney General	60

	(B)	CLF	66
	(C)	DOER	66
	(D)	NECEC.....	68
iii.		D.P.U. 15-122, Eversource	69
	(A)	Attorney General	69
	(B)	Acadia Center	71
	(C)	CLF	72
	(D)	DOER	73
	(E)	NECEC.....	75
	(F)	Compact.....	75
2.		Companies	80
	a.	National Grid, D.P.U. 15-120	80
	b.	Unitil, D.P.U. 15-121	87
	c.	Eversource, D.P.U. 15-122	94
C.		Analysis and Findings	99
	1.	Grid Modernization Objectives	99
		a. Introduction.....	99
		b. Reducing the Effect of Outages.....	100
		c. Optimizing Demand.....	101
		d. Integration of Distributed Energy Resources.....	102
		e. Improving Workforce and Asset Management.....	105
		f. Conclusion	105
	2.	Regulatory Review Construct	106
		a. Introduction	106
		b. Preauthorization and Future Plan Filings	107
		c. Plan Performance Reports and Timing of Prudence Reviews	110
		d. Preauthorization of Term Budget.....	113
		e. Filing Dates.....	114
	3.	Customer-Facing and Grid-Facing Investments.....	115
		a. Introduction.....	115
		b. Customer-Facing Investments	117
		i. Introduction.....	117
		ii. Business Case Analysis.....	121
		(A) Costs of Deployment	121
		(B) Benefits	124
		iii. Next Steps for Deployment of Customer-Facing Investments	135
		c. Grid-Facing Investments	137
		i. Introduction.....	137
		ii. Measurable Progress	139
		iii. Incremental	145
		iv. Business Case Analysis.....	149
		(A) D.P.U. 15-120, National Grid.....	149
		(1) Introduction.....	149

	(2)	Cost Estimates	149
	(3)	Projected Benefits	151
	(4)	Bill Impacts.....	153
	(5)	Conclusion.....	154
	(B)	D.P.U. 15-121, Unitil.....	156
	(1)	Cost Estimates	156
	(2)	Projected Benefits	158
	(3)	Bill Impacts.....	162
	(4)	Conclusion.....	163
	(C)	D.P.U. 15-122, Eversource	165
	(1)	Cost Estimates	165
	(2)	Projected Benefits	167
	(3)	Bill Impacts.....	171
	(4)	Conclusion.....	172
	(D)	Other Proposed Grid Modernization Investments	173
	(1)	Eversource.....	173
	(2)	Unitil.....	174
4.		Other Issues.....	175
	a.	Cybersecurity.....	175
	b.	Energy Efficiency	180
	c.	Research, Development, and Deployment	183
	d.	Eversource - Energy Storage Demonstration Program	186
	e.	Eversource – Electric Vehicle Infrastructure Program	186
VI.		METRICS & EVALUATION PLAN	187
	A.	Introduction	187
	B.	Description of Proposals	188
	C.	Positions of the Parties	191
	1.	Intervenors	191
	2.	Companies	194
	D.	Analysis and Findings	196
	1.	Introduction.....	196
	2.	Grid-Facing Technology Metrics	198
	a.	Infrastructure Metrics.....	198
		i. Introduction.....	198
		ii. Statewide Infrastructure Metrics.....	198
		iii. Company-Specific Infrastructure Metrics	200
	b.	Performance Metrics.....	201
	3.	Evaluation Plan	204
VII.		COST RECOVERY.....	205
	A.	Introduction	205
	B.	Description of Proposals	207

1.	D.P.U. 15-120, National Grid	207
2.	D.P.U. 15-121, Unitil	208
3.	D.P.U. 15-122, Eversource	209
C.	Positions of the Parties	210
1.	Intervenors	210
a.	General Arguments	210
b.	Plan-Specific Arguments	211
i.	D.P.U. 15-120, National Grid	211
ii.	D.P.U. 15-121, Unitil	212
iii.	D.P.U. 15-122, Eversource	213
2.	Companies	213
a.	National Grid	213
b.	Unitil	215
c.	Eversource	215
D.	Analysis and Findings	216
1.	Introduction	216
2.	Changes to Mechanism Design	216
3.	Eligibility for Targeted Cost Recovery	220
a.	Preauthorization	220
b.	Incremental	221
4.	Targeted Cost Recovery Mechanism	224
a.	Recovery Period	224
b.	Annual Factor Filing	225
c.	Revenue Requirement Calculation	226
i.	Eligible Capital Costs	226
ii.	Annual Depreciation Expense Adjustment	227
iii.	Property Tax Calculation	228
iv.	Operation and Maintenance Costs	228
v.	Labor Overhead and Clearing Account Burdens	229
d.	Expenditure Cap	231
e.	Allocation of Grid Modernization Factor	231
f.	Volumetric Rate	232
g.	Ratemaking Treatment of Premature Asset Retirements	233
h.	Other Issues	233
i.	Filing Dates	234
j.	Tariff Expiration Date	235
E.	Conclusion	235
VIII.	CONCLUSION	235
IX.	ORDER	238

I. EXECUTIVE SUMMARY

In D.P.U. 12-76-B, the Department adopted a vision of a cleaner, more efficient and reliable electric grid, which would empower customers to manage and reduce their energy costs. The Department affirms and embraces this broad vision articulated in D.P.U. 12-76-B as a guidepost for the evolution of the electric distribution industry in Massachusetts. In this Order, we consider the electric distribution companies' plans to implement that broad vision.

While the companies shared the grid modernization objectives outlined by the Department in D.P.U. 12-76-B, each company interpreted that vision differently and submitted a unique plan to address the complex and challenging implementation details of grid modernization. The Department has now investigated each company's grid modernization proposal within the context of the Department's vision and standards outlined in D.P.U. 12-76-B.

Based on a review of the evidence in these proceedings, the Department has determined it must reassess a central objective of D.P.U. 12-76-B, namely strategies for the deployment of advanced metering functionality, in order to maximize the benefits for Massachusetts ratepayers. The Department does not make this decision lightly. The evidence in these cases revealed weaknesses in the business case for advanced metering functionality presented by each company and, therefore, we declined to preauthorize any customer-facing investments at this time. The Department weighed the significant costs associated with full achievement of advanced metering functionality using advanced metering infrastructure against the considerable uncertainty regarding benefits from reduced demand,

capacity savings, and customer participation in time varying rates or other forms of dynamic pricing. We determined that the benefits of a full deployment of advanced metering functionality do not currently justify the costs.

In particular, the Department found that the primary benefits of advanced metering functionality are derived from reduced peak usage as customers respond to pricing signals. Achieving this benefit requires customers to participate in time varying rates or other dynamic pricing programs. As more customers migrate off of basic service to alternatives, such as municipal aggregation, the Department would need the certainty of wide adoption of dynamic pricing products from the competitive supply market to maximize the benefits of advanced metering functionality. Without such wide adoption, the Department lacks the needed assurance that the benefits associated with advanced metering functionality will justify the substantial costs.

There are several issues that competitive suppliers face with regard to the decision to offer dynamic pricing products, including access to customer data, billing limitations, and the inherent risk of customer choice. Given the steep increase in the number of customers on competitive supply in recent years, particularly through municipal aggregation, the uncertainty of customer participation in dynamic pricing products has increased dramatically from when the Department released D.P.U. 12-76-B in 2014.

We emphasize that the Department is not moving away from the deployment of advanced metering functionality and remains convinced that it is an important tool in meeting our grid modernization objectives. The Department intends to engage stakeholders, including

the electric distribution companies and competitive market participants, in a process to consider how to remove barriers to the implementation of dynamic pricing products for all customers. The goal of this investigation will be to enable a successful future deployment of advanced metering functionality where the benefits are certain and they justify the costs. As part of this investigation, we will consider whether an immediate targeted deployment of advanced metering functionality to certain customer groups will yield benefits that justify the costs.

In the past six months, Massachusetts has been impacted by five serious storms that have exposed weaknesses in the electric grid and power restoration. Unlike the deployment of advanced metering functionality, the evidence in these cases supports the electric distribution companies' proposed investments in grid-facing technologies, such as advanced distribution management system, automation, and Volt/VAR optimization to secure resiliency and power quality benefits. In addition, grid-facing technologies lay the foundational framework to improve the companies' ability to integrate distributed energy resources onto the electric grid, including improved visibility of where distributed energy resources can be interconnected, and management of intermittent power flow associated with these distributed energy resources.

Our Order today establishes the platform and the method for the electric distribution companies to make initial investments in grid modernization technologies to upgrade their current infrastructure and to increase the use of renewable energy, electric vehicles, and energy storage. While it is difficult to quantify direct benefits, we conclude that the

grid-facing investments we preauthorize today will make measureable progress towards meeting our grid modernization objectives by reducing outages and optimizing distribution system performance, optimizing system demand, and integrating distributed energy resources.

In light of the increased adoption of distributed energy resources, the Department has refined our grid modernization objectives to place additional focus on improved access to the distribution company system planning process to ensure cleaner, more efficient and reliable grid. Integrating distributed energy resources into system planning and operations processes will require the electric distribution companies to adopt a system planning process that includes input from third parties. Through our preauthorization of the grid-facing investments here, we have taken the significant steps towards developing a robust distributed energy market in Massachusetts.

The grid modernization process in Massachusetts has taken place over several years and will continue into the future. Since the Department first began that process, there have been significant shifts in the electric wholesale and retail markets. The Commonwealth has achieved its goal of 1,600 megawatts of solar capacity and is actively pursuing its clean energy supply goals with its Clean Energy and Offshore Wind Energy solicitations. In addition, the Federal Energy Regulatory Commission has approved Independent System Operator New England's proposed mechanism to integrate state policy-based resources into the forward capacity market. Finally, energy storage technology has transformed from concept to reality, expanding the limits of energy planning.

With a three-year preauthorization of grid-facing investments, the plans we approve today will allow the electric distribution companies to adjust their deployment strategies in order to respond quickly to lessons learned. At the same time, the Department will continue to exercise our responsibility to ensure that all investments are prudent and that the expenditure of ratepayer funds is in the public interest.

In conclusion, the magnitude of the expenditures on grid modernization investments requires certainty of ratepayer benefits at the lowest possible cost. To maximize benefits from dynamic pricing, we need an inclusive deployment strategy for competitive supply, municipal aggregation, and basic service customers. While that is developed, the electric distribution companies will begin making the foundational investments needed to modernize the electric grid and achieve our grid modernization objectives. The Department is committed to working with stakeholders to explore innovative opportunities to cost-effectively deploy advanced metering functionality, integrate distributed energy resource into system planning, and to fully engage ratepayers in their energy usage to unlock an efficient, clean, and reliable grid.

II. INTRODUCTION

In October 2012, the Department of Public Utilities (“Department”) initiated an inquiry to inform an approach to grid modernization over the short, medium, and long term. Modernization of the Electric Grid, D.P.U. 12-76 (2012). As part of that inquiry, the Department sought to develop policies that would provide electric distribution companies with the guidance and flexibility to implement grid modernization technologies and practices to

enhance reliability, reduce electricity costs, empower customer to better manage usage, and support a clean, more efficient electric system. D.P.U. 12-76, at 5.

In subsequent Orders, the Department identified several grid modernization objectives and set forth a policy framework for the review of grid modernization investments. See, generally, D.P.U. 12-76-A (2013); D.P.U. 12-76-B (2014); D.P.U. 12-76-C (2014); see also Time Varying Rates, D.P.U. 14-04-C (2014). More specifically, the Department established the following grid modernization objectives: (1) to reduce the effects 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. D.P.U. 12-76-A at 3. The Department required each electric distribution company to submit a grid modernization plan outlining how the company proposed to make measurable progress towards these grid modernization objectives. D.P.U. 12-76-B at 9, 15.

The Department required each company to include in its grid modernization plan a five-year short-term capital investment plan, including a proposed approach supported by a business case to achieve advanced metering functionality within five years of the Department's approval of the plan. D.P.U. 12-76-B at 17-25. If the business case did not justify deployment of advanced metering functionality within five years, the Department stated that the electric distribution company should include an alternate proposal that would achieve such functionality within a longer timeframe. D.P.U. 12-76-B at 17. The Department further indicated that companies that fully deploy advanced metering functionality would be eligible to seek accelerated cost recovery of grid modernization capital investments.

D.P.U. 12-76-B at 19-20. The electric distribution companies filed their respective grid modernization plans for Department review in the instant dockets.

Since the Department began its investigation of the grid modernization plans, several important developments affecting the electric industry have occurred. In particular, in August 2016, Governor Baker signed into law St. 2016, c. 188, An Act Relative to Energy Diversity (“Act”), which commits the electric distribution companies to competitively procure clean energy generation. Further, consistent with Section 15(b) of the Act, in June 2017, the Massachusetts Department of Energy Resources (“DOER”) established an energy storage target for the Commonwealth. Massachusetts has also seen a steady growth in the adoption of electric vehicles as well as increases in the deployment of distributed energy resources and the adoption of municipal aggregation programs under G.L. c. 164, § 134. These developments each present new opportunities and challenges that the Department must consider as we further our grid modernization efforts.

After review of each company’s grid modernization plan in the instant dockets and in light of the developments described above, the Department has determined that certain changes or refinements to the grid modernization policy framework outlined in D.P.U. 12-76-B are necessary. As discussed in the Sections below, these refinements include: (1) clarification of the Department’s grid modernization objectives (Section V.C.1); (2) the establishment of a three-year regulatory review construct for preauthorization of grid modernization investments (Section V.C.2); and (3) certain changes to the short-term targeted cost recovery parameters outlined in D.P.U. 12-76-B (Sections V.C.2, VII.D).

The Department's goal with grid modernization is to facilitate the transition of the electric industry towards a more sustainable regulatory model that aligns policy objectives and the public interest with business objectives. The Commonwealth must adjust to ongoing changes in the electric industry as we move forward with grid modernization. The Department's review of the proposed grid modernization plans in the instant dockets takes these changes into account and is another step toward achieving a modern electric grid in Massachusetts.

III. PROCEDURAL HISTORY

On August 19, 2015, Massachusetts Electric Company and Nantucket Electric Company d/b/a National Grid ("National Grid"), Fitchburg Gas and Electric Light Company d/b/a Unitil ("Unitil"), and NSTAR Electric Company and Western Massachusetts Electric Company, each d/b/a Eversource Energy ("Eversource") (collectively, "Companies") each filed a grid modernization plan with the Department.¹ The Department docketed the plans as D.P.U. 15-120, D.P.U. 15-121, and D.P.U. 15-122, respectively.

The Department held a joint public hearing in all three dockets on April 14, 2017.² Written comments were filed in all three dockets by the Attorney General of the

¹ On June 16, 2016, Eversource and National Grid each filed updates to their respective grid modernization plans.

² Comments were received at the public hearing from: (1) Susan Butler, Energy Committee, Greater Boston Chapter, Sierra Club; (2) Christine Marzigliano, Town of Yarmouth; (3) Nadia Arid, Emmet Environmental Law and Policy Clinic at Harvard Law School; and (4) Jee Jun Ho, Emmet Environmental Law and Policy Clinic at Harvard Law School.

Commonwealth of Massachusetts (“Attorney General”), Applied Materials, Inc. (“Applied Materials”), ChargePoint, Inc. (“ChargePoint”), the Emmet Environmental Law and Policy Clinic at Harvard Law School, the Interstate Renewable Energy Council, Inc., and the Northeast Clean Energy Council. The Towns of Barnstable, Bourne, Eastham, Sandwich, West Tisbury, and Yarmouth filed written comments in D.P.U. 15-122.

The Attorney General of the Commonwealth of Massachusetts filed a notice of intervention pursuant to G.L. c. 12, § 11E(a) in all three dockets. The Department granted full party intervenor status in all three dockets to: (1) DOER; (2) the Conservation Law Foundation (“CLF”); and (3) the Low-Income Weatherization and Fuel Assistance Program Network (“LEAN”). The Department granted limited participant status in all three dockets to: (1) NRG Energy, Inc.; (2) Energy Consumers Alliance of New England, Inc. d/b/a Massachusetts Energy Consumers Alliance (“Mass Energy”); (3) Northeast Clean Energy Council, Inc. (“NECEC”); (4) Applied Materials; (5) ChargePoint; (6) Utilidata, Inc.; (7) Direct Energy Business, LLC, Direct Energy Services, LLC, and Astrum Solar, Inc. d/b/a Direct Energy Solar; and (8) Energy Freedom Coalition of America, LLC. Finally, the Department granted: (1) full intervenor party status to Acadia Center in D.P.U. 15-120 and D.P.U. 15-122, and limited participant status in D.P.U. 15-121; (2) limited participant status to National Grid in D.P.U. 15-121 and D.P.U. 15-122; (3) limited participant status to Eversource in D.P.U. 15-120 and D.P.U. 15-121; (4) full party status to the Towns of Aquinnah, Barnstable, Bourne, Brewster, Chatham, Chilmark, Dennis, Edgartown, Eastham, Falmouth, Harwich, Mashpee, Oak Bluffs, Orleans, Provincetown, Sandwich, Tisbury,

Truro, West Tisbury, Wellfleet and Yarmouth, and Dukes County, organized and operating collectively as the Cape Light Compact JPE (“Compact”) in D.P.U. 15-122 and limited participant status in D.P.U. 15-120.

In D.P.U. 15-120, in support of National Grid’s filing, the following employees of National Grid USA Service Company, Inc., provided testimony: (1) James P. Perkinson, Engineering Manager for the Advanced Grid Engineering Team in the New Energy Solutions Group; (2) William F. Jones, Director, Smart Energy Solutions Program/New England and Federal Energy Regulatory Commission Solution Delivery; (3) Robert D. Sheridan, Director, Grid Modernization Strategy with the New Energy Solutions Group; and (4) Mousumi Bhakta, Principal Specialist, New Energy Solutions Communications and Marketing Group. The Attorney General sponsored the testimony of: (1) Paul L. Alvarez, President, Wired Group; (2) Gregory Booth, President, PowerServices, Inc.; and (3) Peter Brown, Senior North American Reliability Corporation and Cybersecurity Consultant, PowerServices, Inc. Acadia Center sponsored the testimony of Abigail Anthony, Director, Grid Modernization Initiative, and Director, Rhode Island Office, Acadia Center. CLF sponsored the testimony of: (1) Caroline Golin, Chief Executive Officer, Greenlink Group; (2) Tim Woolf, Vice President, Synapse Energy Economics; and (3) Ariel Horowitz, Senior Associate, Synapse Energy Economics.

In D.P.U. 15-121, in support of Unitil’s filing, the following witnesses provided testimony: (1) Justin C. Eisfeller, Director of Energy Measurement and Control, Unitil; (2) Keven E. Sprague, Director of Engineering, Unitil; (3) Forrest J. Small, Vice President

of Grid Optimization, Bridge Energy Group; (4) Scott Grafelman, Principal Consultant, Bridge Energy Group; (5) James D. Simpson, Senior Vice President, Concentric Energy Advisors, Inc.. The Attorney General and CLF each sponsored the same witnesses as in D.P.U. 15-120.

In D.P.U. 15-122, in support of Eversource's filing, the following employees of Eversource Energy Service Company, provided testimony: (1) Craig Hallstrom, President, Regional Electric Operations for Massachusetts and Connecticut; (2) Penelope M. Conner, Chief Customer Officer and Senior Vice President; (3) Douglas P. Horton, Director, Revenue Requirements – Massachusetts; (4) Paul R. Renaud, Vice President of Engineering-Massachusetts; (5) Richard D. Chin, Manager of Rates; (6) Jennifer A. Schilling, Director of Strategy and Performance; and (7) Samuel G. Eaton, Project Director, Electric Vehicle Charging and Energy Storage. Additionally, Erik I. Gilbert, Director of Strategy and Operations, Navigant Consulting, provided testimony on behalf of Eversource. The Compact sponsored the testimony of: (1) Margaret T. Downey, Administrator, Compact; (2) Austin T. Brandt, Power Supply Planner, Compact; (3) Kevin F. Galligan, President, Galligan Energy Consulting, Inc.; (4) Jordan R. Gerow, Staff Attorney, Pace Energy and Climate Center, Elizabeth Haub School of Law, Pace University; (5) Frank Lacey, Consultant, Electric Advisors Consulting LLC; and (6) Karl R. Rabago, Executive Director, Pace Energy and Climate Center, Elizabeth Haub School of Law, Pace University. The Attorney General, Acadia Center, and CLF each sponsored the same witnesses as in D.P.U. 15-120.

On February 3, 2017, Eversource filed a revised grid modernization plan that sought to narrow the scope of its proposal in D.P.U. 15-122 in coordination with the proposed grid modernization initiatives included in its base distribution rate filing in D.P.U. 17-05³ (D.P.U. 15-122, Eversource Filing Letter at 1-2 (February 3, 2017)). On November 30, 2017, the Department determined that, with the exception of energy storage and electric vehicles, it would address Eversource's proposed grid modernization investments in D.P.U. 17-05 as part of the investigation of the investments proposed in D.P.U. 15-122.⁴ NSTAR Electric Company and Western Massachusetts Electric Company d/b/a Eversource Energy, D.P.U. 17-05, at 441-442 (2017).

From May 17, 2017 to May 31, 2017, the Department held seven days of joint evidentiary hearings in all three dockets. In addition, in June 2017, the Department held evidentiary hearings in D.P.U. 17-05 on Eversource's grid modernization initiatives.

In July and August 2017, respectively, initial and reply briefs were filed in the instant proceedings. In D.P.U. 15-120, National Grid, the Attorney General, Acadia Center, CLF, DOER, LEAN,⁵ and NECEC⁶ filed initial briefs, and National Grid, the Attorney General,

³ Eversource sponsored the testimony of Samuel G. Shilling and Jennifer A. Eaton on grid modernization issues in D.P.U. 17-05.

⁴ Pursuant to 220 CMR 1.10(3), the Department incorporates by reference from D.P.U. 17-05 into D.P.U. 15-122, the exhibits, discovery responses, testimony, and briefs pertaining to Eversource's grid modernization base commitment, including the associated metrics.

⁵ LEAN filed a single brief in D.P.U. 15-120 and D.P.U. 15-122.

⁶ NECEC filed a single brief in all three proceedings.

Acadia Center, and LEAN also filed reply briefs. In D.P.U. 15-121, Unitil, the Attorney General, CLF, DOER, and NECEC filed initial briefs, and Unitil and the Attorney General also filed reply briefs. In D.P.U. 15-122, Eversource, the Attorney General, Acadia Center, CLF, the Compact, DOER, LEAN, and NECEC filed initial briefs, and Eversource, the Attorney General, the Compact, DOER, and LEAN also filed reply briefs.

The record in D.P.U. 15-120 includes responses to 27 sets of information requests and nine record requests. The record in D.P.U. 15-121 includes responses to 24 sets of information requests six record requests. The record in D.P.U. 15-122 includes responses to 29 sets of information requests and twelve record requests.⁷

IV. DESCRIPTION OF PROPOSALS

A. Introduction

In D.P.U. 12-76-B, the Department required each electric distribution company to submit a grid modernization plan outlining how the company proposed to make measurable progress towards these grid modernization objectives. D.P.U. 12-76-B at 9, 15. As part of their grid modernization plans, the Companies were required to include: (1) a marketing, education, and outreach plan; (2) a research, development, and deployment plan; and (3) proposed individual and statewide infrastructure and performance metrics to measure

⁷

Additional exhibits and record responses pertaining to Eversource's grid modernization initiatives were submitted in D.P.U. 17-05 and pursuant to 220 CMR 1.10(3) are incorporated into the D.P.U. 15-122 record (see n.4, above).

progress in achieving the grid modernization objectives. D.P.U. 12-76-B at 16, 26-34.⁸

Below is a description of the Companies' grid modernization proposals.

B. D.P.U. 15-120, National Grid

1. Introduction

Below, the Department describes the categories of grid modernization investments proposed by National Grid.⁹ Next the Department discusses each of National Grid's four proposed investment scenarios. Then we discuss National Grid's proposed investment timelines and the business case analysis supporting each scenario.

2. Proposed Investments

a. Field Deployment and Enabling Infrastructure

i. Introduction

National Grid divides its proposed grid modernization investments into field deployment, enabling infrastructure, distributed energy resources and research, development, and deployment ("RD&D") (D.P.U. 15-120, Grid Modernization Plan at 11). Field deployment includes advanced metering infrastructure ("AMI"), customer load management, advanced distribution automation, Volt/Volt-ampere reactive optimization ("VVO"), and feeder monitors. Enabling infrastructure includes advanced distribution management system

⁸ Metrics proposals are discussed below in Section VI.

⁹ Unless otherwise specified, all references are to the most updated version of National Grid's Grid Modernization Plan, attachments, and testimony, filed on June 14, 2016.

and supervisory control and data acquisition system (“SCADA”),¹⁰ communications, information/operational technology, billing systems and cybersecurity, workforce training and asset management, and marketing, education and outreach (D.P.U. 15-120, Grid Modernization Plan at 11).

ii. Field Deployment

National Grid proposes to deploy smart meters that support two way communications (D.P.U. 15-120, Grid Modernization Plan at 40). National Grid states that back office and communication systems will need to be operational before meters are installed (D.P.U. 15-120, Grid Modernization Plan at 40-42)

In addition, National Grid’s proposes customer load management investments that include infrastructure to support in-home devices (e.g., load control switches, smart thermostats, energy monitoring displays and other consumer devices) (D.P.U. 15-120, Grid Modernization Plan at 37). National Grid also proposes a web portal that customers can use to install, program, and control devices (D.P.U. 15-120, Grid Modernization Plan at 54). National Grid proposes to recover the costs of infrastructure (e.g., software, connectivity to AMI, demand response management system, and gateways through the grid modernization plan and the costs for in-home devices through its three-year energy efficiency plan (D.P.U. 15-120, Grid Modernization Plan at 37, 54).

¹⁰ In this Order, unless otherwise indicated, all references to SCADA are to SCADA in the distribution system (e.g., substation SCADA).

Pursuant to its advanced distribution automation program, National Grid proposes to install, automate and control sectionalizing protection equipment in a coordinated manner to minimize the effects of outages (D.P.U. 15-120, Grid Modernization Plan at 37). Under its VVO program, National Grid proposes to install and coordinate conservation voltage reduction, VVO, and advanced distribution automation on high value feeders in a manner to optimize the distribution system (D.P.U. 15-120, Grid Modernization Plan at 45, 49).¹¹

National Grid proposes a feeder monitors program that consists of installing interval power monitoring devices on feeders where it does not currently have interval power information (D.P.U. 15-120, Grid Modernization Plan at 51). National Grid states that feeder monitors will be used to capture real-time voltage, current, and power which will be used to optimize the control and design of the distribution system (D.P.U. 15-120, Grid Modernization Plan at 51).¹² Finally, National Grid proposes to deploy feeder monitors and migrate them to the new advanced distribution management system, once it is operational (D.P.U. 15-120, Grid Modernization Plan at 51).

iii. Enabling Infrastructure

National Grid proposes investments in communications infrastructure to connect its information/operational systems with field devices in the service territory

¹¹ In this Order, unless otherwise indicated, all references to VVO include the voltage controlling effects attained through conservation voltage reduction technologies.

¹² Data storage and transport of information from feeder monitors are part of National Grid's proposed enabling investments (D.P.U. 15-120, Grid Modernization Plan at 51).

(D.P.U. 15-120, Grid Modernization Plan at 60). These investments include additional backhaul networks, substation fiber installation, a multi-tiered field based wireless communication network, and radios for devices without embedded communications (D.P.U. 15-120, Grid Modernization Plan at 60).

In addition, National Grid proposes information/operational technology investments to link together its proposed AMI, VVO, advanced distribution automation, customer load management, feeder monitor, and communications systems investments (D.P.U. 15-120, Grid Modernization Plan at 61). National Grid states that its proposed information and operational technology investments are also designed to integrate these systems into National Grid's existing systems and to establish comprehensive data management, cybersecurity and data analytical functions. National Grid states that the integration will incorporate the AMI back office systems, and include a meter data management system and a head end system (D.P.U. 15-120, Grid Modernization Plan at 69).

National Grid proposes investments in its billing systems and customer service support in order to accommodate new time-varying rate ("TVR") structures, increased volumes of data, and the new functionalities resulting from grid modernization (D.P.U. 15-120, Grid Modernization Plan at 86). Further, National Grid proposes to make investments in cybersecurity and privacy (D.P.U. 15-120, Grid Modernization Plan at 86-87).

With respect to its workforce training and asset management proposal, National Grid maintains that grid modernization will require numerous changes to its workforce, including the hiring of additional employees and training of affected personnel (D.P.U. 15-120, Grid

Modernization Plan at 71). National Grid states that advances in asset management and system operations toolsets will require higher levels of data granularity and accuracy (D.P.U. 15-120, Grid Modernization Plan at 71). National Grid also proposes training for employees, as well as additional staff (D.P.U. 15-120, Grid Modernization Plan at 72-73). In addition, National Grid proposes investments in asset and related management tools for data capture for employee use (D.P.U. 15-120, Grid Modernization Plan at 77-78). To accommodate these changes, National Grid proposes to expand its computer-based operating functions through the use of near real-time data and mobility services for its workforce (D.P.U. 15-120, Grid Modernization Plan at 69).

Finally, National Grid proposes to deploy marketing, education and outreach plan that consists of data and analytics and communication strategies (D.P.U. 15-120, Grid Modernization Plan at 162). As part of this plan, National Grid proposes to create two full-time staff positions that are accounted for in workforce, training and asset management (D.P.U. 15-120, Grid Modernization Plan at 166).

b. Proposed Investment Scenarios

i. Introduction

National Grid's proposed grid modernization plan includes four different scenarios that the company refers to as: (1) the "Balanced Plan" scenario; (2) the "AMI-Focused" scenario; (3) the "Grid-Focused" scenario; and (4) the "Opt-In" scenario. The Balanced Plan scenario is the most costly and comprehensive of the four scenarios; the other three scenarios are different variations of the Balanced Plan scenario, with the Opt-In scenario at

the lowest total cost (D.P.U. 15-120, Grid Modernization Plan at 9, 14-18). National Grid states that the scenarios provide an opportunity for the Department to review investments in light of objectives and costs and benefits to customers (D.P.U. 15-120, Grid Modernization Plan at 9-10). For each proposed scenario National Grid includes distributed energy resource interconnection investments and RD&D pilots (D.P.U. 15-120, Grid Modernization Plan at 11, Table 1).

ii. Balanced Plan Scenario

Under its Balanced Plan scenario, National Grid proposes opt-out AMI deployment for 100 percent of its customers within five years (D.P.U. 15-120, Grid Modernization Plan at 11, Table 1). In addition to distributed energy resources and RD&D investments, the Balanced Plan scenario includes the following categories of proposed grid modernization investments: (1) customer load management (customer portal and distributed energy resource management system); (2) advanced distribution automation and VVO to 30 percent of customers; (3) feeder monitors; (4) advanced distribution management system and SCADA; (5) communications to support AMI and grid-facing investments; (6) information/operational technology including data lake, meter data management system, integration services, integrated network operations center, and applications; (7) cybersecurity and billing; (8) workforce training and asset management; and (9) opt-out-focused marketing, education and outreach (D.P.U. 15-120, Grid Modernization Plan at 11, Table 1, 14-16, 35-98,

128-163). National Grid estimates that the total five-year cost of the Balanced Plan scenario is \$792.9 million (D.P.U. 15-120, Grid Modernization Plan at 11).¹³

iii. AMI-Focused

The AMI-Focused scenario differs from the Balanced Plan scenario in the following ways: (1) VVO installed for ten percent of customers; (2) does not include advanced distribution management system and SCADA; (3) reduction in integration services under information/operational technology investments; and (4) training only for workforce (D.P.U. 15-120, Grid Modernization Plan at 11). National Grid estimates that the total five-year cost for the AMI-Focused scenario is \$619.6 million (D.P.U. 15-120, Grid Modernization Plan at 11).

iv. Grid-Focused Scenario

For the Grid-Focused scenario, National Grid proposes to deploy opt-out AMI meters for 30 percent of its customers over ten years, and opt-in AMI meters for the remaining 70 percent of customers during this same period (D.P.U. 15-120, Grid Modernization Plan at 11). Because the Grid-Focused scenario reduces deployment of AMI meters, it differs from the Balanced Plan in the following ways: (1) telecommunications will only be deployed for 30 percent of its service territory; and (2) both the opt-in and opt-out marketing, education, and outreach plans will be used (D.P.U. 15-120, Grid Modernization Plan at 11).

¹³ These costs include capital investments as well as operations and maintenance costs related to deployment (D.P.U. 15-120, Grid Modernization Plan at 29, Table 6).

National Grid estimates that the total five-year cost for the Grid-Focused scenario is \$584.6 million (D.P.U. 15-120, Grid Modernization Plan at 11).

v. Opt-In Scenario

For the Opt-In scenario, National Grid proposes to deploy opt-in AMI meters throughout its entire service territory in ten years (D.P.U. 15-120, Grid Modernization Plan at 11). To this end, National Grid states that it intends to leverage and expand its existing investments in the smart grid pilot program¹⁴ it is conducting in Worcester, Massachusetts, including customer load management, communications, information/operational technology, and cybersecurity and privacy, and billing (D.P.U. 15-120, Grid Modernization Plan at 11). This scenario will use the opt-in focused marketing, education, and outreach plan (D.P.U. 15-120, Grid Modernization Plan at 11). Similar to the Balanced Plan, the Opt-In scenario will deploy advanced distribution automation and VVO to 30 percent of customers and deploy an advanced distribution management system and SCADA (D.P.U. 15-120, Grid Modernization Plan at 11). National Grid estimates that the total five-year cost of the Opt-In scenario is \$238.6 million (D.P.U. 15-120, Grid Modernization Plan at 11).

c. Cybersecurity

National Grid proposes to implement investments in multiple cybersecurity and data privacy services to support the business functions affected by grid modernization

¹⁴ For a description of National Grid's smart grid pilot program, see Massachusetts Electric Company and Nantucket Electric Company, D.P.U. 11-129 (2012) and Massachusetts Electric Company and Nantucket Electric Company, D.P.U. 16-149 (2016).

(D.P.U. 15-120, Exh. MR-1, at 11). National Grid states these proposed investments are incremental and intended to reduce exposure to new threats related to the use of internet, internet-related, and wireless technologies as part of its grid modernization plan

(D.P.U. 15-120, Exh. MR-1, at 14). The total cost of National Grid's proposed cybersecurity and privacy investments (both capital and operations and maintenance ("O&M") costs) for years one through three of its grid modernization plan are:

(1) \$58 million for the Balanced Plan scenario; (2) \$40 million for the AMI-Focused scenario; (3) \$40 million for the Grid-Focused scenario; and (4) \$10 million for the Opt-In scenario (D.P.U. 15-120, Grid Modernization Plan at 29-35).

More specifically, the National Grid's proposed cybersecurity services include network security, data security, identity and access management, threat and vulnerability management, and security operations center services (D.P.U. 15-120, Exh. MR-1, at 14-15). National Grid states these investments are designed to address the following risks and threats: (1) unauthorized access/insider attack; (2) system availability/malfunction; (3) malware/virus attack; (4) advanced persistent threat/external attack; and (5) data leakage/loss (D.P.U. 15-120, Exh. MR-1, at 15).¹⁵ National Grid states the deployment of cybersecurity investments will be based on business priority, for example advanced metering functionality

¹⁵ National Grid states that its cybersecurity investments are also designed to protect against "regulatory non-compliance" which it describes as "threats of fine or sanction resulting in monetary loss or negative reputational impact" (D.P.U. 15-120, Exh. MR-1, at 23). National Grid did not explain the relevance of this risk to the cybersecurity of grid modernization investments.

or advanced distribution automation, with the foundational security services established throughout years one to five (D.P.U. 15-120, Exh. MR-1, at 16-17).

In addition, National Grid proposes data privacy investments in the following two categories: (1) previously collected personal information made vulnerable to privacy concerns by grid modernization-related technology development; and (2) newly collected personal information (D.P.U. 15-120, Exh. MR-1, at 21-22). National Grid states that its proposed privacy investments will employ a cross-functional framework to address legal, regulatory, privacy, and identity theft-related vulnerabilities (D.P.U. 15-120, Exh. MR-1, at 22-23). Finally, National Grid states that it will implement a revised information access policy to address how the company will control data and authorize information access rights (D.P.U. 15-120, Exh. MR-1, at 25).

d. Deployment Schedule and Business Case Analysis

National Grid proposes separate deployment schedules for each investment scenario, both for years one to five, and for years six to ten (D.P.U. 15-120, Grid Modernization Plan at 29-36, 38-59, 60-100). In all four investment scenarios, National Grid proposes to deploy the enabling infrastructure including information/operational technology, communications, advanced distribution management system, and SCADA in the first two years of the plan period, before beginning the deployment of the other technologies in year three and beyond (D.P.U. 15-120, Grid Modernization Plan at 29-36).

In addition, National Grid presented a business case analysis to support its proposed investments. National Grid provided general assumptions, cost estimates, monetized benefits,

quantified but not monetized benefits, and qualitative benefits for all four investment scenarios, as well as a sensitivity analysis for the Balanced Plan scenario (D.P.U. 15-120, Grid Modernization Plan at 101-127).

National Grid identified the following categories of benefits from its proposed grid modernization investments: (1) O&M savings; (2) reduced energy and demand benefits accruing to customers; (3) deferred capital investments and reliability benefits from reduced outages; (4) improved customer satisfaction; (5) greater workforce productivity; (6) enhanced integration of distributed energy resources; (7) better optimized system planning; (8) acceleration of future beneficial technologies; (9) safety and compliance improvements, and (10) improved quality of electricity delivery (D.P.U. 15-120, Grid Modernization Plan at 101).

National Grid calculated the 15-year net present value of the total monetized net benefits for each of the four investment scenarios, excluding qualitative benefits. National Grid estimates that the benefit-cost ratio will be 0.94 in the Balanced Plan scenario, 1.08 in the AMI-Focused scenario, 0.57 in the Grid-Focused scenario, and 0.57 in the Opt-In scenario (D.P.U. 15-120, Grid Modernization Plan at 11).

e. Distributed Energy Resources

With respect to distributed energy resource interconnection, National Grid proposes investments to improve the processing of applications, provide real-time information for system analysis and planning, making information available to customers, and targeted system

upgrades such as high voltage ground fault protection and direct transfer trip protection

(D.P.U. 15-120, Grid Modernization Plan at 131-132).¹⁶

f. Research, Development, and Deployment

National Grid's RD&D proposal includes several projects designed target areas of innovation key to grid modernization (D.P.U. 15-120, Grid Modernization Plan at 144).

These projects include: a vehicle to grid study and demonstration project; a microgrid project; a renewable integrated distribution energy storage demonstration project; targeted inverter conversion; high density community energy storage; short term renewable forecasting; DC to DC charging; fault location analysis, a sensor analytics development program, and analytics for asset management (D.P.U. 15-120, Grid Modernization Plan at 149, 151-153).

C. D.P.U. 15-121, Unitil

1. Introduction

Unitil's proposed grid modernization plan includes 13 projects organized across five program categories: (1) distributed energy resource-enablement; (2) grid reliability; (3) distribution automation; (4) customer empowerment; and (5) workforce and asset management (D.P.U. 15-121, Exh. FG&E-1, at 10). Unitil's grid modernization plan also includes proposals for RD&D, a customer education and outreach plan, and performance metrics. In total, Unitil proposes to spend approximately \$24 million over ten years,

¹⁶ National Grid proposes to recover the costs of its distributed energy resource interconnection projects through its distributed energy resource interconnection tariff (D.P.U. 15-120, Grid Modernization Plan, at 19, 141-143).

\$12 million of which would occur in the first five-years (D.P.U. 15-121, Exhs. FG&E-1, at 12; FG&E-2, at 16).

2. Proposed Investments

a. Distributed Energy Resource Enablement

During the first five years of its grid modernization plan, Unitil proposes to spend \$2 million on a distributed energy resource enablement program that is designed to accommodate increasing distributed energy resource penetration within its distribution system (D.P.U. 15-121, Exhs. FG&E-1, at 35; FG&E-2, at 16). Unitil's proposed program consists of: (1) annual circuit capacity studies to determine where distributed generation can be accommodated; (2) a distributed energy resource analytics and visualization platform to manage distributed energy resources alongside grid operations and planning; and (3) 3V0 relays and voltage regulation controls to maintain grid reliability given an increasing amount of distributed generation (D.P.U. 15-121, Exhs. FG&E-1, at 35-40; FG&E-2, at 16).

b. Grid Reliability

Unitil proposes to allocate \$354,000 across two projects in the grid reliability program category: (1) a damage assessment tool mobile application to enable faster and more efficient deployment of restoration resources during an outage; and (2) AMI integration with its existing outage management system to further reduce outage time (D.P.U. 15-121, Exh. FG&E-1, at 41-45; FG&E-2, at 17). Unitil states these projects are designed to better collect and disseminate real-time outage data to ensure operational efficiency and maintain strong restoration performance (D.P.U. 15-121, Exh. FG&E-1, at 41).

c. Distribution Automation

Unitil proposes to allocate \$7.7 million on distribution automation projects including:

(1) installation of a field area network communications hub; (2) installation of SCADA capabilities at all distribution substations; (3) implementation of an advanced distribution management system; and (4) VVO, including capacitor banks, voltage regulators, and transformer load tap changers (D.P.U. 15-121, Exh. FG&E-1, at 46-54; FG&E-2, at 17).

Unitil states that the first three projects are the key communication and control components necessary to automate the grid and to enable the demand reduction benefits of VVO (D.P.U. 15-121, Exh. FG&E-1, at 53).

d. Customer Empowerment

Unitil proposes to allocate \$1.5 million on customer empowerment projects including:

(1) an energy information web portal to allow customers to directly manage account information and account tools; (2) a gamification pilot program to engage customers in meeting energy and demand shifting goals; and (3) an advanced metering functionality program with an optional TVR (D.P.U. 15-121, Exh. FG&E-1, at 53-70; FG&E-2, at 18).

Unitil states these projects are designed to enable energy consumers to make better energy choices (D.P.U. 15-121, Exh. FG&E-1, at 55).

Unitil has already installed AMI meters throughout its service territory (D.P.U. 15-121, Exh. FG&E-1, at 11). Unitil proposes to upgrade its existing AMI to full advanced metering functionality on an opt-in basis in order to provide hourly interval data, stating this is the one advanced metering functionality its current meters are not capable of

(D.P.U. 15-121, Exh. FG&E-1, at 66-67; FG&E-2, at 25). Given this, Unitil evaluated five options to achieve full advanced metering functionality which separately considered power line carrier, mesh radio frequency, and cellular communication technologies (D.P.U. 15-121, Exh. FG&E-1, at 67-68). Unitil utilized mesh radio frequency when it constructed its business case analysis for both its opt-in and opt-out estimates (D.P.U. 15-121, Exh. FG&E-1, at 67-68, AG-14-1).

e. Workforce and Asset Management

Unitil proposes to spend \$217,000 on a workforce and asset management program. Specifically, Unitil proposes to implement a mobility platform for its restoration workforce to enable faster electronic trouble ticketing for work crews and customers. Unitil states this project is designed to increase operational efficiency and restoration performance through a faster and more accurate exchange of information between Unitil, its restoration workforce, and customers (D.P.U. 15-121, Exh. FG&E-1, at 71).

f. Cybersecurity

Unitil states that it uses a written information security plan and related policies for the maintenance and protection of cyber assets. This written information security plan details controls and standards for securing systems and handling personally identifiable information, and includes considerations for intrusion and threat detection, vulnerability assessment, program capability assessment; risk and threat management (D.P.U. 15-121, Exh. FG&E-1, at 86-88). Unitil proposes to incorporate its current cybersecurity processes and procedures into any future grid modernization plan capabilities (D.P.U. 15-121, Exhs. FG&E-1,

at 85-86; FG&E-2, at 23). Unitil incorporated its grid-modernization cybersecurity budget within the budgets for its proposed grid modernization investments (D.P.U. 15-121, Exhs. FG&E-1, at 86-88; AG-3-16).

g. Customer Education

Unitil proposes to spend \$290,000 on customer education and outreach (D.P.U. 15-121, Exh. FG&E-1, at 101). Unitil states that its education and outreach plan is designed to provide customers with: (1) knowledge of their energy consumption options; (2) the tools to manage their energy consumption; and (3) the benefits of such energy consumption management (D.P.U. 15-121, Exh. FG&E-1, at 80-82).

3. Business Case Analysis

Unitil submitted a business case analysis to support its proposal. Unitil analyzed the costs of the five-year investments and extrapolated benefits over a 15-year period (D.P.U. 15-121, Exh. FG&E-1, at 15-16). Unitil states that the results of the business case analysis indicate a 1.5 benefit-cost ratio, with benefits and costs that measure approximately \$30 million and \$20 million, respectively, in present value dollars (D.P.U. 15-121, Exh. FG&E-1, at 78).

4. Research, Development, and Deployment

Unitil proposes to allocate \$95,000 on several RD&D projects. In collaboration with National Grid and Eversource, Unitil proposes to undertake research projects that may include: (1) a distributed generation pilot program; (2) a breakaway service connector pilot program; (3) an energy storage pilot program; (4) automated fault locating and restoration

research; (5) electric vehicle charging research; and (6) a radio frequency potential outage survey pilot program (D.P.U. 15-121, Exh. FG&E-1, at 83-84).

D. D.P.U. 15-122, Eversource

1. Introduction

As discussed in Section III, above, the Department investigated Eversource's grid modernization plan as two separate proposals: (1) a grid modernization "base commitment" presented as part of its performance base ratemaking plan in D.P.U. 17-05; and (2) an "incremental" grid modernization plan in D.P.U. 15-122 (D.P.U. 15-122, Exh. Eversource-IGMP at 6). The base commitment consists primarily of grid-facing investments, including investments in the distribution system, an electric storage pilot, and electric vehicle make-ready infrastructure (D.P.U. 17-05, Exhs. ES-GWPP-1, at 17-18; ES-GMBC-1, at 14-15). The incremental grid modernization plan consists primarily of customer-facing investments including a customer engagement initiative for opt-in TVR, enabling investments for cybersecurity and customer education, and RD&D proposals (D.P.U. 15-122, Exh. Eversource-IGMP at 7-8). Each proposal contains a five-year investment plan and proposed metrics (D.P.U. 15-122, Exh. Eversource-IGMP at 32, 44, 48, 54, 60; D.P.U. 17-05, Exhs. ES-GMBC-1, at 11, 132-135; ES-GMBC-3; ES-GWPP-1, at 19; DPU-41-7 (Supp.); ME-1, at 71; RR-AC-2, Att.; RR-CLF-2, Att.; RR-DPU-2, Att.; RR-DPU-24).

With the exception of Eversource's storage and electric vehicle proposals, the Department subsequently removed the proposed grid modernization investments from

consideration in D.P.U. 17-05. D.P.U. 17-05, at 434-443. The Department determined that a review of all proposed investments in the instant proceeding would afford the Department the ability to address how Eversource's complete grid modernization proposal complies with our grid modernization objectives and to assess issues that affect grid modernization as a whole. D.P.U. 17-05, at 441. In the sections below, the Department summarizes Eversource's proposed customer-facing and grid-facing investments, including its business case analyses.

2. Proposed Customer-Facing Investments

a. Overview

Eversource's proposed customer-facing investments are comprised of: (1) a customer engagement initiative consisting of an opt-in TVR program and associated infrastructure investments; and (2) investments in cybersecurity; and (3) investments in customer education and outreach to support the engagement initiative (D.P.U. 15-122, Exh. Eversource-IGMP at 7-8). For these three components, Eversource proposes a five-year budget of \$138.2 million, which include capital investments and O&M costs (D.P.U. 15-122, Exh. Eversource-IGMP at 15). In addition, Eversource proposes to implement certain RD&D investments, with a five-year budget of \$7.5 million (D.P.U. 15-122, Exhs. Eversource-IGMP at 15, 73; Eversource-DPH-1, at 4).¹⁷

¹⁷ Unless otherwise specified, all references are to the most updated versions of Eversource's grid modernization plans, attachments, and testimony, filed on February 3, 2017.

b. Customer Engagement Initiative

Pursuant to its customer engagement initiative, Eversource proposes to offer an opt-in TVR program to all of its residential and small commercial and industrial basic service customers (D.P.U. 15-122, Exhs. Eversource-IGMP at 74; D.P.U. 15-122, Tr. 2, at 226).¹⁸ Eversource proposes to make \$104.8 million in capital investments over five years for its opt-in TVR program and associated information technology systems, and an additional \$3.4 million for related O&M expenses (D.P.U. 15-122, Exh. Eversource-IGMP at 15, 32).

Eversource proposes to offer two rate options for its opt-in TVR program: (1) a time-of-use and critical peak pricing rate for residential customers; and (2) a two-hour targeted time-of-use rate for both residential and small commercial and industrial customers (D.P.U. 15-122, Exhs. Eversource-IGMP at 17, 20-23; Eversource-IGMP, App. 5; Eversource-IGMP, App. 6). Eversource estimates that five percent of its total residential and small commercial and industrial customers will participate in its opt-in TVR program (D.P.U. 15-122, Exhs. Eversource-IGMP at 24; Eversource-PMC-1, at 16).

In order to record and communicate hourly and sub-hourly interval data, Eversource proposes to use cellular meters as the primary option, and use network meters in locations where Eversource has deployed its private communication network (D.P.U. 15-122,

¹⁸ A customer who does not receive basic service from Eversource but wishes to opt into the proposed TVR program must switch from competitive supply to Eversource's basic service (D.P.U. 15-122, Tr. 2, at 226).

Exhs. Eversource-IGMP at 26-28; Eversource-IGMP, App. 7, at 15).¹⁹ For opt-in TVR customers for which cellular meters are installed, Eversource proposes to charge these customers the annual cost to transmit the data to Eversource (D.P.U. 15-122, Exh. Eversource-IGMP at 32).

Eversource proposes three possible methods for opt-in TVR customers to access their meter data: (1) Eversource's existing customer engagement platform; (2) a home area network offered through a single source vendor chosen by Eversource; and (3) an enhanced real-time service (D.P.U. 15-122, Exh. Eversource-IGMP at 28). Eversource proposes to choose the meter data access method at the time of installation (D.P.U. 15-122, Exh. Eversource-IGMP at 28).

Finally, Eversource proposes investments in various customer data systems to accommodate the opt-in TVR program including: (1) upgrades to its existing billing system; (2) a data management and storage system; (3) an expanded data collection system; (4) a customer data portal system; (5) enhanced and automated customer notifications; and (6) a modified service order system to support interval meter installation (D.P.U. 15-122, Exh. Eversource-IGMP at 29-31). In particular, with respect to the billing system, Eversource proposes an upgrade that connects the two existing systems for Eversource East and Eversource West (D.P.U. 15-122, Exh. Eversource-IGMP at 29).

¹⁹ Eversource's proposed private communications network is described below. Eversource states that the primary focus of this proposed network is for distribution automation equipment and, therefore, the timing of the availability of the network will depend on the roll-out schedule of distribution automation (D.P.U. 15-122, Exh. Eversource-IGMP at 27-28).

c. Customer Education and Outreach

Eversource proposes a total investment of \$19 million over five years consisting of O&M costs associated with its customer education and outreach plan (D.P.U. 15-122, Exh. Eversource-IGMP at 48, 60). Eversource states that its proposed customer education and outreach plan is focused on disseminating information about working basics of grid modernization, and possibly TVR rates specifically, through multiple channels including television, radio, website pages, digital marketing, social media, email, out-of-home channels (e.g. billboards) information on customer bills, community collaboration, employee communication, and residential and business contact center (D.P.U. 15-122, Exh. Eversource-IGMP at 53-56).

3. Proposed Grid-Facing Investments

a. Overview

Eversource proposes a total five-year spending target of \$400 million for grid modernization investments in two broad categories: (1) distribution network systems operations; and (2) customer engagement and enablement (D.P.U. 17-05, Exhs. ES-GMBC-1, at 52; ES-GMBC-2, at 9-10). Eversource states that the investments in these two categories are foundational investments needed to implement other aspects of grid modernization (D.P.U. 17-05, Exh. ES-GMBC-1, at 13).

Eversource proposes to undertake the following initiatives in the distribution network systems operations category: (1) a distribution network systems operator initiative, which includes investments of \$44 million in distribution management systems, advanced system

load flow, and VVO; (2) an automation initiative, which includes investments of \$84 million in automated feeder reconfiguration, urban underground automation, and adaptive protection; and (3) a foundation technology for distribution management systems and automation initiative, which consists of \$111 million in investments in advanced sensing technology, remote fault indicators, and a communications network (D.P.U. 17-05, Exhs. ES-GMBC-1, at 52; ES-GMBC-2, at 9-10).²⁰ Finally, in the customer engagement and enablement category, Eversource proposes to undertake a distributed energy resource integration initiative, which includes investments of \$15 million for customer tools (D.P.U. 17-05, Exh. ES-GMBC-2, at 9-10).²¹

b. Distribution Network Systems Operations

i. Distribution Network Systems Operator Initiative

(A) Advanced Distribution Management Systems

As the first part of its distribution network systems operator initiative, Eversource proposes \$9 million in capital investments and related O&M costs for: (1) distribution management systems hardware and software licenses; (2) integration with energy control system; and (3) a geographic information system/data interface with distribution management

²⁰ In addition, as part of the distribution network systems operations category, in D.P.U. 17-05, at 455-471, the Department approved Eversource's proposed energy storage demonstration program initiative, which includes investments of \$55 million.

²¹ In addition, as part of the customer engagement and enablement category, in D.P.U. 17-05, at 501-502, the Department approved Eversource's proposed electric vehicle research and demonstration projects initiative, which includes investments of \$45 million for development of electric vehicle charging infrastructure and vehicle conversions.

systems for circuit models (D.P.U. 17-05, Exhs. ES-GMBC-2, at 17-19; Tr. 8, at 1624-162). Eversource states that its proposed distribution management systems are designed to optimize distribution system performance to minimize electrical losses, improve asset utilization, improve reliability, and integrate distributed energy resources (D.P.U. 17-05, Exh. ES-GMBC-2, at 17). The proposed investments will cover 50 percent of Eversource's feeders by the end of five years (D.P.U. 17-05, Exhs. ES-GMBC-3, at 1; ES-GMBC-3, at 1; Tr. 8, at 1624).

(B) Advanced System Load Flow

As the second part of its distribution network systems operator initiative, Eversource proposes to spend \$20 million over five years to develop advanced load flow capability in order to: (1) optimize its capital asset deployment, system planning, real-time loading and contingency scenario planning, and interconnection; and (2) enhance the capability of its distributed energy resource group study (D.P.U. 17-05, Exh. ES-GMBC-2, at 21-24, 26). Eversource's proposed investments include analysis for 2100 circuit models (D.P.U. 17-05, Exh. ES-GMBC-2, at 20, 22-24, 27; Tr. 1, at 127). Although it will use software modules that it already owns, Eversource states that it intends to conduct dynamic and real-time load flow analytics, which is different than the static and case-by-case analytics that Eversource previously conducted (D.P.U. 17-05, Exh. ES-GMBC-2, at 26; Tr. 8, at 1632-1635).

Eversource states that its load flow analysis is designed to achieve a reduction in high voltage complaints (D.P.U. 17-05, Exh. DPU-42-6, Att.). Eversource proposes to apply this analysis to 100 percent of the radial feeders and underground secondary networks in its

service territory (D.P.U. 17-05, Exhs. ES-GMBC-3, at 1; AG-23-10, at 2; Tr. 8, at 1635-1636).

(C) VVO

As the third part of its distribution network systems operator initiative, Eversource proposes to spend \$14.8 million over five years to install VVO on 15 percent of its feeders (D.P.U. 17-05, Exhs. ES-GMBC-2, at 28-30; ES-GMBC-3, at 1). Eversource's proposed VVO investments include: (1) upgrades to substation transformer load tap changers; (2) line voltage regulators and capacitor banks to enable two-way communication; (3) the addition of up to five voltage sensors or meters per affected feeder; and (4) centralized intelligence to collect and analyze voltage and volt-ampere reactive data (D.P.U. 17-05, Exh. ES-GMBC-2, at 30-31; Tr. 1, at 127).

Eversource proposes to implement a staged approach to determine an appropriate feeder deployment strategy for VVO. First, Eversource will study feeders in areas with a high penetration of distributed energy resources and in areas where feeder and load characteristics maximize energy and demand savings, in order to gain an understanding of the interaction between VVO, automated feeder reconfiguration, and distributed energy resource deployment. Based on the results of this analysis, Eversource will deploy VVO on selected feeders selected using the above analysis (D.P.U. 17-05, Exh. ES-GMBC-2, at 29-30).

Eversource states that its VVO proposal is designed to reduce energy consumption and optimize demand (D.P.U. 17-05, Exh. ES-GMBC-2, at 28). Eversource states that it expects to achieve a 2.2 percent reduction in end-use energy consumption, a reduction in resistive,

no-load, and peak line losses, and a 0.6 percent reduction in peak load for every percent reduction in voltage for the feeders (D.P.U. 17-05, Exh. ES-GMBC-2, at 30).

ii. Automation Initiative

(A) Automated Feeder Reconfiguration

For the first part of its automation initiative, Eversource's proposes to invest \$45.1 million over five years in automated feeder reconfiguration for 100 percent of its service territory (D.P.U. 17-05, Exh. ES-GMBC-2, at 32). Eversource's proposed investments include 465 overhead automated switches and an additional 100 overhead automated switches with circuit ties (D.P.U. 17-05, Exh. ES-GMBC-2, at 36).

Eversource states that its overhead automated feeder reconfiguration proposal is designed to minimize the impact to customers in the event of an outage and reduce the duration of a major event (D.P.U. 17-05, Exh. ES-GMBC-2, at 32, 35). Through automated feeder reconfiguration, Eversource states that it will aim to reduce the number of customers affected by an outage condition on the overhead system from 1,500 to 1,000 in the Eversource East service area and achieve a target of 500 customers per segment where circuit ties are available in the Eversource West service area (D.P.U. 17-05, Exh. ES-GMBC-2, at 33).

In addition, Eversource states that its overhead automated feeder reconfiguration proposal is designed to: (1) maximize reliability; (2) reduce the amount of day-to-day manual switching operations; and (3) reduce operations costs (D.P.U. 17-05, Exh. ES-GMBC-2, at 34-35). Finally, Eversource states that automated feeder reconfiguration has the potential

to defer capital upgrades with enhanced flexibility to shift load based on prevailing conditions (D.P.U. 17-05, Exh. ES-GMBC-2, at 35).

(B) Underground Automation

For the second part of its automation initiative, Eversource proposes to invest \$37.5 million over five years on underground automation (D.P.U. 17-05, Exh. ES-GMBC-2, at 37). Eversource plans to replace 225 oil switches with the latest technology and SCADA, and automate 100 circuits by retrofitting existing vacuum fault interpreter switches to allow automated feeder reconfiguration in Eversource's 4 kilo-Volt ("kV") underground systems in the Greater Boston and Cambridge areas (D.P.U. 17-05, Exh. ES-GMBC-2, at 37-38). Eversource states that these upgrades will allow integration of fault location, isolation and substantially improved switching capabilities, and provide a 25 percent reduction in the impact of outages to the customers on circuits where automation is deployed (D.P.U. 17-05, Exh. ES-GMBC-2, at 37-38).

(C) Adaptive Protection

For the third part of its automation initiative, Eversource proposes to invest \$1.1 million over five years on adaptive protection (D.P.U. 17-05, Exh. ES-GMBC-2, at 39). This investment is intended to complement the proposed advanced sensing and VVO investments, which is the human resources required to understand the complex settings and engineering required to maximize the full potential of adaptive protection to integrate distributed energy resources (D.P.U. 17-05, Exh. ES-GMBC-2, at 42). Eversource states that this investment will improve the efficiency of relay maintenance, and the advanced

adaptive protection logic can determine which phase of the circuit is faulted and in some instances the general location of faults to help reduce the impacts of outages (D.P.U. 17-05, Exh. ES-GMBC-2, at 41).

iii. Foundational Technology Initiative

(A) Advanced Sensing Technology

For the first part of its foundational technology initiative, Eversource proposes to invest \$59.9 million over five years, to install advanced sensing technology for 100 percent of its service territory (D.P.U. 17-05, Exhs. ES-GMBC-2, at 43; ES-GMBC-3, at 3). Eversource's proposed investments include: (1) microprocessor relays that can collect real-time loading data and enable remote operations such as application of fast-trip and lock-out settings and protection settings; (2) 4 kV circuit breaker advanced distribution automation that provides real-time visibility of loading conditions on the underground circuits that are among the most heavily loaded on Eversource's distribution system; (3) advanced distribution automation for existing overhead automated devices to provide accurate minimum load data for circuit segments; (4) advanced distribution automation for network protectors to provide real-time network load data and remote control capability; and (5) advanced distribution automation for motor operated padmount switches to indicate fault locations and provide remote switching capability (D.P.U. 17-05, Exh. ES-GMBC-2, at 43-45).

(B) Remote Fault Indicators

For the second part of its foundational technology initiative, Eversource proposes to invest \$21.2 million over five years on remote fault indicators (D.P.U. 17-05,

Exh. ES-GMBC-2, at 46). Eversource proposes to install faulted circuit indicators on infrastructure such as underground cables, padmount equipment, overhead risers, and on overhead circuits in rights-of-way with challenging access conditions (D.P.U. 17-05, Exh. ES-GMBC-2, at 49). Eversource states that remote faulted circuit indication is expected to make a meaningful improvement in reliability for the customers where this is deployed, because the system operators will be able to dispatch personnel more precisely to the zone where repairs are required (D.P.U. 17-05, Exh. ES-GMBC-2, at 48).

(C) Communications Network

For the third part of its foundational technology initiative, Eversource proposes to invest \$30 million over five years on a communications network that will cover most of its service territory (D.P.U. 17-05, Exh. ES-GMBC-2, at 50). Eversource states that SCADA and VVO require high-speed and high-bandwidth communications infrastructure to enable real-time data flows between the field devices and the distribution management systems (D.P.U. 17-05, Exh. ES-GMBC-2, at 50-51). Eversource's proposed communications investments include: (1) the expansion of Eversource's existing operational multiprotocol label switching private communications network; (2) the use of cellular communications at locations where existing multiprotocol label switching does not provide service; (3) the build out of over 550 miles of fiber to connect 161 substations in the Eversource East service area and 26 substations in the Eversource West service area; (4) the construction of wireless point-to-multipoint and mesh base stations; and (5) the construction of new towers and poles, as needed (D.P.U. 17-05, Exhs. ES-GMBC-2, at 52; AG-23-6, Att.).

c. Customer Engagement and Enablement

In the customer engagement and enablement category, Eversource proposes to undertake a distributed energy resource integration initiative (D.P.U. 17-05, Exh. ES-GMBC-2, at 9-10). As part of this initiative, Eversource proposes to spend \$15 million over five years on customer tools including a distributed energy resource customer portal, hosting capacity maps and tools for distributed energy resource integration, and automated billing for improved customer service (D.P.U. 17-05, Exh. ES-GMBC-2, at 62-65). Eversource states that the distributed energy resource customer portal will have information available to customers including tariff documentation, educational materials and technical standards; hosting capacity maps and tools will better integrate the distributed energy resource hosting capacity process with its traditional distribution planning; and automated billing for distributed energy resource customers will improve bill timeliness, accuracy, and bill presentment (D.P.U. 17-05, Exh. ES-GMBC-2, at 62, 64, 65).

d. Geographic Information System Project

In D.P.U. 17-05, Eversource proposed a geographic information system verification project to upgrade the data stored in NSTAR Electric's geographic information system in order to enable its proposed grid-facing grid modernization investments as well as other non-grid modernization requirements of the system, and to optimize use of its new outage management system (D.P.U. 17-05, Exh. ES-DPH-1, at 99). Eversource conducted a competitive solicitation and entered into a fixed-price contract with a vendor to complete this

project for \$5,956,381 during 2018 (D.P.U. 17-05, Exhs. ES-DPH-2 (East) Sch. DPH-20 (Rev. 3); AG-19-26; AG-42-17, Att. (c) at 1, 39; Tr. 13, at 2776-2777).²²

4. Cybersecurity

Eversource proposes to apply its existing enterprise cybersecurity plan to its proposed grid modernization investments (D.P.U. 15-122, Exh. Eversource-IGMP at 44-48). The elements of Eversource's plan include considerations for: (1) risk management; (2) asset, change, and configuration management; (3) identity and access management; (4) threat and vulnerability management; (5) situational awareness; (6) information sharing and communications; (7) event and incident response; (8) supply chain and external dependencies; (9) workforce management; and (10) cybersecurity program management (D.P.U. 15-122, Exh. Eversource-IGMP at 44-49). Eversource's proposed investments in cybersecurity total \$11 million over five years (for both capital and O&M) (D.P.U. 15-122, Exhs. Eversource-GMP at 101, 117; Eversource-IGMP at 15, 38). The proposed \$11 million cost for cybersecurity is included in the TVR investment costs (D.P.U. 15-122, Exh. Eversource-GMP, App. 7, at 13).

²² In D.P.U. 17-05, Eversource proposed to treat the costs of the geographic information system project as a one-time, non-recurring expense (D.P.U. 17-05, Exhs. ES-DPH-1, at 103; DPU-22-15; AG-42-20). In D.P.U. 17-05 the Department stated that the geographic information system is intended primarily to enable Eversource's proposed grid modernization investments and the costs associated with it are more suitable for review as a proposed grid modernization investment. D.P.U. 17-05, at 241.

5. Business Case Analysis

Eversource presented a cost-benefit analysis for its proposed opt-in TVR program over 15-years and a sensitivity analysis. Based on these analyses, Eversource states that the benefit-cost ratio of its proposed opt-in TVR program is 0.27 (D.P.U. 15-122, Exh. Eversource-IGMP App. 7, at 14-24). Eversource provided high-level cost estimates for proposed grid-facing investments, and identified benefits associated with these investments through responses to information requests and evidentiary hearings (D.P.U. 15-122, Exh. Eversource-GMP, App. 7; D.P.U. 17-05, Exhs. AG-23-10, Att.; AG-23-12, Att.; Tr. 7, at 1451-1464; Tr. 8, at 1600-1635; ES-GMBC-2, at 30-33; DPU-42-6, Att.).

6. Research, Development, and Demonstration Projects

Over five-years, Eversource proposes to spend approximately \$7.5 million (or \$1.5 million annually) on RD&D programs.²³ Eversource proposes to undertake RD&D projects in the following areas: (1) sensing and monitoring; (2) advanced analytics; (3) real-time flexible action and dynamic integration of distributed energy resources; (4) impact of grid modernization technologies on low income customers; (5) pricing options; (6) customer engagement and behavioral response; and (7) microgrids (D.P.U. 15-122, Exh. Eversource-IGMP at 74-75).

²³ As discussed in Section V.C.4, below, Eversource proposes to implement a separate cost recovery Eversource's mechanism for its proposed RD&D costs (D.P.U. 15-122, Exhs. Eversource-RDC-3; Eversource-RDC-4).

V. GRID MODERNIZATION INVESTMENTS

A. Introduction

The Companies have proposed both customer-facing and grid-facing investments as part of their proposed grid modernization plans. Below, the Department reviews each company's investment proposals.

B. Positions of the Parties

1. Intervenors

a. Introduction

No intervenors recommend wholesale approval of the Companies' grid modernization plans. Rather, intervenors variously urged the Department to reject the proposed plans as filed, to require more granular cost benefit analyses before approval, and/or to approve certain grid-facing investments and reject customer-facing investments. Below, the Department separately summarizes the intervenors' arguments applicable to the grid modernization plans generally and the arguments applicable to company-specific plans.²⁴

b. General Arguments

i. Attorney General

The Attorney General argues that, based on the record in these proceedings, deployment of advanced metering functionality does not provide enough benefits to justify the costs, either on an opt-in or an opt-out basis (D.P.U. 15-120, Attorney General Brief at 29; D.P.U. 15-121, Attorney General Brief at 25-26; D.P.U. 15-122, Attorney General Brief

²⁴ Arguments regarding the Companies' cost recovery proposals are summarized in Section VII, below.

at 13). The Attorney General maintains, however, that, once certain issues are addressed, advanced metering functionality will be the best path forward to achieve the Department's grid modernization goals (D.P.U. 15-120, Attorney General Reply Brief at 2-3; D.P.U. 15-121, Attorney General Reply Brief at 5; D.P.U. 15-122, Attorney General Reply Brief at 5).

Rather than restart the grid modernization investigation, the Attorney General suggests that the Department can take action to address the outstanding issues affecting the business case for advanced metering functionality (D.P.U. 15-120, Attorney General Reply Brief at 3-4; D.P.U. 15-121, Attorney General Reply Brief at 7-8; D.P.U. 15-122, Attorney General Brief at 8-9). In particular, the Attorney General argues that the Department should take steps to: (1) resolve uncertainties regarding the design of TVR; (2) address the effects of customer migration to competitive supply and municipal aggregation on the deployment of advanced metering functionality; (3) develop standards for how data generated by advanced metering functionality will be collected and shared; and (4) address the challenges and differences in customer benefits presented by the region's capacity markets and summer peak load reductions targeted by TVR (D.P.U. 15-120, Attorney General Brief at 39-48; D.P.U. 15-121, Attorney General Reply Brief at 8; D.P.U. 15-122, Attorney General Reply Brief at 9).

Specific to the argument of customer migration, the Attorney General argues that the size of the population eligible to participate in Eversource's and Unitil's proposed opt-in advanced metering programs is shrinking due to the migration of basic service customers to

municipal aggregation and competitive supply. The Attorney General maintains that, as a result, the assumed participation rates are insufficient to offset the high fixed costs of the proposed programs or capture the full benefits of advanced metering functionality

(D.P.U. 15-120, Attorney General Brief at 25-26; D.P.U. 15-122, Attorney General Brief at 14-15; Attorney General Reply Brief at 8).

ii. Acadia Center

Acadia Center urges the Department to require National Grid and Eversource to offer an opt-in time of use rate for basic service customers as an interim step before each company files a revised grid modernization plan that includes advanced metering functionality with an opt-out TVR (D.P.U. 15-120, Acadia Center Brief at 22; D.P.U. 15-122, Acadia Center Brief at 15). Acadia Center contends that TVR should be phased in so that customers begin to understand rate design options, laying the ground work for future reform, and can be managed by typical metering and billing systems without more significant investments (D.P.U. 15-120, Acadia Center Brief at 22-23; D.P.U. 15-122, Acadia Center Brief at 16-17).

iii. CLF

CLF contends that the proposed grid modernization plans are lacking because they fail to fully consider the value of distributed energy resources to a modernized grid or fully assess the impact of proposed the investments on the integration of distributed energy resources (D.P.U. 15-120, CLF Brief at 8-13; D.P.U. 15-121, CLF Brief at 7-13; D.P.U. 15-120, CLF Brief at 10-15). CLF argues that the grid modernization plans should

be revised to provide a transformative platform for distributed energy resources and to fully integrate these resources to achieve the Department's grid modernization objectives (D.P.U. 15-120, CLF Brief at 8-13; D.P.U. 15-121, CLF Brief at 7-13; D.P.U. 15-122, CLF Brief at 10-15).

iv. DOER

DOER argues that the Department should reduce the period that proposed grid modernization investments are considered for preauthorization. DOER maintains that a shorter preauthorization period will allow for more contemporaneous review of the investments and ensure that they are cost effective when implemented (D.P.U. 15-120, DOER Brief at 12-13; D.P.U. 15-121, DOER Brief at 19-21; D.P.U. 15-122, DOER Brief at 17-19). DOER recommends that, if the Department finds it to be administratively feasible, the Department could preauthorize investments on a yearly basis (D.P.U. 15-120, DOER Brief at 12; D.P.U. 15-121, DOER Brief at 21; D.P.U. 15-122, DOER Brief at 18). In the alternative, DOER recommends the Department adopt an additional alternative timeline to allow for more frequent review (D.P.U. 15-120, DOER Brief at 13; D.P.U. 15-121, DOER Brief at 21; D.P.U. 15-122, DOER Brief at 18-19).

v. LEAN

LEAN asks the Department to clarify that the Companies may not use remote disconnect and/or the service limiter features of advanced meters as a means of bill collection as these actions constitute termination of service (D.P.U. 15-120/15-122, LEAN Brief at 3-4).

vi. NECEC

NECEC asserts that the Department should reaffirm its decisions to require: (1) a comprehensive analysis of the benefits and costs of grid modernization investments; and (2) the achievement of advanced metering functionality or an alternative approach to enable TVR implementation (D.P.U. 15-120/15-121/15-122, NECEC Brief at 12-15). NECEC argues that the proposed grid modernization plans inappropriately focus on capital investments and urges the Department to refocus the Companies' efforts toward a more "holistic and creative" approach to grid modernization (D.P.U. 15-120/15-121/15-122, NECEC Brief at 27). NECEC further argues that, for a more holistic approach to grid modernization, the Department should allow the Companies to seek accelerated cost recovery of non-capital expenditures related to grid modernization and provide further guidance on what may be considered incremental and eligible for special rate treatment (D.P.U. 15-120/15-121/15-122, NECEC Brief at 27-28). NECEC also maintains that the Department should require no less than annual reporting on the implementation of grid modernization and review future grid modernization plan filings on a staggered basis (D.P.U. 15-120/15-121/15-122, NECEC Brief at 28, 31). NECEC also recommends the Department require the Companies to describe how they intend to coordinate their proposed grid modernization activities in Massachusetts with actions in other states to achieve greater benefits at a lower cost (D.P.U. 15-120/15-121/15-122, NECEC Brief at 30).

Finally, NECEC recommends the Department direct the Companies to refile their RD&D proposals with additional information to ensure they meet the standards and goals of

D.P.U. 12-76-B (D.P.U. 15-120/15-121/15-122, NECEC Brief at 25, citing D.P.U. 12-76-B at 28-29). NECEC also argues the Department should require an annual report on the status of RD&D efforts to be shared with stakeholders, made available for public comment, and followed with an annual stakeholder meeting to communicate changes and solicit additional comment (D.P.U. 15-120/15-121/15-122, NECEC Brief at 26). NECEC recommends this process then be followed with a report to the Department (D.P.U. 15-120/15-121/15-122, NECEC Brief at 26).

c. Plan-Specific Arguments

i. D.P.U. 15-120, National Grid

(A) Attorney General

The Attorney General contends that the Department should use National Grid's grid modernization plan as a foundation and then, with stakeholder input: (1) determine the best way to maximize TVR benefits of automated meter reading ("AMR") meters; (2) develop statewide data access protocols; and (3) require an updated business case analysis and TVR study to ensure accurate estimates of capacity and energy savings benefits (D.P.U. 15-120, Attorney General Brief at 7). The Attorney General argues that the Department should not preauthorize National Grid's proposed investments in advanced metering functionality because the benefits do not justify the costs (D.P.U. 15-120, Attorney General Brief at 6-7). In this regard, the Attorney General argues the greatest benefit of advanced metering functionality (i.e., the replacement of meter readers) has already been achieved through National Grid's deployment of AMR meters (D.P.U. 15-120, Attorney General Brief

at 29-30, citing Exh. AG-PA-1, at 6-7). In addition, the Attorney General argues that National Grid's estimated participation levels of 66 to 71 percent are outdated as recent increases in municipal aggregation, including those pending before the Department, could potentially have decrease the number of basic service customers to 48 percent of National Grid's distribution customers (D.P.U. 15-120, Attorney General Brief at 31-32, citing Exh. DPU-5-11(a)). Further, the Attorney General argues that National Grid's estimates of the benefits from advanced metering functionality are flawed in that the estimates for demand reduction are too optimistic and the benefits from avoided and capacity costs are out of date (D.P.U. 15-120, Attorney General Brief at 32-37). The Attorney General also argues that the Department should not approve any proposed spending in customer education and outreach beyond traditional methods (D.P.U. 15-120, Attorney General Brief at 49, citing Exh. AG-PA-1, at 40-41). The Attorney General contends that, because National Grid should not undertake any advanced metering functionality investment at this time, there is no need for an extensive customer education and outreach plan (D.P.U. 15-120, Attorney General Brief at 50).

The Attorney General argues that incremental investment is not "business as usual" or investment that the Company would make in the ordinary course of capital planning. The Attorney General argues that if National Grid were allowed to classify business as usual investments as grid modernization investments, the company would be charging customers twice for the same investment (D.P.U. 15-120, Attorney General Brief at 16-17, citing Exh. AG-GLB-1, at 14).

Regarding specific investments, the Attorney General argues that the Department should adopt National Grid's planned five-year spending on the grid-facing elements of its proposed field deployment, with qualifications (i.e., VVO, advanced distribution automation, and feeder monitors) (D.P.U. 15-120, Attorney General Brief at 18). Looking at variations in spending levels across all four proposed scenarios, the Attorney General maintains that National Grid should adopt a \$66.38 million budget for these investments over five years (D.P.U. 15-120, Attorney General Brief at 18). Nonetheless, the Attorney General argues that, once the Department approves an investment scenario, National Grid should be directed to prepare revised budgets and business case analyses before any preauthorization (D.P.U. 15-120, Attorney General Brief at 25-26).

The Attorney General maintains that if the Department requires National Grid to delay implementation of advanced metering functionality and scale back related investments, the Company should also reduce its spending on other proposed investments, such as its proposed field area network (D.P.U. 15-120, Attorney General Brief at 17). Conversely, the Attorney General argues that she fully supports National Grid's planned VVO deployment and a potential acceleration of these planned investments, as the projected benefits are among the largest in the business case analysis (D.P.U. 15-120, Attorney General Brief at 19-20, citing Exh. AG-GLB-1, at 31).

For advanced distribution automation, the Attorney General argues that National Grid should proceed with these investments, but with a less aggressive deployment (i.e., only twelve circuits in the first five years, instead of the 46 as proposed) (D.P.U. 15-120,

Attorney General Brief at 20). In this regard, the Attorney General contends that distribution automation should be treated as a pilot project in order to confirm its capabilities, including the potential reduction in customer minutes of interruption (D.P.U. 15-120, Attorney General Brief at 20). The Attorney General supports National Grid's proposed field monitor devices, but recommends that the company engage in additional communications planning due to her proposed deferral of advanced metering functionality (D.P.U. 15-120, Attorney General Brief at 21, citing Exh. AG-GLB-1, at 39).

The Attorney General argues that within the enabling infrastructure investments proposed by National Grid (i.e., communications, information/operational technology, SCADA, advanced distribution management systems, and workforce training and asset management), certain investment components are business as usual investments that should not be recovered as grid modernization costs (D.P.U. 15-120, Attorney General Brief at 21-22). The Attorney General argues that these investment components are merely "customary evolutionary" investments in processes which the Company already employs, making them business as usual (D.P.U. 15-120, Attorney General Brief at 22, citing Exh. AG-GLB-1, at 41-42). Likewise, the Attorney General argues that National Grid's proposed investments in an integrated network operating center, changes to its customer service systems, meter inventory tracking systems, geographic information system, and new data collection and analytics capabilities are part of the company's on-going service obligations and not a direct result of its proposed grid modernization spending (D.P.U. 15-120, Attorney General Brief at 22, citing Exh. AG-GLB-1, at 42-44). In

addition, the Attorney General argues that any deferral of advanced metering functionality would require National Grid to conduct a communications study to reexamine these enabling infrastructure investments (D.P.U. 15-120, Attorney General Brief at 22, citing Exh. AG-GLB-1, at 41-43).

Alternately, the Attorney General argues that National Grid's proposed enabling investments in advanced distribution management systems and SCADA are appropriately categorized as grid modernization investments although she cautions that SCADA investments should be coordinated with the recommended communications study (D.P.U. 15-120, Attorney General Brief at 23). With respect to workforce training and asset management, the Attorney General argues that the Department should only approve advanced technology training as grid modernization investment. The Attorney General maintains that all other proposed workforce training and asset management should be considered business as usual investment that is already accounted for in rates (D.P.U. 15-120, Attorney General Brief at 23-24).

The Attorney General argues that National Grid's cybersecurity plan would be enhanced with regular cyber vulnerability assessments (D.P.U. 15-120, Attorney General Brief at 48-49, citing Exh. AG-GLB/PB-1, at 13-14). The Attorney General argues that her recommendation is fully consistent with industry standards (D.P.U. 15-120, Attorney General Brief at 48-49, citing Exh. AG-GLB/PB-1, at 13-14).

(B) Acadia Center

Acadia Center argues that National Grid has complied in whole, or in part, with the Department's directives in the D.P.U. 12-76. In particular, Acadia Center maintains that the National Grid's proposed Balanced Plan and AMI-Focused Plan scenarios both comply with the Department's directives in D.P.U. 12-76 and D.P.U. 14-04 by incorporating a full roll out of advanced metering functionality, a plan for an opt-out TVR, and a reasonably complete business case analysis demonstrating benefits commensurate with costs (D.P.U. 15-120, Acadia Center Brief at 10-11). Acadia Center, therefore, urges the Department to preliminarily approve either the Balanced Plan or the AMI-Focused Plan scenario and to direct National Grid to refile that scenario with an updated cost-benefit analysis, an assessment of cost sharing among states,²⁵ and strengthened protections for low-income ratepayers (D.P.U. 15-120, Acadia Center Brief at 10, 14-16, 21; Acadia Center Reply Brief at 3).²⁶

(C) CLF

CLF argues that the Department should reject National Grid's proposed grid modernization plan because it fails to meet the Department's directives. Specifically, CLF

²⁵ Acadia Center argues that the Department should require National Grid to review whether it can synchronize its grid modernization investments with New York and Rhode Island affiliates, contending the potential for sharing costs could be significant (D.P.U. 15-120, Acadia Center Brief at 15, citing Tr. 1, at 64-65).

²⁶ Acadia Center argues the Department should clarify existing protections against remote shut-off and determine an alternative rate design to apply to low-income ratepayers (D.P.U. 15-120, Acadia Center Brief at 21).

argues National Grid fails to: (1) connect its proposed investments to the Department's grid modernization objectives; (2) provide a clear picture of the impact that the investments will have on the objectives; (3) explain the difference in outcomes among the four proposed scenarios; and (4) provide an evaluation of how the grid modernization plan will meet policy goals (D.P.U. 15-120, CLF Brief at 7-8, 15-16). CLF maintains that National Grid's proposed grid modernization plan fails to change the relationship between its customers and third-party providers as it does not allow customers to change their energy use and fails to provide procedures for third-party providers to access aggregate usage data (D.P.U. 15-120, CLF Brief at 13-15).

CLF also argues that National Grid fails to provide a clear description of how proposed investments were selected and did not provide a clear or comprehensive picture of how the outcomes of investment scenarios would meet grid modernization objectives (D.P.U. 15-120, CLF Brief at 15-16). Further, CLF contends that because National Grid did not clearly outline how proposed investments were selected, it is also not clear whether proposed investments are actually foundational grid modernization investments or displace traditional capital investments (D.P.U. 15-120, CLF Brief at 16).

(D) DOER

DOER argues that National Grid has failed to comply with the Department's directives in D.P.U. 12-76 because it offered more than one grid modernization plan scenario for review. DOER asserts that the Department should require National Grid to submit a revised grid modernization plan with only one scenario, with updated and more granular cost

and benefit data (D.P.U. 15-120, DOER Brief at 8-9, 13).

Regarding advanced metering functionality, DOER supports, in concept, enabling advanced metering functionality and TVR, but has concerns with the significant costs associated with National Grid's opt-out proposals (D.P.U. 15-120, DOER Brief at 14-15). DOER maintains it would be supportive of an opt-in approach to advanced metering functionality if National Grid can achieve a participation rate higher than the two percent currently estimated (D.P.U. 15-120, DOER Brief at 15).

DOER maintains that it supports National Grid's proposed customer load management investments in concept (including the proposed web and mobile platforms and demand response management systems), arguing that these investments will enable the deployment of the infrastructure needed to leverage energy efficiency devices and improve demand response (D.P.U. 15-120, DOER Brief at 16). DOER further maintains that it is supportive of these investments if they are coordinated with implementation of TVR because the projected benefits of the investments are tied to customer enrollment in TVR (D.P.U. 15-120, DOER Brief at 16-17).

In addition, DOER asserts that it supports National Grid's targeted deployment of advanced distribution automation, which it argues has the benefit to reduce scale and duration of outages (D.P.U. 15-120, DOER Brief at 17). DOER also maintains that it supports a "broad and sensible" deployment of conservation voltage reduction and VVO (D.P.U. 15-120, DOER Brief at 18-19). DOER argues that once National Grid completes its advanced distribution management system investments, the data from VVO can be used to

enable distributed energy resource integration and improve system awareness and operational efficiency (D.P.U. 15-120, DOER Brief at 18, citing Grid Modernization Plan, Table 2, at 48). DOER contends, however, that the benefit cost analysis of VVO provided by National Grid lacks transparency because the benefits attributed to this investment were combined with advanced distribution automation and feeder monitors (D.P.U. 15-120, DOER Brief at 18, citing Grid Modernization Plan, Table 2, at 13). DOER asserts that National Grid should provide granular quantifiable and unquantifiable benefits in support of VVO deployment (D.P.U. 15-120, DOER Brief at 19).

DOER maintains it would likely support a cost-effective deployment of feeder monitors because it argues that they can reduce the impact of outages and increase efficiency in system operations (D.P.U. 15-120, DOER Brief at 20). DOER contends, however, that National Grid needs to provide additional support for the costs and benefits of feeder monitors before the Department should preauthorize these investments (D.P.U. 15-120, DOER Brief at 19-20).

DOER supports cybersecurity and privacy investments as categories within National Grid's proposed enabling infrastructure investment projects (D.P.U. 15-120, DOER Brief at 21-22). DOER maintains, however, that National Grid should be required to provide a specific cost-benefit analysis of these investments (D.P.U. 15-120, DOER Brief at 21-22). DOER also maintains that it is supportive of National Grid's proposed distributed energy resources integration investments as well as the company's proposal to install these investments in ten percent of its service territory (D.P.U. 15-120, DOER Brief at 22-23).

DOER maintains it conceptually supports National Grid's proposed RD&D projects, contending these projects allow National Grid to explore programs and technologies that further grid modernization (D.P.U. 15-120, DOER Brief at 23). DOER contends the proposed projects would inform National Grid of the evolution and innovation of technology and result in cost effective and timely achievement of grid modernization benefits (D.P.U. 15-120, DOER Brief at 25). DOER recommends the Department require National Grid to submit a compliance filing with budgeted projects to be undertaken (D.P.U. 15-120, DOER Brief at 25). DOER also recommends a compliance filing for RD&D projects that include progress reports by both the Department and DOER, and the creation of an RD&D working group (D.P.U. 15-120, DOER Brief at 26).

(E) LEAN

LEAN argues that National Grid has not shown that a full roll out of advanced metering functionality would be cost effective (D.P.U. 15-120/15-122, LEAN Brief at 6-7). LEAN further asserts that National Grid has failed to demonstrate that low-income customers would respond to TVR or have discretionary load to shift (D.P.U. 15-120/15-122, LEAN Brief at 7-9). Accordingly, LEAN argues that low-income customers should be exempt from any TVR offered by National Grid (D.P.U. 15-120/15-122, LEAN Brief at 7-9, 13).

(F) NECEC

NECEC argues National Grid should revise its grid modernization plan drawing on the Balanced Plan and AMI-Focused Plan scenarios (D.P.U. 15-120/15-121/15-122, NECEC Brief at 22-23). NECEC argues National Grid should: (1) provide a more comprehensive

analysis on the process used to select investments; (2) consider distributed energy resources to meet distribution system needs; (3) comprehensively assess how its grid modernization plan will advance the Department's goal of integrating distributed energy resources; and (4) provide a comprehensive analysis of demand response and non-wires alternatives (D.P.U. 15-120/15-121/15-122, NECEC Brief at 24-25).

Specifically, NECEC argues that National Grid's grid modernization plan focuses on incremental investments and is not robust enough in its assessment of whether its proposed investments will displace the need for traditional baseline capital investments (D.P.U. 15-120/15-121/15-122, NECEC Brief at 24, citing Exh. CLF-TW/AH-1, at 23-24). NECEC contends National Grid should have provided a clearer explanation of how it selected investments and how that process was designed to make cost-effective, measurable progress in advancing the Department's grid modernization objectives (D.P.U. 15-120/15-121/15-122, NECEC Brief at 24, citing Exh. CLF-TW/AH-1, at 24-26). Further, NECEC argues that National Grid failed to consider distributed energy resources as a tool to meet distribution needs or fully assess how its grid modernization plan would advance the goal of integrating distributed energy resources (D.P.U. 15-120/15-121/15-122, NECEC Brief at 24, citing Exh. CLF-TW/AH-1, at 26-27).

ii. D.P.U. 15-121, Unutil

(A) Attorney General

The Attorney General argues that the Department should deny Unutil's proposed opt-in advanced metering functionality and TVR program and associated cost-recovery

(D.P.U. 15-121, Attorney General Brief at 22-24; Attorney General Reply Brief at 3).

Specifically, the Attorney General argues that the Company's proposal to offer advanced metering functionality with TVR on an opt-in basis fails to meet the requirements outlined by the Department in D.P.U. 12-76 (D.P.U. 15-121, Attorney General Brief at 23-24). In addition, the Attorney General argues that Unitil's opt-in TVR proposal fails to yield a positive benefit/cost ratio because it will not achieve participation rates high enough to capture the full benefits of advanced metering functionality (D.P.U. 15-121, Attorney General Brief at 24-25; Attorney General Reply Brief at 4). The Attorney General argues that Unitil should investigate an alternative plan that uses its existing AMI to fulfill the Department's advanced metering functionality requirements and provides enough benefits to justify the costs (D.P.U. 15-121, Attorney General Brief at 27).

The Attorney General argues the Department should not approve Unitil's proposed customer education and outreach investments (D.P.U. 15-121, Attorney General Brief at 30). The Attorney General asserts that if there is no change in how customers use energy through TVR, then an extensive customer education and outreach plan is unnecessary (D.P.U. 15-121, Attorney General Brief at 31; Attorney General Reply Brief at 15). The Attorney General contends that Unitil's remaining grid modernizations investments do not require active customer participation and, therefore, Unitil does not need a plan that is

beyond its traditional manner of communication (D.P.U. 15-121, Attorney General Brief at 31, citing Exh. AG-PA-1, at 45).²⁷

The Attorney General argues that certain grid-facing investments proposed under of Unitil's plan are eligible for preauthorization (D.P.U. 15-121, Attorney General Brief at 9). In particular, the Attorney General argues that the Department should preauthorize \$7,790,000 in grid modernization investment over five years for Unitil consisting of distribution automation investments including a field area network, SCADA, automated distribution devices for VVO, and advanced distribution management system (D.P.U. 15-121, Attorney General Brief at 21).

The Attorney General maintains that she generally supports Unitil's proposed distribution automation investments, which include installation of a field area communications network, extension of SCADA, installation of automated controls, and investment in advanced distribution management systems (D.P.U. 15-121, Attorney General Brief at 14, citing Exh. FG&E-2, at 17-18). The Attorney General argues, however, that Unitil's deployment of a field area communications network must be coordinated with the deployment of advanced metering functionality. In this regard, the Attorney General argues that, after study, Unitil should be required to develop a comprehensive communications infrastructure

²⁷ The Attorney General argues that if the Department approves advanced metering functionality for Until, then the company should use third-parties (including trade unions, chambers of commerce and environmental groups) to assist in educating customers about TVR (D.P.U. 15-121, Attorney General Brief at 31, citing Exh. AG-PA-1, at 45).

plan before any field area communications network is deployed (D.P.U. 15-121, Attorney General Brief at 14-15, citing Exh. AG-GLB-1, at 30).

The Attorney General argues that Unitil should undertake its proposed SCADA deployment during the first five years of its grid modernization plan (Attorney General Brief at 15, citing Exh. AG-GLB-1, at 30). In addition, the Attorney General argues that Unitil should undertake a pilot approach before it begins wide-scale spending on VVO. Also, the Attorney General asserts that it is more appropriate to deploy conservation voltage reduction, rather than advanced distribution management systems, with VVO, as proposed (D.P.U. 15-121, Attorney General Brief at 15, citing Exh. AG-GLB-1, at 27-29). The Attorney General maintains that she supports Unitil's proposed spending on advanced distribution management systems (D.P.U. 15-121, Attorney General Brief at 15, citing Exh. AG-GLB-1, at 32).

The Attorney General argues that the Department should deny Unitil's proposed investments in workforce training and asset management as these investments are business as usual and should not be considered grid modernization investments (D.P.U. 15-121, Attorney General Brief at 16, citing Exh. AG-GLB-1, at 71). For similar reasons, the Attorney General argues that the Department should not approve Unitil's proposed investments in distributed energy resources enablement and reliability (D.P.U. 15-121, Attorney General Brief at 16-17). In particular, the Attorney General argues that, while Unitil's circuit capacity study for distributed energy resource enablement is important, current annual

capacity studies should consider distributed energy resources as a matter of course

(D.P.U. 15-121, Attorney General Brief at 17, citing Exh. AG-GLB-1, at 20).

The Attorney General maintains that it is questionable for Unitil to invest in its proposed distributed energy resource analytics and visualization platform because it is a tool that benefits only a minority of customers with plans to install distributed energy resources (D.P.U. 15-121, Attorney General Brief at 18, citing Exh. AG-GLB-1, at 21-22). In addition, the Attorney General argues that Unitil should not deploy 3V0 system wide, as proposed, as the record does not demonstrate that reverse power flow is a growing concern. Instead, the Attorney General maintains that Unitil should target locations that pose “imminent reverse flow issues” (D.P.U. 15-121, Attorney General Brief at 18, citing Exh. AG-GLB-1, at 22; Attorney Reply Brief at 12-13, citing Exh. FG&E-6-Rebuttal at 10; Tr. J-2, at 147).

The Attorney General also argues that Unitil’s enterprise mobile damage assessment tool is a business as usual investment (D.P.U. 15-121, Attorney General Brief at 18-19). The Attorney General contends that this tool, on its own, will not speed up restoration if there is not a commitment by Unitil for more “boots on the ground” for restoration (D.P.U. 15-121, Attorney General Brief at 19, citing Exh. AG-GLB-1, at 23-24).

Further, the Attorney General argues that the proposed spending to integrate current AMI with its outage management system relies on existing technology that, in the event of a major outage, would result in the outage management system being unable to receive any AMI data (D.P.U. 15-121, Attorney General Brief at 19-20, citing Exh. AG-GLB-1,

at 24-25). The Attorney General argues that Unitil needs to demonstrate a more robust communications investment strategy to support this type of investment (D.P.U. 15-121, Attorney General Brief at 19-20, citing Exh. AG-GLB-1, at 24-25). Further, the Attorney General argues that Unitil's reliance on mostly qualitative benefits for these projects are likely overstated (D.P.U. 15-121, Attorney General Brief 20, citing Exh. AG-GLB-1, at 24-25).

The Attorney General argues that Unitil did not provide adequate information to demonstrate compliance with the Department's cybersecurity directives (D.P.U. 15-121, Attorney General Brief at 28, citing D.P.U. 12-76-B at 34-36; Exhs. FG&E-6, at 26; AG-3-15). Specifically, the Attorney General contends that Unitil did not describe in detail the cybersecurity measures it intends to take related to its proposed grid modernization investments (D.P.U. 15-121, Attorney General Brief at 28, citing Exhs. FG&E-1, at 85-87; AG-GLB/PB-1, at 8-12, 16). The Attorney General further argues that Unitil did not provide methods for validating its cybersecurity strategy (D.P.U. 15-121, Attorney General Brief at 29). The Attorney General argues that the Department should review Unitil's cybersecurity strategy for adequacy and completeness. In addition, the Attorney General argues that the Department should direct Unitil conduct a third-party cybersecurity vulnerability assessment both annually and whenever a new technology is implemented (D.P.U. 15-121, Attorney General Brief at 30).

(B) CLF

CLF argues the Department should reject Unitil's grid modernization plan because the Company failed to demonstrate how the proposed investments make measurable progress toward any of the Department's grid modernization objectives (D.P.U. 15-121, CLF Brief at 8). In addition, CLF argues that Unitil's proposal does not comply with the directives in D.P.U. 12-76 as it (1) provides for advanced metering functionality and TVR on an opt-in basis, and (2) fails to provide evidence of benefits sufficient to justify the proposed spending (D.P.U. 15-121, CLF Brief at 3-15).

(C) DOER

DOER is generally supportive of Unitil's proposed grid modernization plan, maintaining that the plan broadly addresses the policies outlined in D.P.U. 12-76 (D.P.U. 15-121, DOER Brief at 6). DOER argues, however, that the Department should require Unitil to submit a compliance filing with updated cost estimates and a more granular analysis of benefits and costs (including costs associated with distributed automation, customer empowerment, and distributed energy resource enablement) (D.P.U. 15-121, DOER Brief at 8-9, 15-17). DOER contends that this updated cost and benefit information is required in order to determine the correct level of preauthorized investment (D.P.U. 15-121, DOER Brief at 17-19).

For Unitil's distributed automation proposals (i.e., field area network, VVO, SCADA, and advanced distribution management systems), DOER argues that the Department should require additional support from the company before it preauthorizes any investments

(D.P.U. 15-121, DOER Brief at 12). In particular, DOER argues there is a lack of specific analysis and a need for additional information regarding the costs and potential benefits of these investments (D.P.U. 15-121, DOER Brief at 10). For example, DOER argues that the analysis supporting deployment of a field area network and SCADA does not include the effects of the technologies enabling other investments, such as advanced distribution management systems (D.P.U. 15-121, DOER Brief at 10-11). DOER is also concerned that Unitil's analysis of VVO shows zero benefits when there are clear benefits from this technology (D.P.U. 15-121, DOER Brief at 11, citing Exh. FG&E-1, at 51).

Similarly, DOER argues that Unitil needs to provide additional support for certain of its proposed distributed energy resources enablement projects (i.e., a circuit capacity study for distributed energy resources, a distributed energy resources platform, and 3V0 deployment) before the Department can preauthorize the investments (D.P.U. 15-121, DOER Brief at 13-14). DOER recognizes the importance of these proposed investments to enable interconnection and accommodate additional distributed energy resources (D.P.U. 15-121, DOER Brief at 14). DOER contends, however, that Unitil may not have included all of the benefits to the grid and to customers from these investments, including support of policy objectives, reduction in emissions, and enabling demand optimization (D.P.U. 15-121, DOER Brief at 14). For Unitil's proposed non-advanced metering functionality customer empowerment projects (i.e., energy information web portal, gamification pilot), DOER maintains that these are reasonable investments that also require greater detail related benefits before Department preauthorization (D.P.U. 15-121, DOER Brief at 12-13).

DOER maintains it is conceptually supportive of Unitil's RD&D projects, contending they will allow Unitil to explore programs and technology to further enable grid modernization (D.P.U. 15-121, DOER Brief at 22-23). DOER recommends the completion of these proposed projects be accelerated (D.P.U. 15-121, DOER Brief at 23).

(D) NECEC

NECEC argues that Unitil's grid modernization plan proposal fails to justify its proposed investments or demonstrate measurable progress toward the Department's grid modernization objectives (D.P.U. 15-120/15-121/15-122, NECEC Brief at 18-22, 25-27). In addition, NECEC contends that Unitil's opt-in TVR proposal, with a cost-benefit ratio of less than 1.0, lacks justification as an alternative to an opt-out TVR program (D.P.U. 15-120/15-121/15-122, NECEC Brief at 20-21). To correct these issues, NECEC recommends the Department require Unitil to revise and refile its plan (D.P.U. 15-120/15-121/15-122, NECEC Brief at 18-19, 21-22).

NECEC argues that Unitil's proposal lacks sufficient detail to show why proposed investments were selected (D.P.U. 15-120/15-121/15-122, NECEC Brief at 18-19). NECEC contends that this is especially true for Unitil's proposed distributed energy resources enablement projects (D.P.U. 15-120/15-121/15-122, NECEC Brief at 19, citing Exh. CLF-TW/AH-1, at 38-39). NECEC also argues that Unitil did not explore whether distributed energy resources or non-wire alternatives (either as direct investments or to leverage third party investments) would advance the Department's grid modernization

objectives (D.P.U. 15-120/15-121/15-122, NECEC Brief at 19, citing Exh. CLF-CG-1, at 36-40).

iii. D.P.U. 15-122, Eversource

(A) Attorney General

The Attorney General argues that Eversource's proposed customer-facing investments are not eligible for accelerated cost recovery because the plan fails to meet the advanced metering functionality requirements established by the Department in D.P.U. 12-76 (D.P.U. 15-122, Attorney General Brief at 15; Attorney General Reply Brief at 4). In particular, the Attorney General maintains that Eversource failed to include an analysis of an opt-out advanced metering approach (D.P.U. 15-122, Attorney General Brief at 15). Further, the Attorney General maintains that Eversource's conclusion that opt-in is better for its customers is based on a cursory three-page analysis that fails to meet the D.P.U. 12-76 requirements (D.P.U. 15-122, Attorney General Brief at 15). In addition, the Attorney General argues that Eversource's opt-out analysis fails to fully consider the benefits of advanced metering functionality or recognize all benefits associated with an opt-out program (D.P.U. 15-122, Attorney General Brief at 16-17). The Attorney General also argues that Eversource overestimates the cost of meters in its analysis (D.P.U. 15-122, Attorney General Brief at 17-18).

The Attorney General further contends that the Department should not approve Eversource's proposed customer education and outreach spending (D.P.U. 15-122, Attorney General Brief at 20). The Attorney General argues that, because she recommends the

Department not approve advanced metering functionality, there is no need to spend millions of dollars on extensive customer education and outreach where the focus is informing customers on how TVR works (D.P.U. 15-122, Attorney General Brief at 20-21).

Likewise, the Attorney General argues that there is no basis for accelerated cost recovery of Eversource's proposed grid-facing investments because the plan fails to fully deploy advanced metering functionality and has no business-case analysis to support the proposed grid-facing investments (D.P.U. 17-05, Attorney General Brief at 38). The Attorney General argues that if the Department were to approve a capital tracker for grid-facing investments, then the Department could revisit and modify the D.P.U. 12-76-B requirements (D.P.U. 17-05, Attorney General Brief at 39).

The Attorney General also argues that Eversource has not provided a business case analysis to support proposed grid-facing investments and, as a result, there is no basis to preapprove the proposed investments (D.P.U. 17-05, Attorney General Brief at 38). In addition, the Attorney General argues that many of Eversource's proposed investments are business as usual and not grid modernization investments (D.P.U. 17-05, Attorney General Brief at 39).

The Attorney General contends that there is no way to validate Eversource's cybersecurity strategy (D.P.U. 15-122, Attorney General Brief at 19; Attorney General Reply Brief at 13). To this end, the Attorney General argues that the Department should require Eversource to conduct a third-party cyber vulnerability assessment annually (D.P.U. 15-122, Attorney General Brief at 19-22, citing Exh. AG-GLB/PB-1, at 13). Further, the Attorney

General argues that Eversource's grid modernization plan does not contain a proposal regarding privacy of customer usage data (D.P.U. 15-122, Attorney General Brief at 19; Attorney General Reply Brief at 13). The Attorney General argues that the Department should direct Eversource to establish proper safeguards to protect customer data and information and ensure Eversource is fulfilling its obligation to prevent cyberattacks (D.P.U. 15-122, Attorney General Brief at 19-20).

(B) Acadia Center

Acadia Center argues the Department should reject Eversource's proposed customer-facing investments because they fail to meet the requirements of D.P.U. 12-76 and D.P.U. 14-04, including a failure to: (1) meet the technical requirements of advanced metering functionality; (2) propose widespread deployment of advanced metering functionality with a default TVR or plans to achieve full advanced metering functionality on a longer time horizon; (3) establish performance metrics; (4) provide a robust stakeholder process; and (5) include investments that accomplish automated outage and restoration notification (D.P.U. 15-122, Acadia Center Brief at 8-9).

Acadia Center also argues that Eversource's proposed grid-facing investments fail to meet the requirements for preapproval (i.e., lack of full advanced metering functionality and a benefit-cost analysis) and, therefore, should be rejected (D.P.U. 17-05, Acadia Center Brief at 14-15). Acadia Center asserts that the Department should direct Eversource to file a new grid modernization plan that includes widespread advanced metering functionality with an opt-out TVR, a more robust stakeholder process, a robust benefit-cost analysis, and

additional low-income protections (D.P.U. 15-122, Acadia Center Brief at 10; D.P.U. 17-05, Acadia Center Brief at 14, 16-17; Acadia Center Reply Brief at 5).²⁸ Finally, Acadia Center contends that the Department should require more detail in Eversource's proposed RD&D plan before committing ratepayer funds (D.P.U. 15-122, Acadia Center Reply Brief at 9, citing Compact Brief at 46; D.P.U. 15-120/15-121/15-122, NECEC Brief at 25).

(C) CLF

CLF argues that Eversource's proposed customer-facing investments should be rejected because the company failed to meet the Department's requirements in D.P.U. 12-76 (D.P.U. 15-122, CLF Brief at 10). In particular, CLF argues that Eversource failed to propose a full opt-out option and also did not forecast benefits for the opt-in program it proposed (D.P.U. 15-122, CLF Brief at 17-19). CLF maintains that Eversource fails to consider the ways advanced metering functionality can be used with distributed energy resources to create an adaptive load and allow consumers to manage their energy use (D.P.U. 15-122, CLF Brief at 19). CLF also maintains that Eversource's customer engagement plan is far from the robust engagement the Department envisioned. Specifically, CLF argues that the plan is utility-centric and fails to provide a customer-centric perspective to grid modernization outcomes, for example, focusing on benefits such as system peak

²⁸ Acadia Center is in favor of a more robust stakeholder process for setting targets and performance incentives and penalties, as well as multiple stakeholder meetings per year with materials provided in advance and opportunity for written comment (D.P.U. 15-122, Acadia Center Brief at 13; D.P.U. 17-05, Acadia Center Brief at 16). For low-income customers, Acadia Center urges the Department to clarify protections against remote shutoff and alternative rate designs for low-income customers (D.P.U. 17-05, Acadia Center Brief at 16).

reduction as opposed to reduced system costs for all customers (D.P.U. 15-122, CLF Brief at 20-21). CLF argues Eversource's outreach plan for third parties also falls short, maintaining it basically ignores third parties (D.P.U. 15-122, CLF Brief at 21).

CLF also argues that Eversource's proposed grid-facing investments are not consistent with the policy framework established in D.P.U. 12-76-B (D.P.U. 15-122, CLF Brief at 12; D.P.U. 17-05, CLF Brief at 19). In particular, CLF contends that the proposed investments do not: (1) empower customer adoption of distributed energy resources; (2) provide a platform for third-party distributed energy resource providers; or (3) create a modern grid that efficiently leverages distributed energy resources (D.P.U. 15-122, CLF Brief at 13, citing Exh. CLF-CG1, at 34). In addition, CLF contends that Eversource's proposal fails to meet the Department's grid modernization requirements and is short on details and analysis to support the proposed grid-facing investments (D.P.U. 17-05, CLF Brief at 21-22). To address these issues, CLF argues that the Department should require Eversource to file a more comprehensive revised grid modernization plan (D.P.U. 15-122, CLF Brief at 24).

(D) DOER

DOER argues that the Department should reject Eversource's proposed customer-facing investments, as filed, because the benefits of the proposed investments are not justified by the costs (D.P.U. 15-122, DOER Brief at 8-9; DOER Reply Brief at 1). DOER argues that the Department should require Eversource to provide a more granular cost-benefit analysis to support the cost-effectiveness of the proposed customer-facing investments (D.P.U. 15-122, DOER Brief at 11-12; DOER Reply Brief at 1-2). DOER maintains that

this analysis should include unquantifiable benefits, multiple TVR structure options, and more information on advanced metering capabilities (D.P.U. 15-122, DOER Brief at 9, 11-15). In addition, DOER argues the Department should require Eversource to provide updated pricing, benefits, and cost estimates (D.P.U. 15-122, DOER Brief at 16).

DOER contends that Eversource has not provided a comprehensive business case analysis and, instead, only provided estimated expenditures for anticipated projects to support its proposed grid-facing investments (D.P.U. 17-05, DOER Brief at 29). Therefore, DOER argues that the Department should direct Eversource to file a compliance filing before preapproving any of its proposed grid-facing investments (D.P.U. 17-05, DOER Brief at 28).

DOER asserts that it is conceptually supportive of Eversource's proposed investments in distribution management systems, VVO, and automation, including foundational technologies for distribution management systems and automation (D.P.U. 17-05, DOER Brief at 29-31). DOER contends these investments are foundational to grid modernization and align with grid modernization objectives, including grid optimization, improving restoration, increasing safety and resiliency, enabling distributed energy resources integration, and optimizing demand (D.P.U. 17-05, DOER Brief at 29-31). DOER maintains that it also conceptually supports Eversource's proposed investments in customer tools for distributed energy resources integration, arguing that the investments will collectively enable distributed energy resources integration (D.P.U. 17-05, DOER Brief at 33).

(E) NECEC

NECEC argues that the Department should reject Eversource's proposed customer-facing investments because the proposal is not the "comprehensive roadmap" for a modern grid envisioned in D.P.U. 12-76 and is inconsistent with the approach adopted by the Department that advanced metering functionality should be on an opt-out basis (D.P.U. 15-120/15-121/15-122, NECEC Brief at 15, 17). NECEC argues that Eversource proposes to recover costs from customers for a deployment of advanced metering functionality that is not cost-effective, on an opt-in basis that is not justified by either outcome or metrics (D.P.U. 15-120/15-121/15-122, NECEC Brief at 16). To address these issues, NECEC maintains that the Department should direct Eversource to file a revised grid modernization plan consistent with the directives in D.P.U. 12-76 and D.P.U. 14-04 (D.P.U. 15-120/15-121/15-122, NECEC Brief at 16).

NECEC contends that Eversource's proposed grid-facing investments include foundational investments, such as distribution management systems, that will achieve grid modernization benefits (D.P.U. 17-05, NECEC Brief at 16-17, citing Exhs. ES-GMBC-1, at 111-14, 16-17, 68-69; CLC-KRR-1, at 10; AG-GLB-1, at 49). NECEC argues that these foundational investments are necessary and need to be made quickly (D.P.U. 17-05, NECEC Brief at 18-19).

(F) Compact

The Compact maintains that Eversource's proposed customer-facing investments inappropriately focus on the company's own basic service customers and fail to enable

opt-out advanced metering functionality for all customers (D.P.U. 15-122, Compact Brief at 9-10). Further, the Compact argues that Eversource's proposal undermines competitive markets in contradiction of St. 1997, c. 164, An Act Relative to Restructuring the Electric Utility Industry (D.P.U. 15-122, Compact Brief at 21). In particular, the Compact argues that Eversource's proposal creates a bias by offering advanced meters only to basic service customers and not to competitive supply and municipal aggregation customers (D.P.U. 15-122, Compact Brief at 21-22, 24-26; Compact Reply Brief at 13, citing Exh. CLC-FL-1, at 33).²⁹ The Compact asserts that requiring competitive suppliers and municipal aggregators to fund advanced meters for their customers creates a barrier to retail competition (D.P.U. 15-122, Compact Brief at 23-24).³⁰

In addition, the Compact argues that Eversource's opt-in approach to advanced metering functionality should be rejected because it: (1) does not include a cost-benefit analysis or otherwise meet the business case requirements prescribed by the Department; (2) fails to achieve advanced metering functionality with third party technologies; and (3) fails to achieve full advanced metering functionality within five years or provide an alternative proposal to such functionality over a longer period (D.P.U. 15-122, Compact

²⁹ The Compact does not, however, propose that Eversource design a TVR for competitive supply and municipal aggregation customers (D.P.U. 15-122, Compact Reply Brief at 12-13).

³⁰ The Compact argues that Eversource's proposal to recover meter costs through distribution rates will result in an improper cross-subsidy where competitive supply customers pay a share of basic service customers' opt-in TVR meters as well as the full cost of their own meter (D.P.U. 15-122, Compact Brief at 28; Compact Reply Brief at 14-16).

Brief at 10-16; Compact Reply Brief at 23-24). The Compact contends that, because of these failures, Eversource's proposal will not provide (1) for the collection of usage data in near real time, or (2) an approach for customer or third party access to those data (D.P.U. 15-122, Compact Brief at 10-12, 18).³¹

Further, the Compact maintains that Eversource's analysis of opt-out advanced metering functionality is flawed (D.P.U. 15-122, Compact Brief at 29-30, citing Exhs. AG-1-7(d); CLC-4-10; DPU-1-22; DPU-1-11; DPU-1-6; AG-1-3). Specifically, the Compact argues that Eversource failed to fully account for the full benefits of an opt-out approach, including improved reliability, improved customer service, and benefits from data collection such as improved rate design and forecasting capabilities (D.P.U. 15-122, Compact Brief at 30-31, citing Exhs. CLC-KRR-1; AC-1, at 4; CLC-DBG-1, at 8-17).³² The Compact also maintains that Eversource underestimates customer acceptance rates and was selective in the evidence it used to support its claim that opt-in is more cost-beneficial (D.P.U. 15-122, Compact Brief at 35-36; Compact Reply Brief at 19-20).

The Compact argues that Eversource's proposed customer engagement and outreach plan is not reasonable (D.P.U. 15-122, Compact Brief at 36). The Compact argues that,

³¹ The Compact contends that Eversource's assertion that customers will adopt third-party technologies to achieve grid modernization conflicts with its argument that customers have no interest in TVR and shifting their energy use (D.P.U. 15-122, Compact Reply Brief at 10-11).

³² As an additional benefit, the Compact argues that if full opt-out advanced metering functionality were deployed, certain grid-facing investments (e.g., remote fault indicators) would be obsolete (D.P.U. 15-122, Compact Reply Brief at 24; D.P.U. 17-05, Compact Brief at 17).

because the TVR program proposed by Eversource will have a limited value, spending \$19 million to engage only about five percent of its customers is imprudent (D.P.U. 15-122, Compact Brief at 37).

The Compact further argues that the \$98 million Eversource proposes to invest in as a “bolt-on” for its billing system is inefficient (D.P.U. 15-122, Compact Brief at 37). The Compact contends that a full replacement of the company’s billing system would be more cost effective (D.P.U. 15-122, Compact Brief at 37). The Compact maintains that Eversource’s cost estimates for a new billing system are overstated as they include costs for replacing customer information systems and meter data management systems for Connecticut and New Hampshire (D.P.U. 15-122, Compact Brief at 38, citing RR-DPU-2). The Compact argues that Eversource’s failure to upgrade its billing system has hindered the competitive markets (D.P.U. 15-122, Compact Brief at 39). Further, the Compact argues that Eversource’s proposed investments in its billing systems are long overdue and the proposed modifications to the billing system will only be useful until opt-out TVR is adopted (D.P.U. 17-05, Compact Brief at 16-17).

The Compact further argues that Eversource’s proposed grid-facing investments are neither incremental to capital spending or accelerate grid modernization objectives (D.P.U. 17-05, Compact Brief at 17). The Compact also argues that the remote fault circuit indicators proposed by Eversource will be obsolete once full advanced metering functionality is achieved (D.P.U. 17-05, Compact Brief, citing Exh. AG-GLB-1, at 57-58).

The Compact maintains that Eversource's proposed investments in automation are required only because the company has deferred what should have been ongoing urban underground investment and part of the ordinary course of business (D.P.U. 17-05, Compact Brief at 17, citing Exh. AG-GLB-1, at 55-56). The Compact also argues that investments in advanced system load flow are part of the ordinary course of business (D.P.U. 17-05, Compact Brief at 17, citing Exh. AG-GLB-1, at 48). The Compact contends that these investments are not incremental and grid modernization investment dollars should not be spent to make these investments (D.P.U. 17-05, Compact Brief at 17-18).

With respect to Eversource's proposed distribution management system investments, the Compact argues that these are necessary, but only if linked to grid modernization functionalities such as full deployment of advanced metering functionality (D.P.U. 17-05, Compact Brief at 18). The Compact contends that Eversource's the proposed distribution management system is just a platform with nothing built on it and, therefore, is ineligible for preauthorization (D.P.U. 17-05, Compact Brief at 18).

Finally, with regards to Eversource's proposed RD&D, Compact argues the efforts are still nascent and requests funding for projects it have not yet developed (D.P.U. 15-122, Compact Brief at 46). The Compact also contends that Eversource is not proposing any new or unique demonstration projects (D.P.U. 15-122, Compact Brief at 46, citing Exhs. Eversource-IGMP at 77; CLF-CG-1, at 32). Consequently, the Compact maintains it would be imprudent to commit ratepayer funds to the RD&D plan (D.P.U. 15-122, Compact Brief at 46). The Compact recommends that a final RD&D plan from Eversource could

include research on microgrids, which would allow Eversource to study multiple technologies on a single site (D.P.U. 15-122, Compact Brief at 47-48, citing Exh. CLC-JRG-1, at 8).

2. Companies

a. National Grid, D.P.U. 15-120

National Grid argues that the Department should approve one of its four proposed customer-facing scenarios as filed in order to permit it to deploy advanced metering functionality without delay (D.P.U. 15-120, National Grid Reply Brief at 2-3, 7, citing D.P.U. 15-120, Grid Modernization Plan at 110-116; Exh. AG-3-31(a)-(d)). National Grid maintains that its proposed scenarios are fully detailed and supported with appropriate cost-benefit analyses (D.P.U. 15-120, National Grid Reply Brief at 5-6, citing Exh. AG-3-31(a)-(d)). National Grid contends that the Department's selection of one of the four scenarios does not substitute its business judgment because National Grid used its business judgment to develop the four proposed scenarios (D.P.U. 15-120, National Grid Reply Brief at 4). To develop estimated costs, National Grid asserts that it conducted twenty internal working groups, engaged in a competitive bidding process, and solicited bids from market-leading vendors (D.P.U. 15-120, National Grid Reply Brief at 5-6). National Grid further contends that it included a wide range of quantitative and qualitative benefits in its analyses (D.P.U. 15-120, National Grid Reply Brief at 6, citing Grid Modernization Plan at 110-116, Att. 10(a)-(e)). National Grid argues that requiring updated cost and benefit estimates, as sought by some intervenors, will lead to delays in implementation and

subsequent delays in benefits (including the loss of certain benefits) (D.P.U. 15-120, National Grid Reply Brief at 6-7).

National Grid argues that the largest benefit from the deployment of advanced metering functionality is from demand reduction (D.P.U. 15-120, National Grid Brief at 7-8). National Grid argues that its demand response assumptions are supported by the results of its smart grid pilot, the results of other TVR programs, and a regression model that it compared to other peer-reviewed regression models (D.P.U. 15-120, National Grid Reply Brief at 8, citing Grid Modernization Plan, Att. 13 at 5; Exh. NG Panel-Rebuttal-2, at 14). National Grid also argues that its energy and capacity price assumptions are based on a valid forecasting model (D.P.U. 15-120, National Grid Reply Brief at 9-10, citing Exh. NG-Panel-Rebuttal-1, at 16-17; Tr. 2, at 359). National Grid acknowledges that changes in circumstances, such as tax credits, can impact capacity assumptions but contends that such changes cannot be viewed in isolation as other factors may impact capacity values (D.P.U. 15-120, National Grid Reply Brief at 10, citing Tr. 2, at 341, 358).

National Grid supports intervenor requests for the Department to investigate ways to maximize TVR participation in light of declining basic service customers and other TVR related issues. However, National Grid asserts that such investigation is a not reason to delay TVR implementation (D.P.U. 15-120, National Grid Reply Brief at 11). National Grid maintains that it design its proposed grid modernization plan with the objective of delivering TVR and customer load management opportunities as soon as possible, enabling these functions for customers, on a rolling basis, once they have received the appropriate

technology (D.P.U. 15-120, National Grid Reply Brief at 13, citing Exh. NG-Panel-Rebuttal-1, at 24).

National Grid argues that the Department should approve its proposed grid-focused investments because they are (1) incremental to its baseline capital projects; and (2) needed to achieve the Department's grid modernization objectives (D.P.U. 15-120, National Grid Reply Brief at 15). With respect to whether the investments are incremental, National Grid argues that it would not make any of the proposed investments but for grid modernization (D.P.U. 15-120, National Grid Brief at 16, citing Exh. WFJ/RDS-Rebuttal-1, at 5-7). Using this test, National Grid argues that its proposed field deployment programs, VVO, advanced distribution automation, feeder monitors, and customer load management are incremental (D.P.U. 15-120, National Grid Brief at 17). National Grid contends that there is no requirement to assess whether investments proposed would replace traditional systems, as suggested by NECEC and CLF (D.P.U. 15-120, National Grid Brief at 16, citing CLF Brief at 16; D.P.U. 15-120/15-121/15-122, NECEC Brief at 24). National Grid also maintains that, contrary to NECEC's assertion, the Company would have little opportunity to make these investments in the normal course of business because the Company's current capital spending is based on a historic test year and historic costs (D.P.U. 15-120, National Grid Brief at 17, citing D.P.U. 15-120/15-121/15-122, NECEC Brief at 27-28).

National Grid contends that its VVO proposal should be approved because it has the support of the Attorney General and the company's deployment approach is sensible, and supported by granular cost and benefit data (D.P.U. 15-120, National Grid Reply Brief at 18,

citing Attorney General Brief at 19; Exh. AG-3-31(a)-(d) (Rev.)). In addition, National Grid argues that its advanced distribution automation proposal should be approved because the company has experience with advanced distribution automation technology in its Worcester smart grid pilot and does not need to be a pilot program, as argued by the Attorney General (D.P.U. 15-120, National Grid Reply Brief at 18-19, citing Attorney General Brief at 20). National Grid contends that it supported its advanced distribution automation proposal with a comprehensive cost-benefit analysis, and deployment of these technologies will accelerate the achievement of service quality standards (D.P.U. 15-120, National Grid Reply Brief at 19, citing DOER Brief at 17; Grid Modernization Plan at 49-50; Exh. AG-3-31(a)-(d) (Rev.)).

National Grid maintains that the Department should approve its proposed field monitor deployment because these investments will provide information on circuit conditions in real-time as well as assist with future system designs. National Grid also maintains that field monitor deployment would support the Attorney General's proposal to further study targeted circuits to review options including voltage conversion (D.P.U. 15-120, National Grid Reply Brief at 20, citing Attorney General Brief at 21). Further, National Grid maintains that it supported its field monitor proposal with a cost-benefit analysis (D.P.U. 15-120, National Grid Reply Brief at 20; citing DOER Brief at 20; Grid Modernization Plan at 52, 120; Exh. AG-3-31(a)-(d) (Rev.)).

National Grid argues that the Department should approve its proposed customer load management program because it will make progress on the grid modernization objective of optimizing demand, and DOER and Acadia Center were generally supportive of the program

(D.P.U. 15-120, National Grid Reply Brief at 21, citing Acadia Center Brief at 10-11; DOER Brief at 16-17). To support the proposed field deployments, National Grid argues that it will need to make its proposed foundational infrastructure investments and, therefore, the Department should also approve those investments (D.P.U. 15-120, National Grid Reply Brief at 21).

National Grid also argues that the Department should approve the proposed customer education and outreach plan applicable to whichever grid modernization scenario the Department selects (D.P.U. 15-120, National Grid Reply Brief at 34). National Grid maintains that its proposed education and outreach plans are appropriately designed to provide customer education on TVR and other important aspects of grid modernization (D.P.U. 15-120, National Grid Reply Brief at 34, citing Exh. MB-WFJ-Rebuttal-3, at 5-6).

National Grid disputes the Attorney General's assertions that the company's proposed changes to its internet network operating center, customer service systems, meter inventory tracking system, geographic information system, and data lake and analytics capabilities are business as usual, arguing that it would not have made these investments but for grid modernization (D.P.U. 15-120, National Grid Reply Brief at 22, citing Attorney General Brief at 22). In addition, National Grid argues that its proposed workforce, training and asset management investments are necessary because implementation of its grid modernization plan, including advanced metering functionality, will require new hires and training on new technologies that is incremental to the company's current training requirements (D.P.U. 15-120, National Grid Reply Brief at 23).

National Grid argues that it provided sufficient detail on the costs and benefits of its proposed SCADA and advanced distribution management systems investments and, therefore, undertaking a communications study prior to deployment, as suggested by the Attorney General, is unnecessary (D.P.U. 15-120, National Grid Reply Brief at 23-24, citing Attorney General Brief at 22). National Grid also argues that it will pursue cost synergies across jurisdictions if able but that approval of its grid modernization plan should not be contingent on whether it can share costs with other jurisdictions as proposed by Acadia Center (D.P.U. 15-120, National Grid Reply Brief at 24, citing RR-DPU-3).

National Grid also argues that its proposed investments in tools to monitor distributed energy resource operation will facilitate the integration of distributed energy resources and it considered distributed energy resources in the development of its grid modernization plan (D.P.U. 15-120, National Grid Reply Brief at 26-27). In particular, National Grid argues that its proposed grid modernization plan will improve the interconnection experience and appropriately balance distributed energy resource operation with the maintenance of safe and reliable service (D.P.U. 15-120, National Grid Reply Brief at 26-27).

Further, National Grid argues that, contrary to CLF's assertions, it evaluated the both the quantitative and qualitative benefits of distributed energy resources (D.P.U. 15-120, National Grid Reply Brief at 28, citing Exhs. PTZ/WFJ/RDS-Rebuttal-1, at 6; AG-3-31(a)-(d) (Rev); CLF Brief at 10). National Grid argues that once it can obtain data about distributed energy resources operations through its proposed distributed energy resource monitoring investments, it can quantify the benefits of distributed energy resources

such as reducing peak demand, system costs, capacity costs and electricity costs

(D.P.U. 15-120, National Grid Reply Brief at 28-29, citing CLF Brief at 10).

National Grid also argues that its proposed grid modernization investments will facilitate commitment from distributed energy resources owners, which the company argues is necessary to ensure that distributed energy resources will reliably operate when needed (D.P.U. 15-120, National Grid Reply Brief at 29, citing Exh. PTZ/WFJ/RDS-Rebuttal-1 at 7). In addition, National Grid argues that its grid modernization plan will better enable third-party and customer distributed energy resource participation through proposals to streamline the interconnection process, make hosting capacity available to distributed generation customers and third parties, an online tool for customers considering distributed generation, and AMI that will allow near real- time ability to manage load (D.P.U. 15-120, National Grid Reply Brief at 30-31).

National Grid argues that it met the Department's directive to make aggregate customer data available to third parties, and it will ensure that such data are presented in a manner that prevents disclosure of individual customer information (D.P.U. 15-120, National Grid Brief at 31-32). In addition, National Grid argues that its proposed 3V0 and direct transfer trip investments are key to integrating distributed energy resources as they will allow for additional capacity on National Grid's system that can then be communicated to potential distributed energy resources customers (D.P.U. 15-120, National Grid Reply Brief at 32).

National Grid argues that its cybersecurity proposal provides sufficient detail and uses a risk-based approach that will allow the company to adapt to new technologies and a

changing threat landscape (D.P.U. 15-120, National Grid Reply Brief at 32). In addition, National Grid maintains that its grid modernization plan will be part of the company's overall cybersecurity framework, which includes annual assessments that comply with accepted national standards (D.P.U. 15-120, National Grid Brief at 33, citing Exh. MR-Rebuttal-1, at 5). Accordingly, National Grid contends that an annual cyber vulnerability assessment, as recommended by the Attorney General, is redundant (D.P.U. 15-120, National Reply Brief at 33, citing Attorney General Brief at 49).

For its RD&D proposals, National Grid argues it meets D.P.U. 12-76-B directives to focus on testing, piloting, and deploying new and emerging technologies (D.P.U. 15-120, National Grid Reply Brief at 43, citing D.P.U. 12-76-B at 28). National Grid counters NECEC argument, stating it has described how it chose projects, by ranking them on ability to achieve Department objectives and presenting potential benefits (D.P.U. 15-120, National Grid Reply Brief at 43, citing D.P.U. 15-120/15-121/15-122, NECEC Brief at 25; Grid Modernization Plan at 149-153, Att. 17). National Grid also contends it has proposed annual reporting on its RD&D projects and internal authorizations and cost containment procedures for all RD&D projects, making DOER's compliance filing recommendations unnecessary (D.P.U. 15-120, National Grid Reply Brief at 43-44, citing DOER Brief at 25-26).

b. Unitil, D.P.U. 15-121

Unitil argues that its proposed grid modernization plan meets all of the Department's objectives and requirements (D.P.U. 15-121, Unitil Brief at 7). Unitil argues that, consistent with Department directives, it proposed five years of capital investments (D.P.U. 15-121,

Unitil Brief at 26, citing Exh. FG&E-1, at 32-34). In addition, Unitil maintains that it built upon the Department's business case template to develop its cost-benefit analysis model (D.P.U. 15-121, Unitil Brief at 27). The Company contends that its project input forms, cost-benefit analysis model, and narrative provide a comprehensive view of the Company's proposed investments (D.P.U. 15-121, Unitil Brief at 28).

Further, Unitil maintains that it has complied with the Department directives regarding an approach for achieving advanced metering functionality (D.P.U. 15-121, Unitil Brief at 28-29, citing D.P.U. 12-76-B at 17). Unitil argues that, after investigation, it appropriately determined that an opt-in approach is the best way to achieve advanced metering functionality (D.P.U. 15-121, Unitil Brief at 29). First, Unitil contends that the cost-benefit ratio for an opt-out approach is 0.28 (D.P.U. 15-121, Unitil Brief at 30, citing Exhs. FG&E-1, at 59, 67-68; AG-4-27, Att. 15; AG-4-6). By comparison, Unitil maintains that the cost-benefit ratio for opt-in is 0.43 (D.P.U. 15-121, Unitil Brief at 30, citing RR-DPU-1, Att. 2). Second, Unitil argues that an opt-in approach appropriately considers its recent investment in AMI meters, the Department grid modernization objectives, and rate impact concerns (D.P.U. 15-121, Unitil Brief at 29, 30 citing Exhs. FG&E-1, at 123-124, 33; AG-10-1; AG-12-1; RR-DPU-1, Att. 2; Unitil Rely Brief at 3). Unitil maintains that its proposed opt-in approach provides advanced metering functionality to interested customers without the cost of replacing all of its meters (D.P.U. 15-121, Unitil Brief at 29).

Unitil argues that its proposed projects will use advanced metering functionality as they are installed (D.P.U. 15-121, Unitil Brief at 30-31). As a result, Unitil contends that its

education plan will be in place two years prior to the deployment of advanced metering functionality, likely increasing customer interest in TVR (D.P.U. 15-121, Unitil Brief at 31, citing RR-DPU-1; Tr. 1, at 94-95). Unitil asserts that it will scale up advanced meter deployment as its existing AMI reaches its projected 25 to 30 year lifespan (D.P.U. 15-121, Unitil Brief at 31, citing Exh. AG-4-4).

Unitil argues its proposed opt-in approach is fully supported by a business case analysis and will make measurable progress towards the Department's grid modernization objectives, while balancing customer costs (D.P.U. 15-121, Unitil Reply Brief at 2-3). Unitil contends that intervenors predictions about the benefits of an opt-out approach are unsupported (D.P.U. 15-121, Unitil Brief at 33). Finally, Unitil maintains that if the Department determines that further investigation of issues related to the full deployment of advanced metering functionality is necessary, as suggested by intervenors, the company should nonetheless be permitted to proceed with its grid modernization plan (D.P.U. 15-121, Unitil Reply Brief at 4).

Unitil argues that its marketing, education, and outreach plan should be approved (D.P.U. 15-121, Unitil Brief at 34). Unitil argues that, pursuant to its grid modernization plan, the company will make TVR available to any customer that choose to opt-in and may also offer a simple time-of-use rate using its current infrastructure. In order to achieve the most benefits from these offerings, Unitil argues that a communication plan is necessary (Unitil Brief at 35). Unitil further maintains its proposed marketing, education, and outreach

plan addresses the Department's requirements in D.P.U. 12-76-B (D.P.U. 15-121, Unitil Brief at 35-36).

Unitil further maintains that that the proposed investments in its grid modernization plan meet the Department's objectives in D.P.U. 12-76-B and should be approved (D.P.U. 15-121, Unitil Brief at 8). Unitil argues that its proposed grid reliability program, which includes a mobile damage assessment tool and a project to integrate its AMI with its outage management system, will reduce the effect of outages (D.P.U. 15-121, Unitil Brief at 8-9, citing Exh. FG&E-1, at 41-43). In particular, Unitil argues that these investments will result in reduced outage minutes and improve outage prediction, saving an estimated \$7 million over ten years (D.P.U. 15-121, Unitil Brief at 8-9, citing Exh. FG&E-1, at 41-43, 46). Unitil argues that its proposed field area network and advanced distribution management system will also reduce the effect of outages by collecting and integrating grid data into the outage management system, allowing the company to identify issues on the grid earlier and predict fault locations during a storm (D.P.U. 15-121, Unitil Brief at 9-10, citing Exh. FG&E-1, at 43-47). Unitil contends that the Attorney General's arguments that these investments are business as usual are incorrect and unsupported by any analysis (D.P.U. 15-121, Unitil Brief at 11, citing Attorney General Brief at 18-20; Exh. AG-GLB-1, at 12-13, 23-24). Further, Unitil contends that it used the best available model to estimate the benefits of reducing outage minutes and the Attorney General did not offer any evidence to support her argument that these benefits were overstated (D.P.U. 15-121, Unitil Brief at 12-13, citing Attorney General Brief at 20).

Unitil argues that its proposed distribution automation program, which includes a field area network, SCADA, automated distribution devices for VVO, and advanced distribution management systems, will achieve the objective of optimizing demand (Unitil Brief at 14).³³ Additionally, Unitil contends that its customer empowerment program will expand its customer information service with a web portal and mobile application to provide customers with energy use and account management tools, further optimizing demand (D.P.U. 15-121, Unitil Brief at 15-17, citing Exhs. FG&E-1, at 6-7; AG-4-8 (Supp.); RR-DPU-1).

Unitil does not support the Attorney General's recommendation to accelerate spending for field area network and SCADA investments, arguing that this would increase customer bill impacts (D.P.U. 15-121, Unitil Brief at 18).³⁴ Unitil also argues that using advanced distribution management systems to manage VVO and to analyze VVO separately, as argued by the Attorney General, would potentially duplicate and reduce benefits (D.P.U. 15-121, Unitil Brief at 18, citing Exh. FG&E-6, at 12-13).

Further, Unitil argues that its proposed distributed energy resources enablement program will encourage distributed energy resources, develop a flexible grid, and not place related costs on non-distributed energy resources customers (D.P.U. 15-121, Unitil Brief

³³ Unitil asserts that at the end of this program, advanced distribution management systems will be connected to every point on its grid will and allow Unitil to serve as an enabling platform for customers and third parties (D.P.U. 15-121, Unitil Brief at 14, citing Exh. FG&E-1, at 36-54).

³⁴ Unitil also disagrees with the Attorney General's recommendation to require a statewide communication infrastructure plan, arguing that there are differences among service territories that would make it hard develop a statewide plan and a statewide plan raises security concerns (D.P.U. 15-121, Unitil Brief at 18).

at 19, citing Exh. FG&E-1, at 39). Unitil maintains that it needs to conduct an ongoing circuit capacity study to assess the capacity of the grid to take on distributed energy resources. The information gleaned from the study would help Unitil's proposed distributed energy resource management system provide operators with real-time information on distributed energy resources operations (D.P.U. 15-121, Unitil Brief at 20, citing Exh. FG&E-1, at 36-38). Unitil argues that this knowledge will allow the company to install 3V0 and voltage regulator controls on areas that are vulnerable to reverse power flows (D.P.U. 15-121, Unitil Brief at 20-21, citing Exh. FG&E-1, at 38-40).

Unitil disputes CLF's contention that the company should have assessed the potential for distributed energy resources to defer capital investments, arguing that it has experienced declining system demand and its grid is currently designed to meet a maximum peak demand it no longer reaches (D.P.U. 15-121, Unitil Brief at 21, citing Tr. 1, at 18-19; CLF Brief at 9). In addition, Unitil argues that it has not found distributed energy resources to be a cost effective solution for reliability and resiliency, and CLF has only offered generic studies on the conceptual benefits of distributed energy resources to promote for reliability (D.P.U. 15-121, Unitil Brief at 21-22, citing Tr. 1, at 20-21; CLF Brief at 7,9). Unitil also disputes the Attorney General's argument that 3V0 should not be approved because Unitil has not demonstrated that reverse power flow is an issue and only tied to large scale distributed energy resource projects. Unitil argues that 3V0 investments are necessary to manage significant increases in distributed energy resources and that the company has seen reverse power flows on substations with primarily residential distributed energy resources customers

(D.P.U. 15-121, Unitil Brief at 22, citing Attorney General Brief at 18 ; Unitil Reply Brief at 5-6, citing Attorney General Reply Brief at 12-13).

Unitil argues that its proposed grid modernization plan will improve workforce and asset management, through its proposed grid reliability plan as well as its proposed workforce and asset management program (D.P.U. 15-121, Unitil Brief at 23). Unitil asserts that chose the workforce and asset management program because it will result in a 15-minute savings in restoration response time (D.P.U. 15-121, Unitil Brief at 24, citing Exh. FG&E-1, at 71). Unitil asserts that the Attorney General's argument that the proposed workforce and asset management system should be considered part of normal capital spending is unsupported (D.P.U. 15-121, Unitil Brief at 24, citing Attorney General Brief at 16).

Unitil argues that it has a number of processes in place to protect the grid and its customers from cyberattacks, including: (1) employment of a chief information security officer and an information technology department; (2) regular coordination with external stakeholders, including the Department; (3) an internal written information security plan that it continually tests and reviews; and (4) regular external vulnerability assessments (D.P.U. 15-121, Unitil Brief at 39-41).

Finally, Unitil argues it has proposed a practical RD&D investment (D.P.U. 15-121, Unitil Brief at 36). Unitil contends it has never had an annual RD&D budget, instead investigating new technologies on an as needed basis, and therefore the proposed \$430,000 is a significant increase in spending that it plans to spread out over ten years (D.P.U. 15-121, Unitil Brief at 36, citing Exh. FG&E-1, at 83).

c. Eversource, D.P.U. 15-122

Eversource argues that the best path forward is for the Department to approve both its customer-facing and grid-facing investments (D.P.U. 15-122, Eversource Reply Brief at 22). In this regard, Eversource argues that its business case analysis meets all the requirements set out in D.P.U. 12-76-C and there is a sufficient record to approve its proposals (D.P.U. 15-122, Eversource Brief at 13; Eversource Reply Brief at 13). Eversource argues that DOER's recommendation to adopt shorter timeframe for preauthorization of investments is unnecessary because its grid modernization proposal already contains sufficient transparency and oversight (D.P.U. 17-05, Eversource Brief at 403, citing DOER Brief at 24-25). In addition, Eversource argues that there is no need to delay grid modernization by requiring Eversource to resubmit its plan, as suggested by some intervenors (D.P.U. 17-05, Eversource Reply Brief at 89-90).

Eversource argues that the Department did not unconditionally require the distribution companies to fully deploy advanced metering functionality, as suggested by certain intervenors (D.P.U. 15-122, Eversource Brief at 28-29, citing D.P.U. 14-04-D at 8; Eversource Reply Brief at 6-7, 15). Instead, Eversource maintains that the appropriate way to deploy advanced metering functionality is an issue for investigation in these proceedings (D.P.U. 15-122, Eversource Reply Brief at 8).

Eversource argues that a full deployment of advanced metering functionality is unsupported by a business case analysis (D.P.U. 15-122, Eversource Brief at 29, citing

Exh. AG-4-2; Tr. 1, at 74; Eversource Reply Brief at 5-6).³⁵ Conversely, Eversource contends that its proposed opt-in TVR approach will achieve 80 percent of the benefits of a full scale deployment of advanced metering infrastructure at 15 percent of the costs (D.P.U. 15-122, Eversource Brief at 12-13, citing Exh. Eversource-PMC-1, at 16). Further, Eversource argues that the in-home resources currently and soon to be available to residential customers make full deployment of advanced metering functionality ill-advised at this time (D.P.U. 15-122, Eversource Reply Brief at 15-16). For these reasons, Eversource argues that a full deployment of advanced metering functionality with an opt-out TVR would not be in the best interest of customers (particularly those without discretionary load to shift), requiring them to pay through rates “enormous” up-front implementation costs (D.P.U. 15-122, Eversource Brief at 30, citing Exh. Eversource-CAH-1, at 13).³⁶

In addition, Eversource argues that its customers do not have an interest in TVR and many customers oppose advanced meters (D.P.U. 15-122, Eversource Brief at 31, citing Tr. 1, at 77; RR-CLC-3). Eversource contends intervenors have offered no evidence to counter its estimate that that no more than five percent of customers will opt-in to TVR (D.P.U. 15-122, Eversource Brief at 31, citing Exh. CLC-2-25). Eversource argues that its proposed opt-in approach would provide an appropriate option for customers who have an

³⁵ Eversource maintains that the opt-out scenario had a cost-benefit ratio of less than 0.1 (D.P.U. 15-122, Eversource Brief at 34, citing Exhs. Eversource-IGMP at 63; CLC-2-41).

³⁶ Eversource contends that implementation costs under an opt-out scenario total \$946 million, as compared to \$108.2 million for its opt-in proposal (D.P.U. 15-122, Eversource Brief at 30, citing Exh. Eversource-CAH-1, at 13).

interest in, and can benefit from, a TVR (D.P.U. 15-122, Eversource Brief at 32).

Eversource argues that, while it expects that a small number of customers will participate in TVR, its proposed program contains “some of the more innovative structures in the country” (D.P.U. 15-122, Eversource Reply Brief at 9, citing Tr. 2 at 236).³⁷

Further, Eversource argues that its proposed opt-in advanced metering proposal is a basic service offering in compliance with D.P.U. 14-04-C (D.P.U. 15-122, Eversource Reply Brief at 19). Eversource contends that its opt-in proposal will not harm or undermine competitive markets as suggested by the Compact (D.P.U. 15-122, Eversource Reply Brief at 16-17). In particular, Eversource argues that there is nothing preventing a competitive supplier from providing a customer with an advanced meter and offering TVR (D.P.U. 15-122, Eversource Reply Brief at 16-18).

Eversource argues that its proposed customer education and outreach strategy provides an appropriate avenue to increase customer engagement during grid modernization, including the provision of information so customers can make informed energy-use decisions (D.P.U. 15-122, Eversource Brief at 39, citing Exh. AG-4-28). Eversource maintains that the final scope of its customer education and outreach plan will be determined based the grid modernization investments approved in this docket (D.P.U. 15-122, Eversource Brief at 39-40). Eversource notes that approximately 20 to 25 percent of its annual customer

³⁷ Eversource maintains that its proposal supports 15-minute interval data, sending critical peak pricing signals, collection and presentation of usage and rate data, and the ability for customers to grant permission for third-parties to view usage (D.P.U. 15-122, Eversource Brief at 37-38, citing Exh. CLC-2-27).

education and outreach budget is for the proposed opt-in TVR initiative (D.P.U. 15-122, Eversource Brief at 40, citing Exh. AG-4-26).

With respect to its proposed grid-facing investments, Eversource argues that they are foundational elements necessary to advance grid modernization (D.P.U. 15-122, Eversource Reply Brief at 3; D.P.U. 17-05, Eversource Brief at 43; Eversource Reply Brief at 59). Eversource recognizes that its grid-facing proposal does not “neatly” meet D.P.U. 12-76-B directives, but argues that it is, nonetheless, designed to meet the Department’s grid modernization objectives (D.P.U. 17-05, Eversource Brief at 375-376, citing Exhs. CLC-2-1; DPU-42-2; DPU-42-4). Eversource further contends that its proposed grid-facing investments are narrower in design in order to more quickly achieve results, as compared to the broader plan envisioned in D.P.U. 12-76 (D.P.U. 17-05, Eversource Brief at 376-377). Eversource asserts that its proposed grid-facing investments are of the type specifically contemplated by the Department when it described incremental investments (D.P.U. 17-05, Eversource Brief at 377, citing D.P.U. 12-76-B at 20).

Eversource argues that, together, its proposed grid-facing investments are the initial step necessary to make progress towards a modernized grid (D.P.U. 17-05, Eversource Brief at 41). Eversource contends that its proposed investments in distribution system network operations and customer engagement and enablement, will bring numerous benefits including: (1) system resiliency; (2) carbon emissions reduction; (3) integration of distributed energy resources; (4) distributed energy resource visibility; and (5) distributed energy resource

customer engagement (D.P.U. 17-05, Eversource Brief at 47, citing Exh. ES-GMBC-1, at 13).

Eversource argues that its integration of distributed energy resources will be slowed without the proposed distribution system network operations, automation, advanced system load flow, and VVO investments (D.P.U. 17-05, Eversource Reply Brief at 60). Eversource contends that the number and size of its distributed energy resource interconnections has grown significantly. Eversource argues that these investments will address this growth and the anticipated future increase in distributed energy resource-deployment (D.P.U. 17-05, Eversource Reply Brief at 60, citing Exh. ES-GMBC-2, at 7). Eversource argues that the need for these foundational investments is not disputed and grid modernization benefits will be achieved by their implementation (D.P.U. 17-05, Eversource Reply Brief at 60-61, citing Exh. AG-GLB-1, at 60; Tr. 15, at 3009-3011).

Eversource argues that, contrary to the Attorney General's assertions, it has provided a full description of its expected security investments to support grid modernization (D.P.U. 15-122, Eversource Brief at 41, citing Exh. AG-3-1). Eversource maintains that it will determine the exact cybersecurity measures required for each investment once the investments are preauthorized (D.P.U. 15-122, Eversource Brief at 41, citing Exh. CLC-4-23; Tr. 1, at 113; Eversource Reply Brief at 12). Eversource contends that it would be imprudent to have a final cybersecurity plan in place now, as suggested by the Attorney General, because it would be out of date in a few months (D.P.U. 15-122, Eversource Reply Brief at 12, citing Attorney General Brief at 13-14).

Additionally, Eversource proposes a data presentment capability that would allow customers to view interval data of usage, rates, critical peak pricing signals, and usage and rate data via third-party hosted solutions, as well as the capability to grant others permission to view usage (D.P.U. 15-122, Eversource Brief at 37-38). Eversource also states that it allows energy suppliers access to hourly data for the large customers they serve through certain company data services (D.P.U. 15-122, Eversource Brief at 45-46).

C. Analysis and Findings

1. Grid Modernization Objectives

a. Introduction

In D.P.U. 12-76, the Department outlined a policy framework intended to move Massachusetts towards a modern electric grid. The Department set forth a vision for grid modernization designed to achieve the following four objectives: (1) to reduce the effects of outages; (2) to optimize demand, which includes reducing system and customer costs; (3) to integrate distributed energy resources; and (4) to improve workforce and asset management. D.P.U. 12-76-B at 2, 9.

Our grid modernization objectives serve two purposes. First, the objectives present a concise statement of the Department's views as to what constitutes a modern electric grid. Second, the objectives form the basis for the Department's review and preauthorization of the Companies' proposed grid modernization investments. Based on our review of the grid modernization plans, as well as the changes affecting the electric industry that have occurred since we began this investigation, the Department has determined that certain refinements to

the grid modernization objectives identified in D.P.U 12-76-B are appropriate. We discuss the refinements to each grid modernization objective below.

b. Reducing the Effect of Outages

In establishing the objective of “reducing the effect of outages,” the Department found that it is essential that electric distribution companies maximize the use of technologies to make further progress in meeting service quality goals, reduce the number and duration of outages due to extreme weather, and enhance resiliency in the face of climate change.

D.P.U. 12-76-B at 10. Consistent with this objective, on September 9, 2016, Governor Baker signed Executive Order No. 569: Establishing an Integrated Climate Change Strategy, which requires each agency to assess the potential risk to critical infrastructure assets from natural disasters and climate change as part of climate adaptation.

The Department has stated that the objective of reducing the effect of outages will be primarily met through the deployment of grid-facing technologies that enable companies to attain optimal levels of grid visibility, remotely command and control their grid assets, and have a self-healing grid. D.P.U. 12-76, at 8.³⁸ In addition to reducing the effect of outages, the deployment of grid-facing technologies will establish the foundation by which the Companies can: (1) improve power quality; (2) facilitate the interconnection of distributed energy resources; (3) reduce system losses; (4) improve workforce productivity (e.g., by

³⁸ In addition, the deployment of customer-facing technologies, such as advanced metering functionality, can provide the Companies with improved visibility at the customer level, allowing for, among other things, automated outage and restoration notification. D.P.U 12-76-B at 15.

allowing a company to identify with greater certainty the location and cause of a fault on its system); and (5) improve asset utilization (e.g., by allowing a company to manage the loading of distribution assets such as transformers, thus allowing a company to extend the useful life of its existing distribution assets).

The Department finds that it is appropriate to refine the objective of reducing the effect of outages to more broadly describe the desired outcome, namely “to optimize system performance by attaining optimal levels of grid visibility, command and control, and self-healing.” This refined objective more closely describes the Department’s vision of what constitutes a modern electric grid and will facilitate the Department’s review of the Companies’ proposed grid modernization investments.³⁹

c. Optimizing Demand

In establishing the objective of “optimizing demand, including reducing system and customer costs,” the Department found that the deployment of customer-facing technologies will facilitate the reduction of peak demand by allowing customers to respond to price signals regarding the time-varying cost of electricity. D.P.U. 12-76-A at 14-15; D.P.U. 12-76-B at 11.⁴⁰ In addition to allowing consumers to lower their electric bills, price-responsive

³⁹ For example, when reviewing a company’s proposed investments in grid-facing technologies, the Department will evaluate, among other things, whether the company has demonstrated that the investments are designed to achieve measurable progress toward attaining optimal levels of grid visibility, command and control, and self-healing.

⁴⁰ In addition, as discussed in Section V.C.3 below, the deployment of some grid-facing technologies, such as VVO, also can reduce peak demand by reducing system losses. D.P.U. 12-76-B at 11-12.

usage will provide system-wide benefits by reducing the need for investments in new generation, transmission, and distribution facilities. D.P.U. 12-76-B at 11.

The Department finds that it is appropriate to refine the objective of “optimizing demand, including reducing system and customer costs,” to better describe the desired outcome, namely “to optimize system demand by facilitating consumer price-responsiveness and minimizing losses on the system.” This revised objective more closely describes the Department’s vision of a modern electric grid and will facilitate the Department’s review of the Companies’ proposed grid modernization investments.⁴¹

d. Integration of Distributed Energy Resources

In establishing the objective of “integrating distributed energy resources,” the Department found that grid modernization will enable the safe interconnection and full integration of greater quantities of intermittent distributed energy resources, which is a key to achieving the Commonwealth’s climate goals and requirements. D.P.U. 12-76-B at 12-13. In a modern grid, these distributed energy resources will be able to interact with the distribution system to provide both supply and reliability benefits (see e.g., D.P.U. 15-120, Exh. CLF-TW/AH-1, at 8; D.P.U. 17-05, Exh. CLC-KR-1, at 33-36, Tr. 10, at 1940-1957).

Based on our review of the evidence in these proceedings, the Department finds that it is appropriate to refine the objective of “integrating distributed energy resources,” in order to

⁴¹ For example, when reviewing a company’s proposed investments in customer-facing technologies, the Department will evaluate, among other things, whether the company has demonstrated that the investments are designed to achieve measurable progress toward facilitating customer price-responsiveness.

distinguish between the actions a company must take: (1) to facilitate the interconnection of distributed energy resources; and (2) to integrate these resources into its planning and operations processes. By taking actions to facilitate the interconnection of distributed energy resources, the Companies will enable the environmental benefits that these clean supply resources can provide. However, extracting the full range of benefits that distributed energy resources can provide, including reductions in distribution system costs, will also require the Companies to integrate these resources into their system planning and operations processes (D.P.U. 15-120, Exh. CLF-TW/AH-1, at 8; D.P.U. 17-05, Exh. CLC-KR-1, at 33-36, Tr. 10, at 1940-1957).

The Companies can facilitate the interconnection of distributed energy resources through their deployment of grid-facing technologies.⁴² Such deployment will: (1) allow a company to identify where on its system distributed resources can be most effectively and efficiently interconnected; and (2) enable the company to accommodate the intermittent power flow associated with distributed renewable resources, allowing those resources to inject power into the distribution system with minimum disruptions (see e.g., D.P.U. 15-120, Tr. 1, at 80-81; D.P.U. 17-05, Exhs. DPU-43-9, DPU-43-12).

Integrating distributed energy resources into system planning and operations processes will require the Companies to adopt a system planning process that is inclusive of third parties and their comments and that: (1) identifies the locations where distributed energy

⁴² These technologies include advanced load flow modeling and VVO (D.P.U. 17-05, Exhs. DPU-43-9; DPU-43-12).

resources can provide benefits to the distribution system; and (2) appropriately values the reliability services these resources can provide (D.P.U. 15-120, Exh. CLF-TW/AH-1, at 8; D.P.U. 17-05, Exh. CLC-KR-1, at 33-36, Tr. 10, at 1940-1957).⁴³ Implementing a more accessible planning process will require fundamental changes in the relationship between the Companies, their customers, and third-party service providers (D.P.U. 15-120, Exh. CLF-TW/AH-1, at 8; D.P.U. 17-05, Tr. 10, at 1940-1957).⁴⁴ As the Department found in D.P.U. 12-76-A at 19, customer participation is necessary to realize many of the benefits of grid modernization.⁴⁵

Based on the discussion above, the Department finds that it is appropriate to refine the objective of “integrating distributed energy resources,” to better describe the desired outcome, namely “to facilitate the interconnection of distributed energy resources and to integrate these resources into the Companies’ planning and operations processes.” This

⁴³ The Department has previously expressed support for initiatives that examine how the system planning process can serve as a means of promoting the integration of distributed energy resources at sites where interconnection costs may be relatively low or where distributed energy resources can provide the greatest benefit to the distribution system. D.P.U. 12-76-B at 12-13, n.16.

⁴⁴ For example, National Grid maintains that integrating distributed energy resources into its system planning and operations processes will require it to work with the owners of these resources to ensure that the resources are located and operated in a way that can provide reliable assistance to the distribution system (D.P.U. 15-120, Tr. 1, at 80-81, Tr. 2, at 210).

⁴⁵ The Department recognizes that existing ratemaking policies may encourage investments in company-owned distribution infrastructure rather than customer or third-party-owned distributed energy resources. See, e.g., MIT Energy Initiative, Utility of the Future at 313-316.

revised objective more closely describes the Department's vision of a modern electric grid and will facilitate review of the Companies' proposed grid modernization investments.⁴⁶

e. Improving Workforce and Asset Management

In D.P.U. 12-76-B at 13, the Department identified "improved workforce and asset management" as one of the grid modernization objectives. The Department recognized that the benefits associated with this objective, such as reducing O&M costs and more effective deployment of resources for storm response and other outage events, likely will result from efforts directed towards meeting the other grid modernization objectives. D.P.U. 12-76-B at 13. For this reason, the Department finds that it is appropriate to consider improved workforce and asset management not as a stand-alone objective but rather as a benefit associated with the other three grid modernization objectives, as refined above.

f. Conclusion

As discussed above, the Department finds that a modern grid is one that is characterized by: (1) optimal levels of grid visibility, command and control, and self-healing, thereby providing distribution companies with the tools to optimize system performance; (2) price-responsive usage, thereby optimizing the demand placed by end-users on the system; and (3) a broad range of distributed energy resources that inject clean electricity into the system and are fully integrated into the distribution companies' planning

⁴⁶ In its review of Eversource's proposed energy storage demonstration program in D.P.U. 17-05, the Department recognized that there may be benefit to evaluating how utility-owned storage and third-party-owned storage could work in tandem. D.P.U. 17-05, at 467-468.

and operations processes. Our grid modernization objectives should present a concise statement of the Department's views as to what constitutes a modern electric grid. To that end, the Department establishes the following refined grid modernization objectives:

(1) optimize system performance (by attaining optimal levels of grid visibility, command and control, and self-healing); (2) optimize system demand (by facilitating consumer price-responsiveness); and (3) interconnect and integrate distributed energy resources. The Department will consider the objective to improve workforce and asset management within the context of our consideration of the other objectives described above.

2. Regulatory Review Construct

a. Introduction

In D.P.U. 12-76-B, the Department required each company to file a grid modernization plan made up of (1) a ten-year strategic plan outlining how it intends to meet our grid modernization objectives; and (2) a five year short term investment plan.

D.P.U. 12-76-B at 15-16. The Department stated that investments included in the short-term investment plan would be eligible for preauthorization. D.P.U 12-76-B at 19. Finally, the Department stated that each company would be required to update its grid modernization plan in the context of a subsequent rate case filing. D.P.U.12-76-B at 52.

In the sections below, we adopt a regulatory review construct that departs in several ways from the process anticipated by D.P.U. 12-76-B. First, instead of requiring a ten-year strategic plan, the Department will require the Companies to submit a five-year strategic plan describing how they propose to make measurable progress towards our grid modernization

objectives. Next, the Department will require the Companies to submit a three-year investment plan and we will limit the term for preauthorization accordingly. Finally, the Department will address subsequent grid modernization plans in separate proceedings, outside of the context of a base rate case proceeding. We discuss each of these issues below along with the process the Department will use to review the various grid modernization plans, reports, and cost recovery filings.

b. Preauthorization and Future Plan Filings

Achieving the Department's grid modernization objectives is a complex, long-term, and evolving endeavor, for which a company's short-term investment plan represents a first step. D.P.U. 17-05, at 438. The usefulness of investment plans depends largely on the certainty of the projections included therein. These projections are critical to Department's evaluation of the Companies' proposals.

With preauthorization of investments in a multi-year grid modernization investment plan, it is important to provide the Companies with a certain level of flexibility to deviate from their projections to respond to changes that inevitably will take place over the term of the plan. In the early stages of grid modernization, it is reasonable to expect that significant changes will take place associated with, among the things, the introduction of new technologies and the costs of new and existing technologies. D.P.U. 17-05, at 442.⁴⁷ In

⁴⁷ For example, Eversource states that "advancements in the technology used for automated feeder reconfiguration continue to evolve. What is commercially available today will most likely be different from what will be available in five or ten years" (D.P.U. 17-05, Exh. ES-GMBC-2, at 35).

addition, it is reasonable to expect that the Companies' understanding of how best to deploy grid modernization technologies to optimize their performance will evolve considerably over a five-year period.

With these concerns in mind, DOER recommends that the Department shorten the time period for preauthorization of grid modernization investments, arguing that reducing the term will provide better transparency and improve the accuracy of projected grid modernization investments, and will give the Department greater administrative oversight (D.P.U. 15-120, DOER Brief at 12-13). As discussed below, the Department agrees with DOER that five years is too long a period to preauthorize investments, particularly during the early stages of the Companies' grid modernization activities.

The Department determines that it is in the public interest to limit eligibility for preauthorization to investments made in the initial three years of the short-term investment plans the Companies filed in these proceedings. The Department concludes that reducing the five-year term of preauthorization established in D.P.U. 12-76-B will: (1) improve the accuracy of the projected costs and benefits of grid modernization investments, thus providing the necessary confidence that investments will result in benefits that justify costs; and (2) give the Department greater administrative oversight, thus improving the transparency of the process for stakeholders.

In determining an appropriate term for the preauthorization of grid modernization investments, the Department seeks to strike the appropriate balance between a high degree of certainty in planning outcomes and administrative efficiency. The Department concludes that

a three-year term allows the Companies to gain useful experience in the deployment of grid modernization technologies that they can incorporate into their subsequent grid modernization plans, while allowing the Department to fulfill its regulatory oversight responsibilities in an efficient and effective manner. The Department notes that such an approach mirrors the three-year regulatory review construct we established for the energy efficiency plans in Massachusetts.

As noted above, with respect to planning, the Department required each company to submit a ten-year plan that demonstrates measurable progress toward attaining our grid modernization objectives. D.P.U. 12-76-B at 15-16. Grid modernization is a component of the Companies' distribution system planning process for which the Companies typically use a five- year planning horizon.⁴⁸ The Department concludes that it is appropriate to apply this same five-year planning horizon to grid modernization technologies.

Based on the above, although the Department will consider the five-year short term investment plans submitted in these proceedings, we will limit the time period for preauthorization to those investments made in the initial three years of the plans. In the future, each company will submit a grid modernization plan filing every three years that will include: (1) a three-year short term investment plan that the Department will review to determine which investments are eligible for preauthorization; and (2) a five-year strategic

⁴⁸ The Department concluded that a planning horizon of five years is appropriate for a distribution system. Adoption of an Alternative Process to Exempt Electric Companies from the Provisions of G.L. c. 164, § 69I, D.T.E. 98-84, at 12 (2003).

plan outlining how the company intends to meet our grid modernization objectives (i.e., the three-year short-term investment plan plus two additional years).

c. Plan Performance Reports and Timing of Prudence Reviews

Preauthorization means that the Department will not revisit whether the company should have proceeded with the investments as proposed. The Department will, however, review the prudence of a company's implementation of the preauthorized investments.

D.P.U 12-76-B at 19. This latter prudence determination is required before the Department can approve final cost recovery of any eligible grid modernization costs. As discussed below, the Department finds that it is appropriate to conduct the final prudence review for grid modernization plans upon completion of the three-year term of the grid modernization investment plan.

The Department has approved tracker mechanisms for costs associated with:

(1) incremental capital expenditures that exceed the amount that can be supported by the depreciation expense included in a company's base rates ("CapEx"); and (2) capital expenditures that are part of targeted gas infrastructure replacement ("TIRF"). See e.g., Massachusetts Electric Company and Nantucket Electric Company, D.P.U. 09-39, at 12, 78-85 (2009); Bay State Gas Company, at 129-135 (2009). Capital expenditures associated with the CapEx and TIRFs are not preauthorized by the Department. Accordingly, it is appropriate for the Department to review the prudence of these expenditures annually.

By contrast, the Department has concluded that it is appropriate to review energy efficiency performance at the conclusion of each three-year term, stating that the best method

to evaluate a company's performance in implementing its energy efficiency programs is to examine performance over the entire term of the plan, rather than in each plan year.

Investigation by the Department of Public Utilities on its own Motion into Updating its Energy Efficiency Guidelines, D.P.U. 11-120-A, Phase II, at 2, 11-12 (2013). Each energy efficiency program administrator submits a performance report upon completion of each three-year term that documents its performance during the term. The Department reviews the report to determine whether the company implemented its plan consistent with the Department-approved plan. Based on the results of the prudence review, the Department approves final recovery of a company's energy efficiency costs incurred during the three year term. D.P.U. 11-120-A, Phase II, at 6-7.

To allow the Department and stakeholders to monitor the status of a company's energy efficiency performance during a term, the Department requires each program administrator to submit annual reports that document its performance during the applicable year. D.P.U. 11-120-A, Phase II, at 6-7, 11-12. The Department may investigate a program administrator's performance during the term. D.P.U. 11-120-A, Phase II, at 6-7, 11-12. The Department concluded that such an approach allows: (1) the program administrators and stakeholders to focus on successful implementation of the energy efficiency plans, while maintaining accountability in the implementation of those plans; and (2) the Department to fulfill its regulatory oversight responsibilities in an administratively efficient and effective manner. D.P.U. 11-120-A, Phase II, at 2.

Like the energy efficiency plans, the Department requires the Companies' grid modernization plans to be multi-year. We find that conducting an annual prudence review for grid modernization would not be appropriate as this would be akin to viewing the plans as a compilation of three, one year plans rather than as a single three-year grid modernization investment plan. That is not the Department's intention. We reiterate that the best method to evaluate a company's performance in implementing a multi-year plan is to examine performance over the entire term of the plan, rather than in each plan year.

For the reasons discussed above, the Department determines that it is appropriate to investigate the implementation of each company's grid modernization plan, including the final prudence reviews for grid modernization investments, at the conclusion of the three-year investment term. Each company will submit a performance report upon completion of each three-year term that documents its performance during the term ("Grid Modernization Term Report"). The Department will review the Grid Modernization Term Report in the context of an adjudicatory proceeding to determine whether each company implemented its grid modernization investments consistent with its Department-approved plan. To allow the Department and stakeholders to monitor the status of a company's performance during a term, each company will submit an annual report that documents its performance during the applicable year ("Grid Modernization Annual Report"). The Grid Modernization Annual Reports will be docketed for informational purposes only, although the Department may formally investigate a company's performance during the term of the plan where we determine it is warranted.

The Department concludes that the above approach will allow: (1) the Companies and stakeholders to focus on successful implementation of the grid modernization plans, while maintaining accountability in the implementation of the plans; and (2) the Department to fulfill its regulatory oversight responsibilities in an efficient and effective manner. See D.P.U. 11-120-A, Phase II, at 2. The Department will convene a working group to develop the contents of the Grid Modernization Annual Reports and the Grid Modernization Term Reports.

d. Preauthorization of Term Budget

In Section V.C.3, below, the Department preauthorizes a budget for each company associated with the deployment of its proposed investments in grid-facing technologies over the next three years.⁴⁹ This preauthorized budget will act as a spending cap. As discussed in Section V.C.3, below, any spending above the cap will not be eligible for short term-targeted cost recovery.

The Companies have provided a projected budget for each of their grid-facing investment categories, for each year, although we have preauthorized a combined three-year budget for all grid-facing investments. Our preauthorization of a combined budget recognizes the importance of providing the Companies with the flexibility to respond to what is likely to be an evolving landscape during the early stage of their grid modernization activities. The Companies may shift spending among these categories, subject to the preauthorized budget

⁴⁹ As discussed in Section V.C.3, below, the Department does not preauthorize investments in any customer-facing technologies at this time.

cap. Further, the Companies may shift spending between years over the upcoming three-year term, again subject to the preauthorized budget cap. To the extent that a company deviates (or does not deviate, where warranted) significantly from its planned spending by category or year, the company must be prepared to show that its actions were reasonable and prudent in light of the existing circumstances.

e. Filing Dates

Consistent with the findings above, the Companies' current three-year grid investment plan will cover calendar years 2018, 2019, and 2020. As discussed in Section VII, below, each company shall file a short-term cost recovery filing each year on or before February 15th, for rates effective April 1st. Accordingly, the Companies' first cost recovery filing will be made on or before February 15, 2019, for rates effective April 1, 2019, and cover eligible preauthorized grid modernization investments made during 2018.⁵⁰

The Companies' Grid Modernization Annual Reports will be due on or before April 1st of the year following the first and second plan years. Therefore, the Companies' Grid Modernization Annual Report for plan year 2018 will be due on or before April 1, 2019.

⁵⁰ As discussed above, the Department will review the reasonableness and prudence of the Companies' actual grid modernization expenditures in the Grid Modernization Term Reports. Once the Department has made the appropriate findings in those proceedings, each company may move the applicable capital investments into rate base in its next base rate proceeding thereafter.

The Companies' Grid Modernization Term Report will be due on or before April 1st of the year following the third plan year. Therefore, the Companies' Grid Modernization Term Report for 2018 through 2020 will be due on or before April 1, 2021.

Finally, the Department directs the Companies to make their next grid modernization plan filings six months prior to the end of the current grid modernization plan term (i.e., on July 1st). The Companies next grid modernization plan filings will be due on or before July 1, 2020. These filings will include (1) a three-year short-term investment plan covering 2020, 2021, and 2022; and (1) a five-year strategic plan for 2020 through 2025 outlining how the Companies intend to achieve the grid modernization objectives.

3. Customer-Facing and Grid-Facing Investments

a. Introduction

As described above, the Department will review each company's grid modernization plan in order to determine whether the proposed grid modernization investments are eligible for preauthorization. D.P.U 12-76-B at 19. Where certain conditions are met, the Companies may seek targeted cost recovery of grid modernization investments that are preauthorized by the Department. D.P.U 12-76-B at 19-20.⁵¹

The Department's findings on preauthorization are based on a review of the proposed investments, as supported by each company's business case. D.P.U 12-76-B at 19. The

⁵¹ For example, in order to be eligible for targeted cost recovery, the distribution company must demonstrate that its proposed investments are incremental to costs recovered in base rates. D.P.U. 12-76-B at 22-23. The Department addresses targeted cost recovery in Section VII, below.

company's business case must include: (1) a detailed description of the proposed grid modernization investments; (2) the rationale and business drivers for the investments; and (3) a reviewable and reliable identification of all projected costs⁵² and benefits.⁵³

D.P.U. 12-76-B at 17; D.P.U. 12-76-C at 24-25. In order to obtain preauthorization, a distribution company must demonstrate that the proposed investments are designed to make measureable progress towards achievement of the Department's grid modernization objectives. D.P.U. 12-76-B at 19. In addition, the company must demonstrate that the projected cost of the investments is reasonable, and that the projected benefits justify the costs. D.P.U. 12-76-B at 15, 17. The Department also must consider the bill impacts that customers would experience as a result of the proposed grid modernization investments. D.P.U. 12-76-C at 29-30; D.P.U. 17-05, at 469-470.

Finally, in order to be eligible for preauthorization of its proposed investments, a company must demonstrate that the investments are incremental to its current investment practices. D.P.U. 12-76-B at 19-20. As discussed in Section V.C.3.c.iii., below, the Department has stated that investments may be treated as incremental to current investment practices if their primary purpose is to accelerate progress in achieving the grid modernization objectives. See D.P.U. 12-76-B at 19-20.

⁵² Costs estimates should be based on vendor quotes, to the extent possible, and/or actual data from relevant pilot projects and case studies. D.P.U. 12-76-C at 13.

⁵³ Projected benefits include benefits that: (1) can be both quantified and monetized; (2) can be quantified but not monetized; and (3) cannot be quantified. D.P.U. 12-76-C at 13, 24-25.

b. Customer-Facing Investments

i. Introduction

A significant focus of the generic investigation in D.P.U. 12-76 was the deployment of advanced metering functionality as a means to achieve the Department's grid modernization objectives. In D.P.U. 12-76-B, the Department expressed its view that advanced metering functionality would be the basic technology platform for grid modernization and a priority area of investment for the Companies. D.P.U. 12-76-B at 14. Nonetheless, the Department recognized that grid modernization investments, including investments in advanced metering functionality, would need to be properly supported by a business case analysis to ensure that these investments, which come at a significant cost, would provide a corresponding customer benefit. D.P.U. 12-76-C at 8.

In D.P.U. 12-76-B and D.P.U. 12-76-C, the Department described the business case required to support the Companies' proposed grid modernization capital investments. The Department also outlined a proposal to allow short-term targeted cost recovery for incremental capital investments made to deploy advanced metering functionality as well as other investments where the company also invested in advanced metering functionality. D.P.U. 12-76-B at 17-18; D.P.U. 12-76-C at 9-10.

As described above, the Companies have each proposed to undertake various customer-facing grid modernization investments, including deployment of advanced metering

functionality,⁵⁴ associated back office upgrades, and customer engagement strategies. Each company supported its proposed customer-facing investments with a business case analysis, although the type of analysis differed among the Companies. National Grid presented a combined assessment of the expected benefits from all of its proposed grid modernization investments, including a quantitative assessment of value to customers and a qualitative assessment of potential opportunities for customers in a manner consistent with the template described in D.P.U. 12-76-C (D.P.U. 15-120, Grid Modernization Plan at 22). Unitil used the business case analysis in a manner consistent with the template described in D.P.U. 12-76-C to assess net benefits by proposed project and program. Unitil performed an iterative analysis of various projects in different combinations, over different time periods, to examine how the nature of the underlying benefits can affect the overall cost effectiveness of the investment (D.P.U. 15-121, Exh. FG&E-1, at 27). Finally, Eversource conducted a cost-benefit analysis of the investments included in its original grid modernization plan filing (i.e., prior to the filing of D.P.U. 17-05). Further evidence regarding the costs and benefits of Eversource's proposed investments was developed through discovery and hearings (D.P.U. 15-122, Exh. Eversource-GMP, Att. 7; D.P.U. 17-05, Exhs. AG-23-10, Att.;

⁵⁴ 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-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. D.P.U. 12-76-B at 3, n.1.

AG-23-12, Att.; ES-GMBC-2, at 30-33; DPU-42-6, Att.; Tr. 7, at 1451-1464; Tr. 8, at 1600-1635).

National Grid maintains that the business case for its proposed AMI-Focused scenario shows customer benefits greater than costs from investments in advanced metering functionality over 15 years (D.P.U. 15-120, Grid Modernization Plan at 116, 118, 123; Tr. 1, at 77). In addition, in its sensitivity analysis, National Grid states that its proposed Balanced Plan scenario, with a full deployment of opt-out advanced metering functionality, has a positive benefit-cost ratio over 20 years (D.P.U. 15-120, Grid Modernization Plan at 118). However, the Attorney General and DOER challenge National Grid's business case assumptions. In particular, the Attorney General and DOER maintain that existing conditions call into question the assumptions used by the company to estimate benefits, particularly the number of customers participating in TVR. The Attorney General and DOER conclude that these faulty assumptions negatively affect the company's ability to capture sufficient benefits from advanced metering functionality to justify the high costs (D.P.U. 15-120, Attorney General Brief at 30; DOER Brief at 6-7).

Conversely, Eversource and Unitil maintain that their business case analyses do not support a widespread deployment of opt-out advanced metering functionality (D.P.U. 15-122, Eversource-IGMP at 33; Tr. 2, at 348; D.P.U. 15-121, Exhs. FG&E-1, at 64; AG-4-6; AG-4-27, Att. 15). Unitil's business case analysis indicates that the high costs to deploy advanced metering functionality to all customers results in a benefit-cost ratio of 0.28 over ten years (D.P.U. 15-121, Exhs. FG&E-1, at 64; AG-4-6; AG-4-27, Att. 15). Similarly,

Eversource indicates that a full deployment of advanced metering functionality to all customers would produce a benefit-cost ratio of less than 0.1 over 15 years (D.P.U. 15-122, Exh. Eversource-IGMP at 63; Tr. 2, at 348). In light of these results, Eversource and Unitil each propose a smaller scale, targeted opt-in deployment of advanced metering functionality (D.P.U. 15-122, Exh. Eversource-IGMP at 33; Tr. 2, at 348; D.P.U. 15-121, Exhs. FG&E-1, at 64; AG-4-6; AG-4-27, Att. 15).

In the section below, the Department reviews the evidence offered to support a full deployment of advanced metering functionality, as well as each company's customer-facing grid modernization proposal in order to determine whether the investments are appropriate for preauthorization. The Department weighed the evidence presented regarding the costs and benefits associated with full deployment of advanced metering functionality as contemplated by D.P.U. 12-76-B.

The level of customer participation in TVR directly affects the cost effectiveness of the deployment of advanced metering functionality. As described below, the Department has identified several issues regarding the conditions needed to facilitate customer price-responsiveness and the ability to achieve widespread participation in TVR sufficient to ensure that the benefits of a full deployment of advanced metering functionality justify the costs. Nonetheless, the Department remains persuaded that advanced metering functionality is necessary to achieve our grid modernization objectives. The Department intends to work with stakeholders to investigate the best way to achieve a cost-effective deployment of advanced metering functionality. While we work towards this goal, the Department will also

consider how a targeted deployment of advanced metering functionality may benefit ratepayers.

ii. Business Case Analysis

(A) Costs of Deployment

Eversource estimates that the cost of a full deployment of advanced metering functionality in its service territory would be \$781 million over a five year period (D.P.U. 15-122, Exh. Eversource-IGMP at 36).⁵⁵ Unitil's cost estimate for the full deployment of advanced metering functionality in its service territory is \$5 million over a five year period (D.P.U. 15-121, Exh. AG-4-27, Att. 15). National Grid's cost estimate for the AMI-focused scenario shows that the cost of full deployment of advanced metering functionality in its service territory would be approximately \$526 million over a five year period (D.P.U. 15-120, Grid Modernization Plan at 32). Therefore, on a statewide basis, the evidence demonstrates that the full deployment of advanced metering functionality would cost approximately \$1.3 billion.

AMR meters are already in wide use throughout the Commonwealth (D.P.U. 15-120, Grid Modernization Plan at 40; D.P.U. 15-122, Exh. Eversource-IGMP at 35). To the extent that the Companies were required to prematurely retire these meters to install new technology, this could create stranded costs that the Companies would seek to recover from ratepayers. Specifically, Eversource, National Grid, and Unitil estimate that the remaining

⁵⁵ This number excludes costs related to premature asset retirements (D.P.U. 15-122, Exh. Eversource-IGMP at 36).

undepreciated value of any meters and other customer-facing investments prematurely retired as the result of a Department-mandated replacement of existing AMR meters with AMI meters would be approximately \$165 million, \$41 million, and \$1.7 million, respectively for full deployment (D.P.U. 15-122, Exh. AG-8-3(a), Att.; D.P.U. 15-120, Exh. AG-3-31(a); D.P.U. 15-121, Exh. AG-4-9, at 1). Therefore, on a statewide basis, the full deployment of advanced metering functionality could result in stranded costs of approximately \$210 million. This would increase the total cost of full deployment of advanced metering functionality in the Commonwealth to approximately \$1.5 billion.

Another important factor to consider with respect to full deployment of advanced metering functionality is the cost of the necessary billing system and meter data management system upgrades to accommodate TVR. Until's billing system can accommodate time-of-use pricing with up to four pricing periods (D.P.U. 15-121, Tr. 1, at 91). However, National Grid's⁵⁶ and Eversource's⁵⁷ existing billing systems can accommodate only fixed-price products (D.P.U. 15-120, Grid Modernization Plan at 86, Att. 9; D.P.U. 15-122, Exhs. DPU-5-1; AG-4-5; CLC-2-27). Large-scale, multi-year billing system upgrades would be required to enable National Grid or Eversource to enroll a large percentage of their

⁵⁶ Even to accommodate billing for a limited number of customers in an opt-in TVR program, National Grid would need to contract with a third-party provider to perform billing services (D.P.U.15-120, Tr. 1, at 164-166; Tr. 2, at 276-277).

⁵⁷ Eversource states that it can adapt its billing system to accommodate the approximately 75,000 customers it projects will participate in its proposed opt-in TVR program (D.P.U.15-122, Tr. 1, at 91-93). This represents approximately five percent of Eversource's total customer base (D.P.U.15-122, Tr. 1, at 91-93).

customers in TVR (D.P.U. 15-120, Grid Modernization Plan at 86-87; D.P.U.15-122, Tr. 1, at 99-107).

In addition, Unitil's meter data management system is capable of handling 100 percent of TVR enrollments (D.P.U. 15-121, Exh. AG-4-11). However, National Grid's and Eversource's meter data management systems will require significant upgrades to manage and store the enormous amount of data associated with the metering of interval usage necessary to support TVR programs (D.P.U. 15-120, Grid Modernization Plan at 41-42; D.P.U. 15-122, Tr. 1, at 93-97; Tr. 2, at 312).⁵⁸

Altogether, the evidence demonstrates that a significant expenditure of ratepayer funds would be required to fully deploy advanced metering functionality in the Commonwealth, including the cost of meters, as well as the substantial required upgrades to the Companies' billing and data management systems. In recognition of these substantial costs and in light of the challenges associated with the achievement of benefits (as discussed below), both Eversource and Unitil propose to implement far less than a full deployment of advanced metering functionality at this time, at a total cost of \$138 million and \$1.1 million, over five years, respectively (D.P.U. 15-121, Exh. FG&E-1, at 59; D.P.U. 15-122; Exh. Eversource-IGMP at 10-11, 15). In addition, National Grid offers two alternative scenarios that achieve less than a full deployment of advanced metering functionality, at costs

⁵⁸ For example, National Grid states that it currently collects twelve data points per customer, per year, from its monthly meter reads. With meters that collect data at five-minute intervals, National Grid states that it could collect more than 100,000 data points per customer, per year (D.P.U. 15-120, Grid Modernization Plan at 41-42).

ranging from \$74 million to \$369 million, over five years, depending on the scenario (D.P.U. 15-120, Grid Modernization Plan at 33, 35). Below, the Department discusses the likely benefits of each of these opt-in proposals.

(B) Benefits

In order to preauthorize the expenditure of the level of funds described in the section above, the Department would need to be persuaded that the benefits of those investments in advanced metering functionality would justify the costs. D.P.U. 12-76-B at 15. Based on the evidence presented in these proceedings, however, the Department has identified a number of issues or barriers that could prevent the achievement of those benefits with the current deployment strategies. The Department addresses each of these issues below, as well as how they impact the business case analyses presented for the Companies' proposed customer-facing investments.

One of the largest sources of benefits that can result from the deployment of advanced metering functionality is the savings in O&M expenses associated with the transition from manual meter reading to automated and remote meter reading (D.P.U. 15-120, Exh. AG-PA-1, at 6-7). However, this benefit has already been realized through the Companies' previous deployment of AMR meters that replaced manual meter reads (D.P.U. 15-120, Exh. AG-PA-1, at 7; D.P.U. 15-122, Exh. Eversource-IGMP at 43, 143-144, 302).⁵⁹ As a result, the Companies were not able to include this benefit in the

⁵⁹ In addition, Unitil was an early adopter of first generation AMI (D.P.U. 15-121, Exh. FG&E-1, at 19).

business case analyses used to support their proposed customer-facing grid modernization investments. The fact that AMR meters is in wide use and its benefits have already been realized explains why the deployment of advanced metering functionality in Massachusetts will not show the same robust benefit-cost ratios as it has in other jurisdictions (see D.P.U. 15-120, Grid Modernization Plan at 40, 205-206; D.P.U. 15-122, Exh. Eversource-IGMP at 34-35, 43).

Next, the anticipated benefits of the Companies' proposed customer-facing grid modernization investments are called into question by the increasing percentage of customers on competitive supply (including municipal aggregation). On a statewide basis, the number of customers receiving competitive supply (directly or through municipal aggregation programs) has increased significantly in recent years, from 31 percent in January 2016, to 48 percent in December 2017.⁶⁰ It is reasonable to assume that this growth in participation, particularly with respect to municipal aggregation, will continue in coming years. This development affects our assessment of the estimated benefits of customer-facing investments because, as discussed below, it could significantly curtail the number of customers that can participate in dynamic pricing, such as TVR.

There is currently no consensus among the Companies on how to best address competitive supply customers in terms of TVR. In its planning estimates, National Grid assumes that a slowly growing percentage of customers on competitive supply would choose

⁶⁰ DOER electric customer migration data can be found at:
<https://www.mass.gov/service-details/electric-customer-migration-data>.

to participate in TVR programs offered by its competitive suppliers (D.P.U. 15-120, Grid Modernization Plan, Att. 14, at 2, 11-12; Exh. DPU-1-12(a) Att.).⁶¹ National Grid maintains that this assumption is sound because a widespread opt-out TVR for basic service customers, together with a growth in opt-in TVR offered by competitive suppliers, could lead to a dynamic where flat rate offerings become increasingly uncompetitive as compared to TVR (D.P.U. 15-120, Exh. NG-Panel-Rebuttal-1, at 11-12).

In contrast, Eversource proposes to require customers to be on basic service to participate in its TVR program (or to return to basic service from competitive supply) (D.P.U. 15-122, Tr. 2, at 239-241). Eversource estimates that only five percent of customers on competitive supply would return to basic service to participate in its proposed TVR program (D.P.U. 15-122, Tr. 2, at 235).

The Compact takes issue with this aspect of Eversource's proposed TVR program design, arguing that it creates an improper bias towards basic service at the expense of competitive supply and results in an unjustified cross-subsidy (D.P.U. 15-122, Compact Brief at 20-28). Eversource maintains, however, that its proposal is reasonable because:

(1) competitive suppliers typically do not have the capability to issue bills for TVR; and

⁶¹ National Grid's deployment of AMI as part of its Worcester smart grid pilot program raised concerns about a loss of benefits when the city considered adopting a municipal aggregation program (D.P.U. 15-120, Tr. 1, at 159-160). To address this concern, National Grid states that it worked with a competitive supplier to design a TVR that could be offered as part of a municipal aggregation program (D.P.U. 15-120, Tr. 1, at 159-160). Worcester does not, however, currently operate a municipal aggregation program. See <http://www.worcesterenergy.org/leading-by-example/municipal-electrical-aggregation>.

(2) the Department findings in D.P.U. 14-04-C were focused on the design of a TVR program for basic service, which the Department found would not harm the competitive market (D.P.U. 15-122, Tr. 2, at 241-242; Eversource Brief at 45).⁶²

Unitil's proposal mirrors Eversource's in requiring customers to leave competitive supply and return to basic service in order to participate in TVR (D.P.U. 15-121, Tr. 1, at 35-36). Like Eversource, Unitil states that it would allow a competitive supplier that wishes to offer TVR to receive an interval data service for a fee, provided also that the competitive supply customer pays for the AMI meter and installation (D.P.U. 15-121, Tr. 1, at 36-37). In its planning, Unitil assumes that no customer on competitive supply would choose to participate in TVR and, therefore, excludes these customers from its business case analysis (D.P.U. 15-121, Exh. DPU-1-5).

Eversource and National Grid maintain that competitive suppliers are not precluded from offering dynamic pricing products, provided that the suppliers bill their customers separately (D.P.U. 15-120, Tr. 2, at 269; D.P.U. 15-122, Tr. 2, at 309). As discussed above, neither National Grid's nor Eversource's existing billing systems are able to accommodate a large number of TVR customers without large-scale, multi-year upgrades (D.P.U. 15-120, Grid Modernization Plan at 86-87; D.P.U.15-122, Tr. 1, at 99-106). The need to bill customers separately could create a barrier to participation in dynamic pricing for

⁶² Eversource states that competitive suppliers can currently offer dynamic pricing if they pay Eversource for the AMI meters and installation (D.P.U. 15-122, Tr. 2, at 251). The competitive supplier would also be required to pay for access to the AMI data that Eversource would collect (D.P.U. 15-122, Tr. 2, at 251).

competitive supply customers which, in turn, will lower the potential benefits to be gained from the deployment of advanced metering functionality.⁶³

Data access is crucial for third parties and competitive suppliers to participate in the modernized grid and provide the benefits of TVR. D.P.U. 12-76-B at 34. In terms of access to data, National Grid, Unitil, and Eversource state that they will make customer usage data available to third parties, including competitive suppliers, using the Green Button⁶⁴ data access protocol (D.P.U. 15-120, Exh. MB/WFG-Rebuttal-1, at 14; Tr. 1, at 57-59; (D.P.U. 15-121, Exh. FG&E-1, at 88; Tr. 1, at 36, 53; D.P.U. 15-122, Tr. 1, at 251).

The Attorney General and CLF argue that establishing standardized policies regarding third-party access to interval usage data (both customer-specific and aggregated) will optimize the benefits that consumers can realize from dynamic pricing (D.P.U. 15-120, Attorney General Brief at 40-43; CLF Brief at 13-14). The Department agrees and, as discussed below, a next step in the deployment of advanced metering functionality will be for the Companies and other stakeholders to develop a uniform statewide data access strategy.

In sum, there are several issues that affect competitive suppliers' interests and ability to offer dynamic pricing products, including access to customer data, billing limitations, and the uncertainty of customer willingness to participate in dynamic pricing products. As more

⁶³ The Compact maintains that Eversource's legacy billing system is a barrier to the deployment of TVR in its municipal aggregation program (D.P.U. 15-122, Tr. 3, at 454-456).

⁶⁴ Green Button is a nationwide standard that allows customers to access their energy usage data and share it with qualified third-parties.
<http://www.greenbuttonalliance.org/about>.

customers migrate from basic service to competitive supply alternatives such as municipal aggregation, the Department will need the certainty of widespread adoption of dynamic pricing products from the competitive market to maximize the benefits of the deployment of advanced meter functionality. As discussed below, the Department intends to work with the Companies and other stakeholders to identify ways to allow all customers, regardless of supplier, to have the opportunity to benefit from dynamic pricing.

Third, there is significant variation in the assumed TVR customer participation rates used by the Companies in their business case analyses (D.P.U. 15-120, Exhs. DPU-5-15; DPU-1-12(a), Att.; D.P.U. 15-122, Exhs. Eversource-IGMP at 24; CLC-2-41; CLC-4-35; D.P.U 15-121, Exh. DPU-1-2(a); Tr. 1, at 69-75). This variation in assumed customer participation, along with questions regarding the methods used to arrive at the assumptions, leads us to question the reliability of the assumptions. For example, National Grid states that it relied on a United States Department of Energy report and an academic discussion paper as the bases for its assumption of customer participation rates in its proposed opt-out and opt-in TVR programs (D.P.U. 15-120, Exhs. DPU-5-15; DPU-1-12(a), Att.). From these two sources, National Grid chose an average participation rate of 82 percent (from a range of 78 percent to 87 percent) from the Department of Energy report for the opt-out program and a participation rate of two percent for the opt-in program, even though the same report included a range from five percent to 28 percent (D.P.U. 15-120, Exhs. DPU-5-15; DPU-1-12(a), Att.). We are not persuaded by National Grid's rationale that the Department of Energy report is an appropriate source for opt-out program assumptions but insufficient for

opt-in program assumptions (D.P.U. 15-120, Exh. DPU-5-16; Tr. 2, at 237-247). This substantial difference in participation rates between opt-out and opt-in was not properly supported (D.P.U. 15-120, Exhs. DPU-5-15; DPU-1-12(a) Att.; AG-3-31(a)-(d); Tr. 2, at 237-247).

At the same time, Eversource states that five percent of its customers would opt into its proposed TVR program, while 14 percent of its customers would participate in demand reduction under an opt-out TVR program (D.P.U. 15-122, Exhs. Eversource-IGMP at 24; CLC-2-41; CLC-4-35). Eversource did not provide a detailed explanation of the basis for these assumptions and provided conflicting documentation in support (D.P.U. 15-122, Exhs. AG-4-4(c), Att.; AG-8-3(f), Att.; Tr. 1, at 179-181, Tr. 2, at 212-218). Finally, Unitil assumed a ten percent opt-in participation rate based on the average results of four pilots, which ranged from four to 19 percent (D.P.U. 15-121, Exh. DPU-1-2(a); Tr. 1, at 69-75).⁶⁵

Both National Grid and Eversource addressed the lack of interest and difficulty of engaging consumers to participate in dynamic pricing (D.P.U. 15-120, Tr. 2, at 247-251; D.P.U. 15-122, Tr. 2, at 233, 235-236). In particular, National Grid cites anecdotal evidence that less than one percent of customers that have AMI are enrolled in TVR products (D.P.U. 15-120, Tr. 2, at 247). Unitil indicates that it does not have extreme confidence in its estimates based on lack of experience (D.P.U. 15-121, Tr. 1, at 78).

⁶⁵ Unitil examined four metering pilot programs that did not have additional enabling technology but offered critical peak pricing (D.P.U. 15-121, Exh. DPU-1-2(a); Tr. 1, at 69-75).

While the Department accepts that assumptions need to be made regarding customer participation rates, the methods used to arrive at those assumptions need to be fully documented so that Department can adequately judge their reasonableness. The wide variation in the assumed TVR participation rates used by the Companies adds to the uncertainty of the likely benefits of the proposed customer-facing grid modernization investments.

Fourth, forward capacity market prices determined by auctions held by Independent System Operator New England (“ISO-NE”) serve as a primary source of the anticipated benefits of the Companies’ proposed customer-facing investments (D.P.U. 15-120, Grid Modernization Plan, Att. 14, at 5-8; Exh. AG-3-31(a)-(d); D.P.U. 15-121, Exh. AG-4-27, Att. 16; D.P.U. 15-122, Exhs. Eversource-IGMP App. 7, at 19; DPU-2-2; DPU-2-3; DPU-2-5; AG-1-9). The Companies used a common forecast of forward capacity market prices to monetize the benefits of peak demand reduction achieved through TVR (D.P.U. 15-120, Grid Modernization Plan, Att. 11, at 42; D.P.U. 15-121, Exh. FG&E-1, App. F, at 43; D.P.U. 15-122, Exh. Eversource-IGMP App. 10, at 2).⁶⁶ However, the forecast relied upon by the Companies is not reflective of actual forward capacity market conditions.

⁶⁶ The Department directed the Companies to use common assumptions for, among other things, the forecast of capacity market prices. D.P.U. 12-76-C at 15. The Companies jointly engaged the services of an outside consultant to develop the forecast of forward capacity market prices (D.P.U. 15-120, Grid Modernization Plan, Att. 11, at 42; D.P.U. 15-121, Exh. FG&E-1, App. F at 43; D.P.U. 15-122, Exh. Eversource-IGMP App. 10, at 42).

In particular, when the Companies filed their grid modernization plans, the forecasted forward capacity market prices per kilo-Watt (“kW”) year in 2019, 2020, and 2021 were \$125, \$138, and \$136, respectively (D.P.U. 15-120, Grid Modernization Plan, Att. 11, at 42; D.P.U. 15-121, Exh. FG&E-1, App. F, at 43; D.P.U. 15-122, Exh. Eversource-IGMP App. 10, at 42). To date, ISO-NE has conducted its forward capacity market auctions through capacity year 2021-2022. ISO-NE’s actual forward capacity market auction prices per kW-year for 2019, 2020, and 2021 are \$84, \$64, and \$56, respectively.⁶⁷ The significant difference between forecasted and actual prices means that approximately half of the anticipated benefits of the proposed customer-facing grid modernization investments will not be realized for 2019, 2020, and 2021.

The Department recognizes the uncertainty inherent in forecasting prices in the wholesale electricity markets. While price fluctuations are common in the market, the scale of fluctuations in the forward capacity market prices has proven to be very large. In addition, as the Attorney General correctly notes, there may be structural changes in the capacity market that also affect price fluctuations (D.P.U. 15-120, Attorney General Brief at 34-36). Such potential for price fluctuations reduces the certainty that the avoided capacity cost benefits will accrue to customers from reductions in peak demand.

⁶⁷ ISO-NE’s forward capacity market auction results can be found at: https://www.iso-ne.com/static-assets/documents/2016/02/20160229_fca10_finalresults.pdf; https://www.iso-ne.com/static-assets/documents/2017/02/20170228_pr_fca11_final_results.pdf; and https://www.iso-ne.com/static-assets/documents/2018/02/fca_12_result_report.pdf.

Finally, technological advances in the market have occurred in recent years that may allow interval meter data collection without the need to replace existing AMR meters with costly AMI meters (D.P.U. 15-122, Tr. 2, at 330-331). Interval AMR meters are capable of measuring usage data every 15 seconds, much more frequently than what is required to operate an effective TVR program (D.P.U. 15-122, Tr. 2, at 243). However, interval AMR meters need additional devices to enable two-way communications (D.P.U. 15-122, Tr. 2, at 269).⁶⁸ Given the high cost of AMI deployment, further investigation is needed to determine whether there are more cost-effective solutions to achieve advanced metering functionality.

As stated above, the cost of a full statewide deployment of advanced metering functionality would be in excess of \$1.5 billion. Before preauthorizing the expenditure of ratepayer funds for investments of this magnitude, the Department would need to have a high degree of certainty that the benefits of such deployment would justify the costs. Our review of the record in the instant proceedings has identified several challenges with respect to achieving the benefits of customer-facing grid modernization investments. TVR has the potential to deliver significant benefits to reduce peak demand, leading to lower bills and lower emissions from peaking generation. However, questions regarding significant variations in Companies' estimates of customer participation in TVR as well as unresolved

⁶⁸ Eversource notes that energy monitoring equipment currently exists that could allow for two-way communications using existing AMR meters (D.P.U. 15-122, Tr. 1, at 9-41). However, the Compact suggests that this equipment does not provide ISO-NE settlement-quality data (D.P.U. 15-122, Tr. 2, at 462-463).

challenges related to the ability of the growing number of competitive supply customers to access TVR make achievement of these benefits uncertain. Further uncertainty is associated with the achievement of anticipated benefits associated with the forward capacity market. In addition, AMR meters are in widespread use in Massachusetts and the change from manual meter reading to remote meter reading has already occurred. Any decision to prematurely retire these meters and replace them with other advanced metering infrastructure would come at a significant cost.⁶⁹

Given our assessment of the benefits discussed above, the Department finds that the anticipated benefits of the Companies' proposed customer-facing grid modernization investments do not justify the costs. Therefore, the Department will not preauthorize any of the Companies' proposed customer-facing investments at this time.⁷⁰

⁶⁹ Because we do not preauthorize any customer-facing investments, the Department will not address National Grid's proposal to establish a regulatory asset to recover any remaining undepreciated value of customer-facing assets being prematurely retired as a result of grid modernization (D.P.U. 15-120, Exh. PTZ-1, at 20-21).

⁷⁰ For National Grid the Department will not preauthorize the following customer-facing investments: smart meters and AMI back office infrastructure; customer load management; communications and information/operational technologies related to AMI; cybersecurity related to customer-side investments; workforce training and asset management; marketing, education, and outreach and project management office (D.P.U. 15-120, Grid Modernization Plan, at 29). For Unitil, the Department will not preauthorize the following customer-facing investments: customer web portal; gamification pilot; TVR and demand response; circuit capacity studies; customer education and outreach (D.P.U. 15-121, Exh. FG&E-1, at 75). Finally, for Eversource, the Department will not preauthorize the following customer-facing investments: customer portal; hosting capacity maps and tools; automated billing for improved customer service; and all investments proposed in the incremental grid modernization plan (D.P.U. 17-05, Exh. ES-GMBC-2, at 10; D.P.U. 15-122, Exh. Eversource-IGMP).

The Department remains fully committed to the goal of optimizing system demand by facilitating consumer price responsiveness. Recent technological advances and changes in the market regarding the deployment of advanced metering functionality lead us to conclude that it is in the public interest to identify ways in which we can achieve this objective in a more cost-effective manner than the short-term full deployment of advanced metering functionality contemplated in D.P.U. 12-76-B or the various alternatives proposed by the Companies in this proceeding. Below, the Department discusses the next steps we will take regarding the deployment of customer-facing grid modernization investments.

iii. Next Steps for Deployment of Customer-Facing Investments

As discussed above, the evidence in these proceedings does not support the Companies' proposals to deploy AMI, either on an opt-out or an opt-in basis. Nonetheless, the Department remains committed to the pursuit of advanced metering functionality as a means to achieve our grid modernization objectives. We intend to open an investigation to consider the next steps for cost-effective deployment of customer-facing investments.

While the Department's ultimate goal is to ensure that all customers have the opportunity to realize the benefits of dynamic pricing, we conclude that, as a transitional strategy, a targeted approach to the deployment of advanced metering functionality may be appropriate. Accordingly, as part of our investigation, the Department will consider whether a targeted deployment of advanced metering functionality to certain customer groups (for example, new net metering and electric vehicle customers), is cost-effective and otherwise in

the public interest.⁷¹ The Department's initial focus will be on customer groups that are likely to be engaged and participate in dynamic pricing, and have the greatest potential to use these technologies to benefit themselves and the system as a whole to lower system costs and offset peak generation. As part of this investigation, the Department will consider the technical specifications required to deploy advanced metering functionality to these customers.

In addition, given recent technological advances, the Department finds that it is appropriate to investigate technology options that could enable a cost-effective deployment of advanced metering functionality without resorting to a costly replacement of existing AMR infrastructure. In particular, the Department intends to explore whether there are alternative solutions that could enable the Companies to collect and communicate interval data without the need to prematurely retire the AMR meters that are in wide use.

Finally, the Department identified a number of issues regarding the ability of competitive supply customers, including municipal aggregation customers, to participate in offering dynamic pricing. A high level of participation in dynamic pricing, such as TVR, is needed to maximize the benefits of customer-facing technologies as a growing number of the Companies' customers receive competitive supply. The ability of the competitive market to

⁷¹ The Department has recognized the importance of sending accurate price signals to net metering and electric vehicle customers regarding electricity usage and facility output in order to optimize the benefits that the facilities provide to both the customers themselves and to the distribution system at large. D.P.U. 17-05, at 491; NSTAR Electric Company and Western Massachusetts Electric Company, D.P.U. 17-05-B at 148-149, 153 (2018).

develop and offer dynamic pricing products depends in large part on: (1) the capability of the Companies to bill for a variety of dynamic pricing products; (2) the ability of suppliers to access interval usage data; and (3) customers to be engaged and knowledgeable about energy pricing. In light of these issues, the Department intends to investigate the most appropriate ways to enable competitive supply customers, including municipal aggregation participants, to participate in dynamic pricing programs. A focus of the investigation will be specific solutions in metering, data access, and billing that would enable customers on competitive supply to participate in dynamic pricing programs as effectively as customers on basic service.

c. Grid-Facing Investments

i. Introduction

In the sections below, the Department assesses whether preauthorization of the Companies' proposed grid-facing investments is appropriate.⁷² As described above, to be eligible for preauthorization, the Companies' proposed investments must: (1) be designed to make measureable progress towards achievement of the Department's grid modernization objectives; (2) be incremental to existing or business as usual investments; (3) be supported by a business case that shows that the projected benefits justify the costs; and (4) result in reasonable bill impacts. See D.P.U. 12-76-B at 15-23; D.P.U. 12-76-C at 29-30; D.P.U. 17-05, at 469-470. First, we look generally at whether the various investments

⁷² The Department addresses eligibility for targeted cost recovery of preauthorized investments in Section VII, below.

proposed by the Companies are designed to make measurable progress towards achievement of the grid modernization objectives. Next we address issues with respect to whether these investment categories are business as usual. Finally, we address each company's individual business case for its proposed grid-facing investments.

As a threshold matter, the Department must determine if there is sufficient evidence to consider the Companies' grid-facing investment proposals for preauthorization. In particular, a number of intervenors argue that the Companies did not provide sufficient detail as to the costs and benefits of their proposed grid modernization investments and, therefore, urge the Department to require the Companies to refile their grid modernization plans before we consider preauthorization of any investments (D.P.U. 15-120, Acadia Center Brief at 22; Attorney General Brief at 29-37, 39-48, Attorney General Reply Brief at 8; CLF Brief at 8, 15-16; DOER Brief at 8-9, 14-15; D.P.U. 15-121, Attorney General Brief at 25-26; CLF Brief at 3-15; D.P.U. 15-122, Acadia Center Brief at 10, 15; DOER Brief at 11-12, DOER Reply Brief at 1-2; Attorney General Brief at 13, 15; Attorney General Reply Brief at 8-9; D.P.U. 17-05, Acadia Center Brief at 14, 16-17, Acadia Center Reply Brief at 5; D.P.U. 15-120/15-121/15-122, NECEC Brief at 16, 27).

Below, the Department identifies several issues with the business case analyses presented by the Companies. Nonetheless, we find that there is sufficient, reliable evidence in the record to review the proposed grid-facing investments and determine whether they qualify for preauthorization. Requiring the Companies to refile their grid modernization proposals, as suggested by certain intervenors, could delay the deployment of important

foundational technologies that are necessary to make measurable progress towards the achievement of the Department's grid modernization objectives. Accordingly, we review the Companies' proposed grid-facing investments, based upon the record in these proceedings, below.

ii. Measurable Progress

In order to be eligible for preauthorization, the Companies must demonstrate that the proposed investments are designed to make measurable progress towards achievement of the Department's grid modernization objectives. Below, the Department discusses the benefits of these technologies as they relate to the grid modernization objectives in the context of our review of the business case presented in each company's individual grid modernization plan. Here, we discuss the overall benefits of these technologies and how they relate to our grid modernization objectives.

Each company has proposed a number of grid-facing investments, including investments in sensing technologies, SCADA, distribution management systems, and load flow analytics with the support of advanced communications and distribution automation investments (e.g., VVO, automated feeder reconfiguration, advanced distribution automation). Although the Companies use different terms to refer to these investments, there are substantial similarities between each company's proposed investments. For example, the term "advanced sensing technology" used by Eversource is similar to the term "feeder monitors" used by National Grid, except that Eversource combines SCADA with sensing technology in its plan (D.P.U. 15-120, Grid Modernization Plan at 11, 14-16, 37-100;

D.P.U. 17-05, Exhs. ES-GMBC-1, at 52; ES-GMBC-2, at 9-10). Similarly, Eversource identifies distribution management systems separately from load flow analytics in its plan, while National Grid proposes an advanced distribution management system that includes a distribution management system as well as load flow analytics and SCADA (D.P.U. 15-120, Grid Modernization Plan, at 11, 14-16, 37100; D.P.U. 17-05, Exh. ES-GMBC-2, at 17). In addition, the automated feeder reconfiguration proposed by Eversource has similar functions as the advanced distribution automation proposed by National Grid (D.P.U. 15-120, Grid Modernization Plan at 37, 60; D.P.U. 17-05, Exh. ES-GMBC-2, at 32, 35). Conversely, all three Companies refer to VVO consistently (D.P.U. 15-120, Grid Modernization Plan at 11, 14-16, 37-100; D.P.U. 15-121, Exh. FG&E-1, at 46-54; D.P.U. 17-05, Exh. ES-GMBC-2, at 29-30).⁷³

Regardless of the terminology used or the varying combinations of these proposed grid-facing technologies, the Department finds that investments in advanced sensing technologies, SCADA, distribution management systems, load flow analytics, advanced communications, VVO, and automated feeder reconfiguration or advanced distribution automation, when coordinated to maximize benefits⁷⁴ to customers, will result in measurable

⁷³ Although each grid modernization plan is company-specific, we find that the use of consistent terminology across plans would streamline review. Going forward, the Department directs the Companies to jointly develop common terms for similar investments or categories of investments for use in future grid modernization reports and proceedings.

⁷⁴ Maximizing benefits means that a company has optimized the deployment of the grid-facing investments to achieve the highest level of benefits to its customers in

progress toward achievement of the grid modernization objectives (D.P.U. 15-120, Grid Modernization Plan at 14; D.P.U. 15-121, Exh. FG&E-1, at 9-10, 34; D.P.U. 17-05, Exh. ES-GMBC-2, at 12). As the Department recognized in D.P.U. 12-76-C, investments in individual grid-facing technologies may not result in a positive business case when evaluated as a single project; however, evaluating a proposed investment based on the technologies that it enables could lead to measureable progress in multiple grid modernization objectives and may produce a positive business case. D.P.U. 12-76-C at 6. This evaluation approach is consistent with the interrelated and interdependent nature of many grid-facing technologies and allows the Department to take into consideration how a proposed technology can be leveraged to achieve multiple objectives.

For example, the deployment of advanced sensing and monitoring devices will enable the Companies to collect real-time data on the operational status of their distribution systems (D.P.U. 15-120, Grid Modernization Plan at 52; D.P.U. 15-121, Exh. FG&E-1, at 40-50; D.P.U. 17-05, Exh. ES-GMBC-2, at 43). The data collected from these field devices will be stored in distribution management systems which, in conjunction with load flow analytics, will provide visibility into the distribution system and improve real-time situational awareness for system operators (D.P.U. 15-120, Grid Modernization Plan at 80-82; D.P.U. 15-121, Exh. FG&E-1, at 52-53; D.P.U. 17-05, Exh. ES-GMBC-2, at 17). Additionally, the distribution management systems can control field devices in emergencies and optimize

terms of energy and demand reduction, cost reduction, reduced impacts from outages, and improved power quality.

system operations (D.P.U. 15-120, Grid Modernization Plan at 80-82; D.P.U. 15-121, Exh. FG&E-1, at 52-53; D.P.U. 17-05, Exh. ES-GMBC-2, at 32). Further, advanced communications infrastructure will enable near real-time information exchange and response between the field devices and the distribution management systems (D.P.U. 15-121, Exh. FG&E-1, at 48; D.P.U. 17-05, Exh. ES-GMBC-2, at 50). Taken together, investments in advanced sensing and monitoring devices, SCADA, load flow analytics, advanced distribution management systems, and advanced communications infrastructure will contribute to optimizing system performance and integrating additional distributed energy resources (D.P.U. 15-120, Exh. AG-6-4; D.P.U. 15-121, Exhs. FG&E-1, at 52; AG-5-7; AG-5-31; D.P.U. 17-05, Exh. ES-GWPP-1, at 10, 13). Therefore, the Department finds investments in advanced sensing, SCADA, distribution management systems, load flow analytics, advanced communications, when combined and coordinated with investments in distribution automation such as VVO, automated feeder reconfiguration, and advanced distribution automation, will make measurable progress towards our grid modernization objectives.

In addition, deployment of distribution automation such as VVO and automated feeder reconfiguration or advanced distribution automation is enabled by, and contingent upon, the deployment of advanced sensing, SCADA, distribution management systems, load flow analytics and advanced communications (D.P.U. 15-120, Grid Modernization Plan at 80-82; D.P.U. 15-121, Exh. FG&E-1, at 52-53; D.P.U. 17-05, Exh. ES-GMBC-2, at 28). VVO reduces energy consumption and optimizes demand by using devices to regulate the distribution voltages within a reasonable range. Automated feeder reconfiguration or

advanced distribution automation reduces the effects of outages by isolating them to the smallest possible area and restoring power from alternative sources (D.P.U. 15-120, Grid Modernization Plan at 56, 59; D.P.U. 15-121, Exh. FG&E-1, at 50-53; D.P.U. 17-05, Exh. ES-GMBC-2, at 28, 32-33). These distribution automation technologies will bring customers the majority of direct benefits such as energy and demand reductions, reduced impacts from outages, and improved power quality (D.P.U. 15-120, Exhs. AG-7-1; AG-3-31(a)-(d); D.P.U. 15-121, Exh. FG&E-1, at 54-55; D.P.U. 17-05, Tr. 8, at 1620). Therefore, the Department finds investments in VVO and automated feeder reconfiguration or advanced distribution automation will make measurable progress towards our grid modernization objectives, provided these investments are combined and coordinated with the deployment of SCADA, distribution management systems, load flow analytics and advanced communications.

The coordinated deployment of advanced sensing, SCADA, distribution management systems, load flow analytics, advanced communications, and distribution automation will contribute significantly more toward the achievement of grid modernization objectives than a piecemeal deployment of the individual technologies. As discussed above, without such coordination, the Companies may not be able to realize a level of benefits that justify the costs (D.P.U. 15-120, Exh. AG-6-17; Tr. 2, at 210-212; D.P.U. 17-05, Tr. 8, at 1620).⁷⁵

⁷⁵ For example, while deployment of a stand-alone automation system independent from the distribution management system is possible, this stand-alone system could become redundant if the company later finds it necessary to integrate automation functionalities into the distribution management system (D.P.U. 15-120, Tr. 2, at 210-212; D.P.U. 17-05, Tr. 8, at 1628-1629). Alternately, if the distribution

In sum, the Department finds that the interplay of foundational grid-facing investments in advanced sensing, SCADA, distribution management systems, load flow analytics, advanced communications, VVO, and automated feeder reconfiguration or advanced distribution automation, will bring direct benefits to customers and make measurable progress toward achievement of our grid modernization objectives (D.P.U. 15-120, Grid Modernization Plan at 14; D.P.U. 15-121, Exh. FG&E-2, at 24-26; D.P.U. 17-05, Exh. ES-GMBC-2, at 12). For this reason, the Department finds that it appropriate to review the grid-facing investments as a suite of investments. The coordinated deployment of a suite of grid-facing investments will expedite the achievement of grid modernization objectives and allow the Department to more accurately assess the benefits to customers relative to the costs.⁷⁶

Finally, some intervenors argue that the Companies' grid modernization plans failed to provide a transformative platform for distributed energy resources, to fully consider the value of distributed energy resources to a modern grid, or to consider distributed energy resources or other alternative resources to advance the grid modernization objectives (D.P.U. 15-120, CLF Brief at 8-13; D.P.U. 15-121, CLF Brief at 7-13;

management system deployment is coordinated with the deployment of automation systems, the distribution management system can optimize the operations of all integrated systems, leading to greater reductions in cost and outage-hours for customers (D.P.U. 17-05, Tr. 15, at 2988-2992).

⁷⁶ At a minimum, the strategic deployment of a suite of grid-facing investments must coordinate the deployment of individual technologies, as well as consider the timing, location, and scale of these investments, with the overall aim of maximizing the benefits to customers.

D.P.U. 15-120/15-121/15-122, NECEC Brief at 19, citing Exh. CLF-CG-1, at 36-40; D.P.U. 15-122, CLF Brief at 10-15). As discussed above, the Department finds that proposed investments in advanced sensing, SCADA, distribution management systems and load flow analytics, supported by advanced two-way communications when combined with distribution automation, will make measurable progress towards a modern grid. A modern grid will enable the Companies to understand and control their distribution systems in real-time, and to optimize assets connected to the distribution system, especially distributed energy resources, based on this enhanced understanding and control. The Department finds that the grid-facing investments we consider today are an important step in further integrating distributed energy resources and building a future distributed energy market where all distribution system resources, including distributed energy resources, will be valued fairly based on market signals.

iii. Incremental

In order to be eligible for preauthorization, the Companies must demonstrate that the proposed investments are incremental to existing or business as usual investments.⁷⁷ In D.P.U. 12-76-B at 19-20, the Department found that investments may be treated as incremental if they accelerate progress in achieving our grid modernization objectives. Here, we find it appropriate to modify this showing to require a demonstration that a primary

⁷⁷ We note that a finding of incremental for preauthorization purposes is not the same as a finding of incremental for cost recovery purposes. See Section VII.D., below.

purpose of the proposed investment is to accelerate progress in achieving our grid modernization objectives.

Several intervenors argue that a number of the Companies' proposed grid-facing investments are business as usual and should not be eligible for preauthorization. The Attorney General argues that National Grid's proposed enabling infrastructure investments are business as usual and that preauthorization of such investments would permit National Grid to recover the investment from ratepayers twice (D.P.U. 15-121, Attorney General Brief at 16-17, 19-20, citing Exh. AG-GLB-1, at 14, 41-42). Further, NECEC argues that National Grid does not explain whether these proposed investments will displace the need for traditional capital investments (D.P.U. 15-120, NECEC Brief at 24, citing Exh. CLF-TW/AH-1, at 23-24). The Attorney General also challenges some of Eversource's and Unitil's proposed investments as business as usual investments (D.P.U. 17-05, Attorney General Brief at 38-39; D.P.U. 15-121, Attorney General Brief at 16, 18-19). Similarly, the Compact argues that many Eversource's proposed investments are not incremental (D.P.U. 17-05, Compact Brief at 16-17).

With limited exceptions discussed below, the Department finds that the grid-facing investments proposed by the Companies are incremental for the following reasons. First, the investments are forward-looking in that they are not designed to solely support today's grid functionality, but will also support the full functionality of the end-state modern grid (D.P.U. 15-120, Grid Modernization Plan at 7, 122; D.P.U. 15-121, Exh. FG&E-1, at 33; D.P.U. 17-05, Exh. ES-GMBC-2, at 6-7). While the proposed grid-facing investments are

expected to provide benefits in both the short and medium term, these investments are fundamental to the transformation of the grid in the long term (D.P.U. 15-120, Grid Modernization Plan at 7, 122; D.P.U. 15-121, Exh. FG&E-1, at 33; D.P.U. 17-05, Exh. ES-GMBC-2, at 6-7). Accordingly, the Department finds that the proposed grid-facing investments are not business as usual but, instead, have a primary purpose to accelerate progress in achieving our grid modernization objectives.

More specifically, we find that National Grid's proposed feeder monitors will increase visibility for feeders where the company currently does not have interval power information that can feed into its proposed distribution management system (D.P.U. 15-120, Grid Modernization Plan at 35). National Grid intends to first integrate these feeder monitors with its existing energy management system and then integrate the feeder monitors and the real-time data they provide with its new advanced distribution management system (D.P.U. 15-120, Grid Modernization Plan at 35). Accordingly, we find that National Grid's proposed investments in an advanced distribution management system and SCADA are part of a new system with a primary purpose to accelerate progress in achieving our grid modernization objectives. Additionally, National Grid's proposed VVO and advanced distribution automation investments are for feeders that the company has identified as having a high value in reducing energy and demand, and in improving power quality and, therefore, have a primary purpose to accelerate progress in achieving our grid modernization objectives (D.P.U. 15-120, Grid Modernization Plan at 35, 58-59).

Turning to Unitil, the company's investments in a field area network, SCADA, and advanced distribution management system, and VVO represent the components of a comprehensive new system that we find has a primary purpose to accelerate the progress toward the grid modernization objectives of reducing the effects of outages, optimizing demand, and integrating distributed energy resources (D.P.U. 15-121, Exh. FG&-1, at 48). Further, Unitil's proposed outage management system integration and its mobile damage assessment tool have a primary purpose to accelerate progress toward achievement of the grid modernization objective of optimizing system performance by improving grid visibility, command and control, and self-healing (D.P.U. 15-121, Exh. FG&E-1, at 42, 45).

Finally, although Eversource has invested previously in some of the grid-facing technologies it seeks preauthorization of here, the company proposes to significantly expand and accelerate the deployment of these technologies over the next five years to achieve the Department's grid modernization objectives (D.P.U. 17-05, Exh. ES-GMBC-2, at 14; RR-DPU-23). For instance, 45 percent of Eversource East's radial network feeders are currently equipped with SCADA. Eversource proposes to expand SCADA deployment to 85 percent of Eversource East's radial network feeders within five years (D.P.U. 17-05, RR-DPU-23). The Department finds the primary purpose of the level of deployment for these grid-facing investments is to accelerate the progress toward our grid modernization objectives.

The Department emphasizes that our findings as to what constitutes an incremental investment for the purpose of preauthorization are limited to the grid-facing investments we

review in this Order. The Department continues to expect that grid modernization will become a part of the normal course of business and that investments we determine to be incremental today may not be incremental in future grid modernization filings.

D.P.U. 12-76-A at 9.

iv. Business Case Analysis

(A) D.P.U. 15-120, National Grid

(1) Introduction

National Grid proposed four investment scenarios, each with different combinations of grid-facing and customer-facing investments (D.P.U. 15-120, Grid Modernization Plan at 9-10). The Department has not preauthorized any customer-facing investments and we decline to select a single grid-facing investment scenario for National Grid. Instead, the Department will review the universe of National Grid's proposed grid-facing investments to determine if they are eligible for preauthorization. As discussed below, from this universe of preauthorized grid-facing investments, National Grid must select the investment mix that is designed to maximize benefits to customers.

(2) Cost Estimates

National Grid divides its proposed grid-facing investments into two categories: (1) enabling infrastructure; and (2) field deployment. Proposed enabling infrastructure investments include communications and information/operational technologies, and advanced distribution management systems and SCADA. Proposed field deployments include VVO,

advanced distribution automation, and feeder monitors (D.P.U. 15-120, Grid Modernization Plan at 37, 60).

National Grid's cost estimates for the proposed enabling infrastructure include: (1) a proposed budget of \$48.4 million for three years for advanced distribution management systems/SCADA; and (2) a proposed budget of \$1.8 million over three years for communications and information/operational technologies (D.P.U. 15-120, Grid Modernization Plan at 29, 35). National Grid's cost estimates for the proposed field deployments include: (1) \$10.6 million over three years for deployment of VVO; (2) \$13.4 million over three years for deployment of advanced distribution automation; and (3) \$8 million over three years for feeder monitors⁷⁸ (D.P.U. 15-120, Grid Modernization Plan at 29, 32, 35, Atts. 3, 5). Together, National Grid's total three-year cost estimate for its proposed grid-facing investments is \$82 million.

National Grid derived the cost estimates for its communications, information/operational technologies, advanced distribution management system, and SCADA proposals based on competitive solicitation processes that it states will be updated at the time of actual procurement (D.P.U. 15-120, Exhs. AG-1-3; AG-1-4; AG-1-5). National Grid

⁷⁸ We note that National Grid proposed two deployment-level options on its high value feeders for both VVO and advanced distribution automation: (1) 24 feeders which covers ten percent of customers or (2) 46 feeders to cover 30 percent of customers (D.P.U. 15-120, Grid Modernization Plan at 11, 45). Given the number of high value feeders in National Grid's service territory and the significant direct benefits anticipated with VVO and advanced distribution automation deployment, the Department evaluated the company's business case for the higher deployment level of 46 feeders.

developed the cost estimates for its VVO, advanced distribution automation, and feeder monitor proposals based on vendor price quotes (D.P.U. 15-120, Grid Modernization Plan at 29, 32, 34, Att. 3, 5). The Department finds that National Grid's cost estimates are sufficiently reviewable and reliable for the purpose of determining eligibility for preauthorization.

(3) Projected Benefits

National Grid did not estimate quantifiable benefits for its proposed enabling investments because these benefits are accounted for in other investments such as distribution automation (D.P.U. 15-120, Exh. AG-3-31(a)-(d)). These investments will, however, bring qualitative benefits such as enhancing National Grid's real-time understanding and control of its distribution system, as well as enabling distribution automation investments.

For the proposed field deployment investments, National Grid identifies several quantified and unquantifiable benefits. In particular, VVO and advanced distribution automation deployment will lead to: (1) improved feeder power factor, flatter voltage profiles, reduced feeder losses, reduced peak demand, and reduced energy consumption by customers; (2) an approximate three percent reduction in customer energy consumption; (3) active maintenance of voltage through intelligent centralized control that will improve feeder voltage performance and will, in turn, allow for greater distributed energy resource integration; (4) improved system awareness, which will enhance operational efficiency; (5) a 25 percent reduction in main-line customer minutes of interruption on feeders equipped with advanced distribution automation; (6) improved operational efficiency and better distribution

system management for the integration of distributed energy resources; and (7) the ability to obtain real-time information to assist in performing system reconfiguration after contingencies and during peak-loading periods from the feeder monitor investment (D.P.U. 15-120, Grid Modernization Plan at 45-50).

Based on the above, National Grid has shown that there are significant benefits associated with its proposed grid-facing investments. Distribution automation will lead to reduced peak demand and avoided capacity costs, reduced consumption and line losses, and reduced customer impacts from outages, and is expected to produce improved reliability benefits estimated at \$71.89 million⁷⁹ (D.P.U. 15-120, Exh. AG-3-31(d)). Additional unquantified benefits associated with the proposed grid-facing investments are in the areas of: (1) enhanced reliability; (2) support for new technology, energy, and environmental requirements; (3) integration of distributed energy resources; (4) improved customer satisfaction; (5) deferred capital replacement; (6) optimization of system planning; (D.P.U. 15-120, Grid Modernization Plan at 120-126; Exhs. JJN-1, at 17-18, 22-23; AG-3-31). Accordingly, the Department finds that the anticipated benefits of National Grid's proposed grid-facing grid modernization investments justify the estimated costs.

⁷⁹ It is difficult to assign a monetary value to certain benefits such as increased reliability. National Grid argues that customers may be willing to pay a small amount of money to avoid a minor inconvenience from a short duration outage, while customers may be willing to pay more to avoid the inconvenience of not being able to work at home or losing their heat/air conditioning for several hours during longer outages (D.P.U. 15-120, Exh. AG-3-34). Although it is difficult to quantify these benefits, National Grid's proposed investments will improve reliability, which will, in turn, optimize system performance to the benefit of all customers.

The Attorney General recommends several changes to the scale of National Grid's proposed technology deployments, such as accelerating VVO deployment, reducing the number of feeders for advanced distribution automation, and treating advanced distribution automation as a pilot (D.P.U. 15-120, Attorney General Brief at 19-20, citing Exh. AG-GLB-1, at 31). In addition, DOER suggests that National Grid should deploy cost-effective VVO based on an analysis of where the greatest benefits can be achieved (D.P.U. 15-120, DOER Brief at 19).

As described in n.81, above, the Department evaluated National Grid's business case for deployment of VVO and advanced distribution automation on 46 feeders. We find that National Grid provided a detailed description of how it selected feeders for the deployment of VVO and advanced distribution automation, provided a ranking list, and explained the rationale behind a staged approach to deployment of these two technologies (D.P.U. 15-120, Grid Modernization Plan at 11, 46, Atts. 3, 4, 5). For these reasons, the Department will not require National Grid to modify the scale of its proposed VVO and advanced distribution automation deployment. As discussed below, National Grid should be prepared to demonstrate that the scale, schedule, and location of these technology deployments have maximized the benefits to customers.

(4) Bill Impacts

The Department must also consider the bill impacts that customers would experience as a result of the proposed grid modernization investments. National Grid has submitted a bill impact analysis allowing the Department to analyze the estimated increases to all

customer rate classes of \$82 million in grid-facing investments over three years

(D.P.U. 15-120, Exhs. CRP-15; CRP-16; CRP-17; CRP-18).

National Grid's proposed investments will involve a combination of O&M as well as capital spending and, therefore, we must make certain assumptions about the likely investment mix in order to analyze bill impacts (D.P.U. 15-120, Exh. AG-3-35(a)-(d)). The Department has evaluated the annual estimated bill impacts of projected annual spending of \$27.34 million (\$82 million three-year budget divided by three) comprised solely of O&M. Based on National Grid's proposed spending and investment mix, we find that these assumptions are conservative and likely to overstate actual bill impacts (D.P.U. 15-120, Grid Modernization Plan at 29, 32, 35, Att. 3, 5).⁸⁰ The Department finds that, on balance, the bill impacts resulting from \$82 million in grid-facing investments over three years are reasonable in light of the anticipated benefits these investments will provide.

(5) Conclusion

Based on the findings above, the Department preauthorizes the following categories of grid-facing investments for a combined three-year budget of \$82 million: (1)VVO; (2) advanced distribution automation; (3) feeder monitors; (4) communications and information/operational technologies; and (5) advanced distribution management

⁸⁰ Our analysis of projected annual spending at 100 percent O&M is meant to illustrate the most conservative scenario from an annual bill impact perspective and is in no way reflective of our actual expectations regarding a prudent investment mix for National Grid.

systems/SCADA (D.P.U. 15-120, Grid Modernization Plan at 29, 32, 35, Atts. 3, 5).⁸¹ We reiterate that deployment of individual grid-facing technologies may not result in a positive business case or make measurable progress towards the grid modernization objectives, and thus a coordinated deployment of the suite of grid-facing technologies is essential.

Accordingly, within the preauthorized budget, National Grid shall coordinate the deployment of VVO, advanced distribution automation, and feeder monitors with the deployment of the advanced distribution management system/SCADA, communications and information/operational technologies. Such coordination should focus on the deployment schedule, location and scale of the investments so that National Grid can show that it has maximized the benefits to customers.

The three-year budget that we preauthorize today is a cap. Any spending over the cap is not preauthorized and will not be eligible for targeted cost recovery. As described in Section V.C.2., above, our preauthorization of a combined grid-facing investment budget will provide National Grid with certain flexibility to respond to evolving conditions during the next three years. National Grid may shift spending among the preauthorized categories, subject to the budget cap. Further, the National Grid may shift spending between years over the upcoming three-year term, subject to the budget cap. National Grid may not, however,

⁸¹ The combined three-year budget is derived from the following cost estimates: (1) VVO for \$10.6 million; (2) advanced distribution automation for \$13.4 million; (3) feeder monitors for \$8 million; (4) communications and information/operational technologies for \$1.8 million; and (5) advanced distribution management system/SCADA for \$48.4 million (D.P.U. 15-120, Grid Modernization Plan at 29, 32, 35, Atts. 3, 5).

reallocate any preauthorized funds to other spending categories (i.e., customer-facing, RD&D, storage, etc.).

(B) D.P.U. 15-121, Unitil

(1) Cost Estimates

Unitil's total three-year cost estimate for its proposed grid-facing investments is \$5.5 million consisting of: (1) \$0.8 million for a field area network with wireless mesh communications and fiber backhaul communications; (2) \$0.4 million for SCADA; (3) \$0.7 million for an advanced distribution management system to integrate its existing geographic information system, outage management system, SCADA, and customer information systems; (4) \$0 for a distributed energy resources analytics and visualization platform;⁸² (5) \$2.2 million for VVO; (6) \$52,000 to integrate an outage management system with its existing advanced metering functionality; (7) \$0.3 million for an enterprise mobile damage assessment tool; (8) \$0.8 million for 3V0 relays and voltage regulation controls; and (9) \$0.2 million for workforce mobility platform (D.P.U. 15-121, Exh. FG&E-1, at 37, 43-44, 47, 49, 50-52, 71). Together, Unitil's total three-year cost estimate for its proposed grid-facing investments is approximately \$5.5 million.

Unitil derived the initial cost estimates for its proposed grid-facing investments based on past spending experience and vendor estimates (D.P.U. 15-121, Exhs. AG-1-3; AG-1-5, Att. 1-6; AG-4-8). Unitil's cost estimate for its proposed advanced distribution management

⁸² Unitil proposed to deploy its distributed energy resources analytics and visualization platform in year five of its grid modernization plan (D.P.U. 15-121, Exh. FG&G-1, at 37).

system was based upon consultation with three vendors. The remaining project cost estimates were developed internally, with input from Unitil's grid modernization consultant (D.P.U. 15-121, Exhs. AG-1-3; AG-1-5, Att. 1-6; AG-4-8). Unitil states it will refresh these estimates prior to deployment through a competitive solicitation process, if and when the investments are preauthorized (D.P.U. 15-121, Exhs. FG&E-1, at 24; AG-1-4).

While use of competitive solicitation processes is the preferred method to collect cost information for budgeting purposes, Unitil has provided sufficiently detailed descriptions of the proposed investments and deployment strategies, and has consulted with external vendors and internal subject matter experts to estimate the costs of each investment (D.P.U. 15-121, Exhs. FG&E-1, at 24, 29, 37, 43-44, 47, 49, 50-53; AG-1-3; AG-1-4; AG-1-5, Att. 1-6; AG-4-8). The Department finds that Unitil's cost estimates are sufficiently reviewable and reliable for the purpose of determining eligibility for preauthorization.

While we accept Unitil's cost estimates to determine eligibility for preauthorization here, Unitil bears the burden to demonstrate that its actual expenditures are reasonable and prudently incurred at the time it seeks final cost recovery. In this regard, Unitil will be expected to provide full support for its actual costs, including the results of competitive solicitation processes and associated documentation at the time of the final cost recovery. In future grid modernization proceedings, the Department expects that Unitil will conduct a competitive procurement process, informed by actual experience with recent expenditures, to develop proposed budgets.

(2) Projected Benefits

Unitil identifies several benefits of its proposed grid-facing investments. The proposed field area network is an enabling technology that is expected to provide Unitil with the communications backbone to deploy other grid modernization technologies such as SCADA, VVO, and an advanced distribution management system (D.P.U. 15-121, Exh. FG&E-1, at 47-48). In addition, SCADA will allow Unitil to monitor and control substation equipment from a remote control center and manage the reliability and operational efficiency of an increasingly distributed grid (D.P.U. 15-121, Exh. FG&E-1, at 49). Unitil estimates that SCADA can reduce the length of an outage by ten minutes, resulting in savings of 20,000 customer-minutes of interruption per circuit level outage (D.P.U. 15-121, Exh. FG&E-1, at 50). Unitil's proposed advanced distribution management system will merge its existing outage management system, circuit analysis, load flow, and SCADA systems. This investment will enable VVO to reduce energy consumption and peak demand, enable better voltage control, and improve reliability (D.P.U. 15-121, Exh. FG&E-1, at 52-53). Unitil's proposed distributed energy resource analytics and visualization platform will improve the situational awareness and operational intelligence in light of the increased use of distributed energy resources, and improve the efficiency of grid operations and planning (D.P.U. 15-121, Exh. FG&E-1, at 37). Unitil's proposed VVO deployment will lead to an expected two percent reduction in demand and energy consumption and will allow the company to more precisely, quickly, and efficiently control voltage on its distribution system (D.P.U. 15-121, Exh. FG&E-1, at 50-51). Unitil's proposed integration of its outage

management system with its existing AMI will reduce the time required to locate and restore outages, improve outage prediction processes, and allow faster identification of outages as they occur (D.P.U. 15-121, Exh. FG&E-1, at 43). Finally, Unitil's proposed enterprise mobile damage assessment tool will help it make quicker and better-informed decisions regarding the extent of the damages, the level of effort needed for restoration, and the estimated time to restore power to its customers (D.P.U. 15-121, Exh. FG&E-1, at 43).

Based on the above, Unitil has shown that there are significant benefits associated with its proposed grid-facing investments. Distribution automation is expected to save \$1,793,272 over ten years by reducing outage time, on average, by ten minutes (D.P.U. 15-121, Exh. AG-4-27, Att. 12).⁸³ In addition, although it does not attribute a monetary value to these benefits, Unitil has shown that its proposed investments in SCADA and VVO will produce additional quantified benefits including reductions in outage minutes, capacity costs, and electricity costs (D.P.U. 15-121, Exh. FG&E 1, at 50-51). Finally, Unitil has shown that there are significant unquantified benefits associated with the proposed grid-facing investments including: (1) reductions in transmission and distribution operation costs; (2) reductions in customer operations costs; (3) support for reducing carbon emissions; and (4) added value from distributed energy resource integration (D.P.U. 15-121,

⁸³ Unitil estimated the crew-dollar savings and the estimated customer interruption-cost savings using Lawrence Berkeley National Laboratory's 2015 Interruption Cost Estimator to calculate the avoided cost of outages (D.P.U. 15-121, Exhs. FG&E-1, at 44, 78; AG-4-12).

Exh. FG&E-1, at 75-77). After review, the Department finds that the anticipated benefits of Unitil's proposed grid-facing grid modernization investments justify the estimated costs.

The Attorney General challenges the reasonableness of several of Unitil's proposed grid-facing investments. Specifically, the Attorney General argues that Unitil's proposed distributed energy resource analytics and visualization platform is unnecessary because Unitil's customer base is largely residential. In addition, the Attorney General recommends that the company use a pilot approach before undertaking significant spending on VVO. The Attorney General also claims that Unitil's outage management system integration is not technically sound, overestimates customer benefits, and is a business as usual investment. Finally, the Attorney General argues that the mobile damage assessment tool is a business as usual investment (D.P.U. 15-121, Attorney General Brief at 15, 18-20, citing Exh. AG-GLB-1, at 22, 24-25, 27-29).

With respect to the proposed distributed energy resource analytics and visualization platform, the record shows that the concentration of distributed energy resources in Unitil's service territory has already created back flow issues to substations, despite a largely residential customer base (D.P.U. 15-121, Exh. FG&E-6, at 10, 39-40). Additionally, when integrated with the proposed advanced distribution management system, the distributed energy resource analytics and visualization platform will provide Unitil with the situational awareness and operational intelligence to integrate and manage distributed energy resource installations as they continue to increase (D.P.U. 15-121, Exh. FG&E-6, at 37). The Department finds that the proposed distributed energy resource analytics and visualization

platform is precisely the type of load flow analytics that will improve Unitil's ability to integrate and manage distributed energy resources (D.P.U. 15-121, Exh. FG&E-6, at 38).

Nor do we find that it is necessary for Unitil to undertake VVO as a pilot. Given that VVO is a technology that has been successfully deployed, we agree with Unitil that a pilot approach would delay the achievement of benefits and add additional costs (D.P.U. 15-121, Exh. FG&E-6, at 12-13). As discussed in Section V.C.3.c.ii., above, the evidence in these proceedings show that VVO is an investment that will bring direct benefits to customers in energy and demand reduction and improved power quality.

Regarding the company's proposed outage management system integration, Unitil's current AMI system "sees" the loss of power as an interruption to the continuous communication channel and changes the status of affected meters to detect outages on the system (D.P.U. 15-121, Exh. FG&E-6, at 8). Therefore, integration of the existing AMI system with the existing outage management system will allow Unitil to better detect outages. The Department finds that Unitil has reasonably appraised the customer benefits to be gained from the integration and that the proposed technical process is sound (D.P.U. 15-121, Exh. FG&E-6, at 8). In addition to its existing AMI system, Unitil intends to integrate its proposed outage management system with its proposed advanced distribution management system in order to improve the company's situational awareness of system conditions (D.P.U. 15-121, Exh. FG&E-1, at 52). We find, therefore, that Unitil has shown that a primary purpose of the proposed investment is to accelerate progress towards a grid modernization objective, namely to optimize system performance (D.P.U. 15-121,

Exh. FG&E-1, at 52). Accordingly, the Department finds that the proposed outage management system integration investment is incremental for preauthorization purposes and not business as usual as the Attorney General claims.

Finally, we find that Unitil has shown that its proposed mobile damage assessment tool will allow it to make quicker, better-informed decisions regarding the extent of system damage, the level of effort needed for restoration, and the estimated time to restore power to its customers (D.P.U. 15-121, Exh. FG&E-1, at 42-43). Unitil's integration of this tool with its outage management and advanced distribution management systems will improve situational awareness of system conditions, thereby reducing the effects of outages on customers (D.P.U. 15-121, Exh. FG&E-1, at 42-43). Because a primary purpose of this proposed investment is to accelerate progress toward a grid modernization objective, we find that the proposed investment is incremental.

(3) Bill Impacts

The Department must also consider the bill impacts that customers would experience as a result of the proposed grid modernization investments. Unitil has submitted a bill impact analysis allowing the Department to analyze the estimated increases to all customer rate classes of \$4.4 million in grid-facing investments over three years (D.P.U. 15-121, Exh. FG&E-1, App. D at Att. 5).

Unitil's proposed investments will involve a combination of O&M as well as capital spending and, therefore, we must make certain assumptions about the likely investment mix in order to analyze bill impacts. The Department has evaluated the estimated bill impacts of

projected annual spending of \$1.47 million (\$4.4 million three-year budget divided by three) comprised solely of O&M. Based on Unitil's actual proposed spending and investment mix, we find that these assumptions are conservative and likely to overstate actual bill impacts (D.P.U. 15-121, Exh. FG&E-1, at 37, 42, 44, 47, 49-52).⁸⁴ The Department finds that, on balance, the bill impacts resulting from \$4.4 million in grid-facing investments over three years are reasonable in light of the anticipated benefits these investments will provide.

(4) Conclusion

Based on the findings above, the Department preauthorizes the following categories of grid-facing investments for a combined three-year budget of \$4.4 million: (1) enterprise mobile damage assessment tool; (2) outage management system integration with AMI; (3) field area network; (4) SCADA; (5) VVO; (6) advanced distribution management system; and (7) distributed energy resource analytics visualization platform (D.P.U. 15-121, Exh. FG&E-1, at 37, 43-44, 47, 49, 50-52, 71).⁸⁵ We reiterate that deployment of individual grid-facing technologies may not result in a positive business case or make measurable progress towards the grid modernization objectives, and, therefore, a coordinated

⁸⁴ Our analysis of projected annual spending at 100 percent O&M is meant to illustrate the most conservative scenario from an annual bill impact perspective and is in no way reflective of our actual expectations regarding a prudent investment mix for Unitil.

⁸⁵ The combined three-year budget is derived from the following cost estimates: (1) enterprise mobile damage assessment tool for \$0.3 million; (2) outage management system integration for \$52,000; (3) field area network for \$0.84 million; (4) SCADA for \$0.3 million; (5) VVO for \$2.217 million; (6) advanced distribution management system for \$0.7 million; and (7) distributed energy resource analytics visualization platform for \$0 (D.P.U. 15-121, Exh. FG&E-1, at 37, 43-44, 47, 49, 50-52, 71).

deployment of the suite of grid-facing technologies is essential. Accordingly, within the preauthorized budget, Unitil shall coordinate the deployment of VVO and outage management system integration and AMI with the deployment of the field area network, SCADA, advanced distribution management system, and the distributed energy resource analytics and visualization platform.⁸⁶ Such coordination should focus on the deployment schedule, location and scale of the investments so that Unitil can show that it has maximized the benefits to customers.

The three-year budget that we preauthorize today is a cap. Any spending over the cap is not preauthorized and will not be eligible for targeted cost recovery. As described in Section V.C.2, above, our preauthorization of a combined grid-facing investment budget will provide Unitil with certain flexibility to respond to evolving conditions during the next three years. Unitil may shift spending among the preauthorized categories, subject to the budget cap. Further, Unitil may shift spending between years over the upcoming three-year term, subject to the budget cap. Unitil may not, however, reallocate any preauthorized funds to other spending categories (i.e., customer-facing, RD&D, storage, etc.).

⁸⁶ Unitil proposes to begin its distributed energy resource analytics visualization platform investment in year five. However, the Department's preauthorization of this investment category means that Unitil may accelerate this investment if it will maximize benefits to customers and overall spending remains within the cap described above.

(C) D.P.U. 15-122, Eversource(1) Cost Estimates

Eversource proposes foundational grid-facing grid modernization investments in advanced sensing, SCADA, distribution management systems, advanced load flow analysis, communications, VVO, and overhead automated feeder reconfiguration (D.P.U. 17-05, Exhs. ES-GWPP-1, at 17-18; ES-GMBC-1, at 14-15). Eversource's cost estimates for proposed foundational grid modernization investment over three years are as follows:

(1) \$2 million for a distribution management system; (2) \$15 million for an advanced load flow model that covers both radial feeders and underground secondary networks; (3) \$41 million for advanced sensing technology; (4) \$18 million for communications; (5) \$13 million for VVO; (6) \$26 million for overhead automated feeder reconfiguration (D.P.U. 17-05, Tr. 8, at 1624-1625, 1635-1636; Exhs. ES-GMBC-2, at 28-30, 32, 43, 50; ES-GMBC-3, at 1, 3; AG-23-10, at 2; RR-DPU-3, Att.).

In addition, Eversource proposes to invest in additional automation technologies, including urban underground automated feeder reconfiguration, remote circuit fault indicators, and adaptive protection for two-way power flow (D.P.U. 17-05, Exh. ES-GMBC-2, at 37-42, 46-51). The three-year budgets are: (1) \$18 million for the urban underground automated feeder reconfiguration; (2) \$10 million for the remote circuit fault indicators; and (3) \$0 for adaptive protection⁸⁷ (D.P.U. 17-05, Exhs. ES-GMBC-2,

⁸⁷ Eversource proposed to deploy adaptive protection beginning in year five of its grid modernization base commitment (D.P.U. 17-05, Exh. AG-33-7(a), Att. at 2).

at 32; AG-33-7(a), Att.). The total three-year budget for the proposed grid-facing investments is \$143 million.

With the exception of its geographic information system verification project (discussed below), Eversource did not conduct a competitive procurement process for the proposed grid-facing investments, but instead provided cost estimates based on past work orders and the costs of similar projects (D.P.U. 17-05, Exhs. AG-22-14; AG-23-10, Att.; AG-23-12, Att.; AG-42-17; Tr. 8, at 1622-1623). While use of competitive solicitation processes is the preferred method to collect cost information for budgeting purposes, Eversource has provided sufficiently detailed descriptions of the proposed investments as well as its past experience with similar projects to estimate the costs of each investment (D.P.U. 17-05, Exhs. AG-23-10, Att.; AG-23-12, Att.). The Department finds that Eversource's cost estimates are sufficiently reviewable and reliable for the purpose of determining eligibility for preauthorization.

While we accept Eversource's cost estimates to determine eligibility for preauthorization here, Eversource bears the burden to demonstrate that its actual expenditures are reasonable and prudently incurred at the time it seeks final cost recovery. In this regard, Eversource will be expected to provide full support for its actual costs, including the results of competitive solicitation processes and associated documentation at the time of the final cost recovery (D.P.U. 17-05, Tr. 15, at 2989; RR-DPU-24 (a), Att.). In future grid modernization proceedings, the Department expects that Eversource will conduct a

competitive procurement process, informed by actual experience with recent expenditures, to develop proposed budgets.

(2) Projected Benefits

Eversource identifies several benefits of its proposed grid-facing investments.

Eversource's distribution management system will optimize distribution system performance to minimize electrical losses, improve asset utilization, improve reliability, and integrate distributed energy resources (D.P.U. 17-05, Exh. ES-GMBC-2, at 17). The advanced load flow model will optimize capital asset deployment, system planning, real-time loading, and contingency scenario planning, as well as optimize interconnection (D.P.U. 17-05, Exh. ES-GMBC-2, at 20, 22-24, 27; Tr. 1, at 127). Eversource's advanced sensing technology will collect real-time data and allow remote operations, which will enable significant improvements in the accuracy and functionality of load flow tools, and also improve situational awareness of loads during peak periods (D.P.U. 17-05, Exh. ES-GMBC-2, at 43-45). The high speed and high bandwidth communications infrastructure, required by both automated feeder reconfiguration and VVO, will enable real-time data flows between field devices and the distribution management system (D.P.U. 17-05, Exh. ES-GMBC-2, at 50). Eversource's overhead automated feeder reconfiguration will reduce the duration of a major event and the number of customers affected by the major event, reduce the amount of day-to-day manual switching operations, reduce operations cost, and has the potential to defer capital upgrades with enhanced

flexibility to shift load based on prevailing conditions (D.P.U. 17-05, Exh. ES-GMBC-2, at 35).

Eversource has also identified quantified benefits associated with the proposed grid-facing investments.⁸⁸ Eversource estimates that its VVO deployment will result in: (1) a 2.2 percent reduction in end-use energy consumption; (2) a reduction in resistive, no-load, and peak line losses; and (3) a 0.6 percent reduction in peak load for every one percent reduction in voltage for VVO-enabled feeders (D.P.U. 17-05, Exh. ES-GMBC-2, at 30; D.P.U. 15-122, Exh. Eversource-GMP, App. 7, at 35). The estimated monetary value of VVO benefits are: (1) \$35.16 million in reduced energy use due to optimized system voltages; (2) \$1.18 million in reduced electricity losses; and (3) \$7.42 million in avoided capacity costs (D.P.U. 15-122, Exhs. Eversource-GMP at 45-47; CLC-1-22). In addition, distribution automation will reduce the number of customers impacted by outages (D.P.U. 17-05, Exh. ES-GMBC-2, at 33). Eversource estimates that the number of customers affected by an outage condition on the overhead system will be reduced from 1,500 customers to 1,000 customers in the Eversource East service area and from 1,500 customers per segment to 500 customers per segment in the Eversource West service area where circuit ties are available (D.P.U. 17-05, Exh. ES-GMBC-2, at 33).

⁸⁸ Eversource states it will conduct cost-effectiveness studies on all of the distribution automation investments including VVO and overhead automated feeder reconfiguration prior to deployment (D.P.U. 17-05, Exh. AG-18-20, Att.; Tr. 7, at 1464). The Department directs Eversource to include the results of these cost-effectiveness studies in its Grid Modernization Annual and Term Reports.

In addition, Eversource has shown that there are significant unquantified associated with the proposed grid-facing investments including: (1) enhanced reliability;⁸⁹ (2) support for new technology, energy, and environmental requirements such as the Global Warming Solutions Act; (3) reduced time and costs to integrate distributed energy resources; and (4) improved customer service (D.P.U. 17-05, Exhs. ES-GMBC-2, at 7; AG-18-11; DPU-42-6, Att.). After review, the Department finds that the anticipated benefits of Eversource's proposed grid-facing grid modernization investments justify the estimated costs.

We now turn to Eversource's proposed investments in urban underground automated feeder reconfiguration and adaptive protection for two-way power flow (D.P.U. 17-05, Exh. ES-GMBC-2, at 37-42). Advancements in the technologies used for automated feeder reconfiguration continue to evolve and what is commercially available today will most likely be very different from what will be available in five or ten years (D.P.U. 17-05, Exh. ES-GMBC-2, at 35). Eversource intends to maintain its current underground system for the foreseeable future (D.P.U. 17-05, Tr. 8, at 1643-1644). However, across Eversource, poor performing circuit lists consistently include 4 kV circuits (D.P.U. 17-05, Exh. ES-GMBC-2, at 38). The proposed investment in underground automated feeder reconfiguration is the result of Eversource working with industry experts to identify options

⁸⁹ As we noted above, it is difficult to assign a monetary value to benefits such as increased reliability. Most reliability investments have numerous and varied benefits for a distribution system, particularly given that the system is designed on an integrated basis with planned redundancy and each customer has its own avoided costs for outages (D.P.U. 15-122, Exh. CLC-4-2). Although difficult to quantify, we find that Eversource's investments will improve reliability, which will optimize system performance.

to bring the benefits of automated feeder switching and reconfiguration to the 4 kV system (D.P.U. 17-05, Exh. ES-GMBC-2, at 38). This automation should provide a 25 percent reduction in the impact of outages to the customers on circuits where it is deployed (D.P.U. 17-05, Exh. ES-GMBC-2, at 38). Accordingly, we find that Eversource has shown that a primary purpose of the proposed investments is to accelerate progress towards our grid modernization objectives. Therefore, the proposed investments are incremental for preauthorization purposes. Given Eversource's current underground system investment practices, the Department emphasizes that Eversource bears the burden to demonstrate conclusively that such investments are incremental and prudently incurred for targeted cost recovery purposes, prior to final recovery.

Finally, with respect to Eversource's proposed geographic information system project, the Department found that, because this project is linked to grid modernization efforts, the costs associated with the geographic information system project are more suitable for review as a proposed grid modernization investment. D.P.U. 17-05, at 241. The proposed geographic information system project is a one-time, non-recurring expense (D.P.U. 17-05, Exh. ES-GMBC-2, at 21-22). Given the nature of the proposed investment, the Department finds that it is reasonable to include the project as part of Eversource's advanced load flow analysis investments we preauthorize below.⁹⁰ Similarly, the proposed adaptive protection investment relates to the resources required to understand the complex settings and

⁹⁰ Eversource estimates that the total cost of its geographic information system project will be \$5,956,381. D.P.U. 17-05, at 236.

engineering required to maximize the full potential of adoptive protection (D.P.U. 17-05, Exh. ES-GMBC-2, at 42). The Department finds that adaptive protection is appropriate for preauthorization and can be integrated into Eversource's existing load flow analysis investments.⁹¹

(3) Bill Impacts

The Department must also consider the bill impacts that customers would experience as a result of the proposed grid modernization investments. Eversource has submitted a bill impact analysis allowing the Department to analyze the estimated increases to all applicable rate classes of \$133 million in grid-facing investments over three years (D.P.U. 15-122, Exh. Eversource-RCD-6; D.P.U. 17-05, RR-DPU-50, Att. (e) at Exh. ES-RDP-2 (ALT1), Sch. RDP-9 (East) & (West); RR-DPU-50, Att. (f) at Exh. ES-RDP-3 (ALT1), Sch. RDP-3 (East) & (West); RR-DPU-50, Att. (j) at Exh. ES-RDP-7 (ALT1), Sch. RDP-5).

Eversource's proposed investments will involve a combination of O&M as well as capital spending and, therefore, we must make certain assumptions about the likely investment mix in order to analyze bill impacts (D.P.U. 17-05, Exh. AG-33-7, Att.; RR-DPU-3, Att. at 2). The Department has evaluated the annual estimated bill impacts of projected annual spending of \$44.37 million (\$133 million three-year budget divided by three) comprised solely of O&M. spending. Based on Eversource's proposed spending and investment mix, we find that these assumptions are conservative and likely to overstate actual

⁹¹ Because Eversource proposed to deploy adaptive protective beyond the three-year period for which we review for preauthorization, the cost estimate for the first three years is zero (D.P.U. 17-05, RR-DPU-3, Att.).

bill impacts (D.P.U. 17-05, RR-DPU-3, Att.).⁹² The Department finds that, on balance, the bill impacts resulting from \$133 million in grid-facing investments over three years are reasonable in light of the anticipated benefits these investments will provide.

(4) Conclusion

Based on the findings above, the Department preauthorizes the following categories of grid-facing investments for a combined three-year budget of \$133 million: (1) distribution management systems; (2) advanced load flow analysis; (3) VVO; (4) overhead automated feeder reconfiguration; (5) underground automated feeder reconfiguration; (6) advanced sensing; and (7) communications (D.P.U. 17-05, RR-DPU-3, Att.).⁹³ We reiterate that deployment of individual grid-facing technologies may not result in a positive business case or make measurable progress towards the grid modernization objectives and, therefore, a coordinated deployment of the suite of grid-facing technologies is essential. Accordingly, within the preauthorized budget, Eversource shall coordinate the deployment of VVO and automated feeder reconfiguration with the deployment of advanced sensing, SCADA,

⁹² Our analysis of projected annual spending at 100 percent O&M is meant to illustrate the most conservative scenario from an annual bill impact perspective and is in no way reflective of our actual expectations regarding a prudent investment mix for Eversource.

⁹³ The combined three-year budget is derived from the following cost estimates: (1) distribution management systems for \$2 million; (2) advanced load flow analysis for \$15 million (inclusive of the geographic information system project costs and the adaptive protection costs described, above); (3) VVO for \$13 million; (4) overhead automated feeder reconfiguration for \$26 million; (5) underground automation for \$18 million; (6) advanced sensing for \$41 million; and (7) communications for \$18 million (D.P.U. 17-05, RR-DPU-3, Att.).

distribution management systems, advanced load flow analysis, and communications. Such coordination should focus on the deployment schedule, location and scale of the investments so that Eversource can show that it has maximized the benefits to customers.

The three-year budget that we preauthorize today is a cap. Any spending over the cap is not preauthorized and will not be eligible for targeted cost recovery. As described above, our preauthorization of a combined grid-facing investment budget will provide Eversource with certain flexibility to respond to evolving conditions during the next three years. Eversource may shift spending among the preauthorized categories, subject to the budget cap. Further, Eversource may shift spending between years over the upcoming three-year term, subject to the budget cap. Eversource may not, however, reallocate any preauthorized funds to other spending categories (*i.e.*, customer-facing, RD&D, storage, etc.).

(D) Other Proposed Grid Modernization Investments

(1) Eversource

Eversource proposes to invest in remote circuit fault indicators for its distribution system (D.P.U. 17-05, Exh. ES-GMBC-2, at 46-51). However, without a clear strategy for the deployment of advanced metering functionality, the Department finds that there is insufficient evidence to demonstrate that the remote circuit fault indicators will not become redundant or a stranded asset when customer-facing technologies are deployed in the future (D.P.U. 17-05, Exh. AG-GLB-1, at 57-58; Tr. 15, at 3005-3006). Therefore, the Department does not preauthorize any investments in remote circuit fault indicators at this

time. Eversource may submit a revised proposal in the future when there is more certainty regarding its deployment of advanced metering functionality.

(2) Unitil

Unitil proposes to expand its existing workforce mobility tool to restoration field crews in order to improve crew productivity and reduce outage times (D.P.U. 15-121, Exh. FG&E-1, at 71). The Attorney General argues that the proposed workforce mobility platform expansion is a business as usual investment that should not qualify for targeted cost recovery (D.P.U. 15-121, Attorney General Brief at 16).

Unitil's proposed workforce mobility platform is a one-time investment and an expansion of an existing technology that has already been implemented for the company's gas operations (D.P.U. 15-121, Exhs. FG&E-1, at 71-72; AG-5-32). This proposed investment is not related to Unitil's other grid modernization investments, which focus on an advanced distribution management system to optimize distribution system operations and integrate distributed energy resources (D.P.U. 15-121, Exh. FG&E-1, at 71-72). For these reasons, we find that the proposed workforce mobility platform is a business as usual investment that is not primarily designed to advance the Department's grid modernization objectives. Accordingly, the Department does not preauthorize any workforce mobility expenditures as eligible grid modernization investments.

Finally, Unitil proposes to install 3V0 relays and voltage regulation controls on all of its substations in order to protect equipment from reverse power flow caused by distributed energy resources on its feeders (D.P.U. 15-121, Exh. FG&E-1, at 38-39). The Attorney

General argues that, based on cost causation principles, the cost of 3V0 deployment should not be borne by all ratepayers. Instead, the Attorney General recommends that Unitil employ a targeted deployment of 3V0 and pursue cost recovery from distributed energy resource owners (D.P.U. 15-121, Attorney General Reply Brief at 12-13, citing Tr. J-2, at 147).

The Department finds that the costs of 3V0 deployment should not be borne by all ratepayers, but rather by the distributed energy resource owners triggering the distribution system issues requiring such investments. This rate treatment is consistent with Department practice regarding responsibility of costs associated with interconnection of distributed energy resources. See Distributed Energy Interconnection, D.P.U. 11-75-G (2015), Att. A, § 5.0.⁹⁴ In addition, we find that the proposed 3V0 investment is a business as usual investment that is not primarily designed to advance the Department's grid modernization objectives. Accordingly, the Department does not preauthorize any 3V0 expenditures as eligible grid modernization investments.

4. Other Issues

a. Cybersecurity

In D.P.U. 12-76-B, the Department emphasized that cybersecurity is a “critical component of grid modernization and that electric distribution companies must continually assess and upgrade their defenses against cyberattacks.” D.P.U. 12-76-B at 34. The Department directed each company to integrate grid modernization-related cybersecurity

⁹⁴ Attachment A to D.P.U. 11-75-G is the Omnibus Revised Tariff dated April 22, 2015. Section 5 of the Omnibus Revised Tariff addresses cost responsibility for interconnection of a distributed energy resource.

concerns into existing planning processes and show how the proposed grid modernization plans will prevent unauthorized access to control systems, operations, and data.

D.P.U. 12-76-B at 35.

The Department noted that customer-facing grid modernization investments including advanced metering functionality will produce more detailed usage data and, therefore, directed each company to address privacy and meter data access in their grid modernization plans. D.P.U. 12-76-B at 35-36. Further, the Department recognized that grid-facing investments could increase the vulnerability of the electric grid because such initiatives will involve: (1) increasing the number of digital access points within the electric distribution system; and (2) increasing the number and level of control by networked devices.

D.P.U. 12-76-A at 35. For these reasons, the Companies must ensure that they have sufficient processes in place to address the potential of the various grid modernization investments to increase the vulnerability of the electric grid.

In the instant proceedings, the Department did not preauthorize any customer-facing investments, including the Companies' advanced metering functionality proposals, which would implicate the collection and sharing of more detailed customer usage data.

Accordingly, we will not address the Companies' cybersecurity proposals relating to customer-facing investments at this time. Below, we address the Companies' cybersecurity proposals associated with preauthorized grid-facing investments and the Attorney General's request to require the Companies to conduct grid modernization-related cyber vulnerability assessments.

The Attorney General argues that, consistent with industry practice, the Companies should be required to conduct periodic cyber vulnerability assessments related to their grid modernization investments (D.P.U. 15-120, Attorney General Brief at 38, citing Exh. AG-GLB/PB-1, at 13-14; D.P.U. 15-121, Attorney General Brief at 30; D.P.U. 15-122, Attorney General Brief at 19-22, citing Exh. AG-GLB/PB-1, at 13). Conversely, the Companies argue that a grid modernization-specific assessment is unnecessary because they already have adequate processes in place that satisfy the function of a periodic cyber vulnerability assessment for all assets (D.P.U. 15-120, National Grid Reply Brief at 33; D.P.U. 15-121, Unitil Brief at 39-41; D.P.U. 15-122, Eversource Brief at 41, citing Exhs. CLC-4-23; Tr. 1, at 113; Eversource Reply Brief at 12).

As the Attorney General correctly notes, cybersecurity is critical to the operation of an electric distribution company and it is imperative that a company continually assess and upgrade its defenses. D.P.U. 12-76-A at 35. Regular cyber vulnerability assessments are one important tool in this regard. National Grid's grid modernization cybersecurity proposal is not a standalone program, but will be integrated into its existing cybersecurity assessment framework that is designed to evaluate the risk of various grid modernization elements and prioritize their assessment accordingly in the scope of the company's larger assessment framework (D.P.U. 15-120, Exh. MR-Rebuttal-1, at 5). Similarly, Unitil conducts regular external vulnerability assessments that it intends to employ, as necessary, for additional projects including grid modernization investments (D.P.U. 15-121, Exhs. AG-3-5; AG-3-9; AG-3-16 Exhs. FG&E-1, at 85-86; FG&E-2, at 23). Finally, Eversource's grid

modernization program investments will be covered by its broad enterprise cybersecurity plan that provides for third-party security assessments (D.P.U. 15-122, Exh. Eversource-IGMP at 44-48; Eversource Reply Brief at 12). Accordingly, the Department finds that National Grid, Unitil, and Eversource have cybersecurity processes in place that incorporate periodic vulnerability assessments and such processes should incorporate review of grid modernization investments (D.P.U. 15-120, Exh. MR-Rebuttal-1, at 5; D.P.U. 15-121; Exhs. AG-3-5; AG-3-9; AG-3-16; D.P.U. 15-122; Exhs. AG-3-1; CLC-4-23). For this reason, we decline to adopt the Attorney General's recommendation for separate grid modernization-specific cyber vulnerability assessments.

With respect to the cybersecurity proposals associated with the preauthorized grid-facing investments, consistent with the Department's directives in D.P.U. 12-76-B at 34, the Companies intend to integrate any additional security considerations related to grid modernization into their existing cybersecurity processes (D.P.U. 15-120, Exh. MR-Rebuttal-1, at 4-5; D.P.U. 15-121; Exhs. FG&E-1, at 85-86; FG&E-2, at 22; FG&E-6, at 26-33; D.P.U. 15-122, Exhs. CLC-4-23; AG-3-3). In addition, consistent with D.P.U. 12-76-B at 35, the Companies described how their proposed grid modernization plans were designed to prevent unauthorized access to control systems, operations, and data.⁹⁵

In particular, each company has described the various security services it intends to employ and has identified the threats these services are designed to address (D.P.U. 15-120,

⁹⁵ The Department has reviewed the proposed cybersecurity investments associated with National Grid's Opt-In scenario because it aligns most closely to the grid-facing grid modernization investments we preauthorize above.

Grid Modernization Plan at 87-100; Exhs. MR-1, at 11, 14-15; D.P.U. 15-121, Exhs. FG&E-1, at 85-88, AG-3-5; AG-3-9; D.P.U. 15-122, Exhs. Eversource-GMP at 101-104; Eversource-IGMP at 44-49, AG-3-1; AG-3-4; AG-3-6). In addition, as described above, the Companies each intend to review and update their overall cybersecurity system architecture as an ongoing process (D.P.U. 15-120, Exh. MR-1, at 19; D.P.U. 15-121, Exh. FG&E-1, at 87; D.P.U. 15-122, Exhs. Eversource-GMP at 101-104; AG-3-1; CLC-4-23). Finally, the Companies each intend to apply applicable industry standards for cybersecurity related to grid modernization, including standards developed by the National Institute of Standards and Technology as well as the North American Electric Reliability Organization (D.P.U. 15-120, Exhs. MR-1, at 27; MR-Rebuttal-1, at 3; D.P.U. 15-121, Exhs. FG&E-1, at 86-87; FG&E-6, at 30; D.P.U. 15-122, Exhs. Eversource-GMP at 101-104; Eversource-IGMP at 44-48). After review, the Department finds that the Companies have explained in sufficient detail how they intend to address cybersecurity related to the preauthorized grid-facing investments.

As described above, the Companies intend to integrate the deployment of preauthorized grid modernization technologies into existing cybersecurity protocols and, therefore, we will not authorize separate cybersecurity budgets for the grid-facing investments. Instead, the preauthorized budgets for the grid-facing investments addressed in Section V.C.3.c., above, incorporate implementation of any incremental cybersecurity measures associated with these investments. As with any other grid modernization

investments, the Companies must demonstrate that the grid-facing cybersecurity investments are incremental in order to be eligible for targeted cost recovery (see Section V.II, below).

b. Energy Efficiency

Several issues relating to the interplay between energy efficiency and grid modernization investments were raised in these proceedings that require discussion here. First, National Grid and Unitil propose to recover certain grid modernization-related costs through future energy efficiency plan budgets. National Grid proposes to recover the costs for in-home devices, such as smart thermostats as part of a future three-year energy efficiency plan budget (D.P.U. 15-120, Grid Modernization Plan at 37, 64). In addition, Unitil opines that many of its proposed grid modernization investments (i.e., approximately 58 percent of its total proposed grid modernization spending) could be made within the context of its existing energy efficiency plan (D.P.U. 15-121, Exh. FG&E-1, at 101-102). While Unitil does not propose to recover any of these costs as energy efficiency investments at this time, it requests the “flexibility” to evaluate certain grid modernization investments, such as VVO, and incorporate them into its energy efficiency plan going forward if these measures provide energy savings (D.P.U. 15-121, Tr. 1, at 130).

The Green Communities Act specifies that energy efficiency-related costs are to be collected through a fully reconciling funding mechanism and the Department has approved an energy efficiency surcharge for this purpose. G.L. c. 25, §§ 19(a), 21(b)(2)(vii); D.P.U. 15-160 through D.P.U. 15-169, at 98. The Department has determined that all energy efficiency-related costs are to be collected through the energy efficiency surcharge

(and not base rates) in order facilitate review and ensure that these costs are properly accounted for in both the required bill impact and cost-effectiveness analyses.

D.P.U. 15-160 through D.P.U. 15-169, at 98-99. Similarly, as discussed in Section VII, below, the Department will establish a short-term targeted cost recovery mechanism to recover eligible grid modernization costs outside of base rates.

The Department anticipates that there will be future areas of overlap between the Companies' energy efficiency and grid modernization plans. Where such overlap occurs, we strongly caution the Companies that they will be required to scrupulously identify and track the related costs to ensure that they do not seek to recover the costs twice (i.e., through the energy efficiency surcharge and the grid modernization targeted cost recovery mechanism). Failure to do so will result in disallowance of those costs. Because we have not preauthorized any customer-facing investments in this Order, we will not address National Grid's proposal to recover the costs for in-home devices as a part of a future energy efficiency plan.

Regarding Unitil's request for flexibility to incorporate grid modernization investments such as VVO in its energy efficiency plan going-forward, we find that it is not appropriate to recover distribution-related capital investments such as VVO through the energy efficiency surcharge (D.P.U. 15-121, Tr. 1, at 130). Individual customers will not install VVO technology in their homes. Rather, VVO is installed on the distribution system and, therefore, we find that it is not appropriate to recover such costs through a customer incentive-based, behind-the-meter program like energy efficiency.

As noted by the Companies, there is potential for overlap between energy efficiency and grid modernization (D.P.U. 15-120, Grid Modernization Plan at 63-64, Exhs. DPU-8-3; DPU-9-3, DPU-9-4, DPU-9-5; D.P.U. 15-121, Exhs. DPU-6-1; DPU-6-2, DPU-6-3; D.P.U. 15-122, Eversource-IGMP at 28, Exhs. AG-6-17, DPU-7-3, DPU-7-5). The single largest source of benefits for grid modernization identified by the Companies in these proceedings is the optimization of energy and system demand (D.P.U. 15-120, Exh. AG-3-31(a); D.P.U. 15-121, Exh. AG-4-27, Att. 15; D.P.U. 15-122, Eversource-IGMP, App. 8). Achievement of this grid modernization objective involves changing customer behavior. The Companies' current three-year energy efficiency plans have robust marketing and other programs that are designed to change customer behavior (D.P.U. 15-120, Exhs. DPU-9-3; AG-4-18; D.P.U. 15-122, Exhs. DPU-7-2; AG-4-24, AG-6-17). By leveraging various grid modernization investments, there is the potential for these energy efficiency programs to generate higher savings.

For example, Eversource and National Grid currently provide home energy comparison reports to certain customers through the energy efficiency behavioral/feedback program (D.P.U. 15-120, Exh. DPU-9-3; D.P.U. 15-122, Exh. DPU-7-2). In other jurisdictions that use these reports in conjunction with TVR, savings have increased by 13 percent to 17 percent (D.P.U. 15-120, Exh. DPU-9-3). Eversource currently cannot incorporate into its home energy comparison reports the more granular data (i.e., daily or hourly usage) needed to provide specific insights to TVR customers (D.P.U. 15-122, Exh. DPU-7-2). Eversource states, however, that it would be able to identify discretionary

load through its proposed customer engagement platform (D.P.U. 15-122, Tr. 1, at 51-52).

National Grid states that its behavior/feedback program savings can be improved through AMI-specific communications, such as high bill alerts (D.P.U. 15-120, Exh. DPU-9-3).

The coordinated deployment of energy efficiency and grid modernization technologies may be a significant source of quantifiable benefits and/or cost reductions that were not identified as part of the Companies' business case analyses. Energy efficiency programs working with deployed grid modernization technologies could increase the benefits of advanced meter functionality, as well as decrease the cost of the communications required to enable customers to respond to prices. D.P.U. 14-04-C at 3. Savings from existing energy efficiency initiatives, such as the behavioral/feedback program discussed above, could similarly be enhanced by customer-facing grid modernization technology deployment.

As part of our investigation of the next steps for customer-facing grid modernization technology deployment, the Department will explore whether and how to account for these benefit increases and cost reductions as part of future grid modernization business case analyses. The energy efficiency program delivery model, which includes innovative technology advancements coupled with the robust marketing efforts, should be fully leveraged when the Department considers the next phase of deployment of customer-facing technologies.

c. Research, Development, and Deployment

In D.P.U. 12-76-B, the Department directed the Companies, as part of their grid modernization plans, to propose RD&D projects that focus on the testing, piloting, and

deployment of new and emerging technologies to meet our grid modernization objectives.

D.P.U. 12-76-B at 27-30. The Department identified the following topics that each company could include in its portfolio of RD&D projects: (1) smart inverter systems; (2) energy storage; (3) vehicle-to-grid; and (4) software and hardware tools that optimize system planning and management. D.P.U. 12-76-B at 27-30.

At a high level, Eversource, National Grid, and Unitil propose topics for RD&D projects that are consistent with those identified by the Department in D.P.U. 12-76-B (D.P.U. 15-122, Exh. Eversource-IGMP at 73-75; D.P.U. 15-120, Grid Modernization Plan at 144-157; D.P.U. 15-121, Exh. FG&E-1, at 80-82). National Grid proposes an RD&D budget of \$28 million over ten years (D.P.U. 15-120, Grid Modernization Plan at 154). Eversource and Unitil propose RD&D budgets of \$1.5 million and \$430,000 per year, respectively (D.P.U. 15-122, Eversource IGMP at 73-75; D.P.U. 15-121, Exh. FG&E-1, at 80-82). Eversource and National Grid each propose to recover the costs of their R&D efforts through a separate tariff (D.P.U. 15-120 Grid Modernization Plan, at 154; D.P.U. 15-122, Exhs. Eversource-DPH-1, at 4-5, Eversource-RDC-1, at 7). Unitil proposes to recover RD&D costs through its proposed targeted cost recovery factor (D.P.U. 15-121, Exh. FG&E-3, at 3).

DOER and NECEC argue that the Companies' RD&D proposals require more development before the Department approves any budgets. These parties suggest that a stakeholder process may be an appropriate way to gather feedback and develop proposals (D.P.U. 15-120, DOER Brief at 26; D.P.U. 15-120/15-121/15-122, NECEC Brief at 26).

In a number of recent proceedings, the Department has had the opportunity to discuss the appropriate standard of review we will use to review proposed demonstration projects, including consideration of policy objectives, the reasonableness of size, scope, and scale, the adequacy of evaluation plans, and bill impacts to customers. D.P.U. 17-05, at 457-460; NSTAR Electric Company and Western Massachusetts Electric Company, D.P.U. 16-178, at 26, 29-30 (2017), Fitchburg Gas and Electric Light Company, D.P.U. 16-184, at 11 (2017). We intend to apply this standard to the review of any proposed grid modernization-related RD&D projects.

Other than a high-level identification of potential topic areas, the Companies did not identify or provide any specific projects for the Department's consideration in this case. We find, therefore, that the Companies have not provided sufficient detail regarding the costs and benefits associated with any specific RD&D proposals to allow us to determine whether the proposed expenditure of funds is in the public interest. Accordingly, the Department does not approve the Companies' proposed RD&D budgets or cost recovery proposals at this time.

The Department expects that any future RD&D project proposals will be fully developed before they are presented for the Department for review⁹⁶ in the context of a future grid modernization plan filing. We emphasize that collaboration among the Companies and other stakeholders should inform a company's RD&D project development efforts.

D.P.U. 12-76-B at 29. The Companies should report on the status of any RD&D project

⁹⁶ As discussed above, the Department intends to review any proposed grid modernization-related RD&D projects using the standards developed in D.P.U. 17-05, at 457-460, D.P.U. 16-178, at 26, 29-30, and D.P.U. 16-184, at 11.

development efforts in their Grid Modernization Annual Reports and Grid Modernization Term Reports, as applicable, described in Section V.C.2.b., above.

d. Eversource - Energy Storage Demonstration Program

In D.P.U. 17-05, the Department approved two projects proposed by Eversource for its energy storage demonstration program. D.P.U. 17-05, at 461-465. The Department stated that we would address the recovery of program costs and performance metrics associated with the program in the instant proceeding. D.P.U. 17-05, at 469-470.

The Department concludes that it is appropriate for Eversource to recover costs associated with its energy storage demonstration program through the short term targeted cost recovery mechanism we approve for its other eligible grid modernization plan investments. Eversource may not reallocate any unspent funds approved for its energy storage demonstration project to other efforts, including the grid-facing investments approved in this proceeding. D.P.U. 17-05, at 470. The Department will develop performance metrics for Eversource's energy storage demonstration program through the metrics stakeholder process discussed in Section VI, below.

e. Eversource – Electric Vehicle Infrastructure Program

In D.P.U. 17-05, the Department approved the spending of \$45 million on an electric vehicle infrastructure program as part of Eversource's proposed grid modernization investments. D.P.U. 17-05, at 500. The Department stated that we would address the recovery of program costs and the performance metrics associated with the program in the instant proceeding. D.P.U. 17-05, at 501.

The Department concludes that it is appropriate for Eversource to recover costs associated with its electric vehicle infrastructure program through the short term targeted cost recovery mechanism we approve for its other eligible grid modernization plan investments. Eversource may not reallocate any unspent funds approved for its electric vehicle infrastructure program to other efforts, including the grid-facing investments approved in this proceeding. D.P.U. 17-05, at 501. Finally, the Department will develop performance metrics for Eversource's electric vehicle infrastructure program through a separate electric vehicle metrics stakeholder process.

VI. METRICS & EVALUATION PLAN

A. Introduction

In D.P.U. 12-76-B, the Department directed the Companies to include in their grid modernization plans 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. D.P.U. 12-76-B at 30. In addition, the Department directed the Companies to jointly propose a common list of statewide metrics. To assist the Companies in this effort, the Department provided an illustrative list of potential statewide metrics for consideration. D.P.U. 12-76-B at 30-32.

As part of their proposals, the Department directed the Companies to include metrics that measure outcomes that may not be within their complete control, as it is important to track these outcomes to determine benefits, understand consumer behavior, and measure the

success of the Companies' efforts in a number of respects. D.P.U. 12-76-B at 33. The Department also directed the Companies to solicit stakeholder input in the development of the statewide and company-specific metrics, including the development of a process to solicit input, clear communication of this process to stakeholders. D.P.U. 12-76-B at 33-34. The Department stated that the purpose of the metrics will be to record and report information, and that the metrics will not be tied to incentives or penalties at the present time. D.P.U. 12-76-B at 34.

B. Description of Proposals

National Grid proposes five statewide infrastructure metrics that it states are designed to address the grid modernization objectives, and four company-specific infrastructure metrics to measure year-to-year progress in the installation of and spending on grid modernization technologies (D.P.U. 15-120, Grid Modernization Plan at 171-173). In addition, National Grid proposes two statewide performance metrics that it states are designed to measure progress toward reducing the effects of outages and optimizing demand, and four company-specific performance metrics to measure the progress toward improving workforce and asset management, reducing effects of outages, and optimizing demand (D.P.U. 15-120, Grid Modernization Plan at 172-173). National Grid states that an internal company working group collaborated with representatives responsible for stakeholder engagement to develop and refine proposed technologies, and this input is also reflected in metrics (D.P.U. 15-120, Grid Modernization Plan at 170).

Unitil proposes to implement 16 metrics to measure both its progress in implementing the grid modernization plan as well as the effects of the grid modernization plan over time (D.P.U. 15-121, Exh. FG&E-1, at 89-101).⁹⁷ The proposed metrics are divided into two categories: (1) build metrics, which focus on measuring quantities such as customers served or devices installed; and (2) impact metrics, which measure the effects or value derived from implemented projects. Unitil's proposed build metrics include: (1) distributed energy resource-customer totals; (2) total distributed energy resource capacity; (3) total number of customers on TVR; (4) total grid modernization plan-related sensors installed; and (5) total number of customers using Unitil's self-service web portal or mobile application. Impact metrics include indices or calculations that measure: (1) Unitil's average cost per customer contact; (2) peak demand per customer, and (3) reductions in energy and demand through conservation voltage reduction (D.P.U. 15-121, Exh. FG&E-1, at 89-101).

Eversource proposed two statewide metrics and one company-specific metric for customer-facing investments (D.P.U. 15-122, Exh. Eversource-IGMP at 67-69).⁹⁸ Eversource's proposed statewide metrics are: (1) measurement of TVR customers' kW-hour load reduction during critical peak pricing events; and (2) measurement of TVR customer participation rates (D.P.U. 15-122, Exh. Eversource-IGMP at 67-69). Eversource's

⁹⁷ Unitil calls all proposed metrics "performance metrics" (D.P.U. 15-121, Exh. FG&E-1, at 89).

⁹⁸ As part of its original grid modernization plan, Eversource included proposed statewide and company-specific metrics (D.P.U. 15-122, Exh. Eversource-GMP at 125).

proposed company-specific metric is a measurement of customers reached through TVR marketing efforts (D.P.U. 15-122, Exh. Eversource-IGMP at 68-69). Eversource states that its three proposed customer-facing metrics address the Department's grid modernization goal of optimizing demand (D.P.U. 15-122, Exh. Eversource-IGMP at 67-69). Eversource states that it established an internal working group and worked collaboratively with staff from National Grid and Unitil to develop these metrics (D.P.U. 15-122, Exh. Eversource-IGMP at 66-67).

In addition, Eversource proposes to track 14 metrics for its grid-facing investments (D.P.U. 17-05, Exhs. ES-GMBC-1, at 11, 132-135; ES-GMBC-3). The 14 proposed metrics include company-specific implementation metrics and customer benefit sub-metrics (D.P.U. 17-05, Exh. ES-GMBC-3).⁹⁹ Eversource states that the proposed grid-facing metrics are not tied to specific grid modernization outcomes. Instead, Eversource states that the proposed metrics will track progress milestones, spending parameters, and other indicators to monitor and evaluate progress on the its grid modernization base commitment investments (D.P.U. 17-05, Exhs. ES-GMBC-1, at 132, 134-135; ES-GWPP-1, at 13; ES-CAH-1, at 13, 18). Additional metrics were developed during the course of the investigation in D.P.U. 17-05 (D.P.U. 17-05, Exh. D.P.U. 41-7; RR-AC-2, Att.; RR-CLF-2, Att.; RR-DPU-2).

⁹⁹ Within the 14 proposed metrics, there are 35 separate implementation and customer benefit sub-metrics (D.P.U. 17-05, Exh. ES-GMBC-3; RR-DPU-2, Att.).

C. Positions of the Parties

1. Intervenors

The Attorney General argues that the Companies' failed to provide adequate performance metrics for grid modernization investment outcomes (D.P.U. 15-120, Attorney General Brief at 51; D.P.U. 15-121, Attorney General Brief at 33; D.P.U. 17-05, Attorney General Brief at 56-57). The Attorney General contends Companies' metrics do not go beyond infrastructure investment and recommends that the Department require them to adopt "true" performance metrics (D.P.U. 15-120, Attorney General Brief at 51-52, citing Exh. DPU-AG-1-4, Att.; D.P.U. 15-121, Attorney General Brief at 33, citing Tr. J-2, at 206-207; D.P.U. 17-05, Attorney General Brief at 58, citing Exh. DPU-41-7, Att. (Supp.)).

Acadia Center argues the Department should require the Companies to submit a new set of statewide metrics, arguing that the metrics selected by the joint working group are insufficient and, in particular, omit peak demand reduction metrics (D.P.U. 15-120, Acadia Center Brief at 17, citing Exh. AC-1, at 3, 10; Acadia Center Reply Brief at 4; D.P.U. 15-122, Acadia Center Brief at 11; D.P.U. 17-05, Acadia Center Brief at 19-20).¹⁰⁰ Acadia Center recommends the Department strengthen statewide metrics, and including metrics on customer behavior, integration of third party facilities, and the impact of grid

¹⁰⁰ Acadia Center contends that certain company-specific performance metrics proposed by National Grid are potentially useful (e.g., percentage of peak load reduction by feeder) but asserts that, collectively, National Grid's proposed metrics fail to achieve Department objectives or demonstrate benefits to customers (D.P.U. 15-120, Acadia Center Brief at 16-17).

modernization efforts (D.P.U. 15-120, Acadia Center Brief at 17-18; Acadia Center Reply Brief at 5; D.P.U. 17-05, Acadia Center Brief at 19). Acadia Center urges the Department to adopt specific statewide metrics in this proceeding so that the Companies can make needed investments to collect required data, and begin tracking and reporting data (D.P.U. 15-120, Acadia Center Brief at 18-19; D.P.U. 17-05, Acadia Center Brief at 20). Acadia Center maintains that in a subsequent proceeding, with stakeholder input and sufficient information from the Companies, the Department should set targets along with performance incentives and penalties (D.P.U. 15-120, Acadia Center Brief at 18-19; D.P.U. 15-122, Acadia Center Brief at 13). Acadia Center recommends that the Department look to other jurisdictions for guidance regarding appropriate statewide performance metrics (D.P.U. 15-120, Acadia Center Brief at 19-20; D.P.U. 15-122, Acadia Center Brief at 13-14; D.P.U. 17-05, Acadia Center Brief at 20-21).¹⁰¹

CLF contends the Companies' proposed metrics do not enable the Department or stakeholders to assess progress in achieving grid modernization objectives, including distributed energy resource integration and customer engagement (D.P.U. 15-120, CLF Brief at 16; D.P.U. 15-121, CLF Brief at 17; D.P.U. 15-122, CLF Brief at 23; D.P.U. 17-05, CLF Brief at 52-53). CLF argues the Companies should be collecting metrics designed to track the role of distributed energy resources on the Companies' systems (D.P.U. 15-120,

¹⁰¹ Acadia Center identifies a number of recommended metrics used in other jurisdictions, including metrics that report on distributed generation (e.g., number and location, load served by distributed energy resources, rate of distributed energy resource adoption) (D.P.U. 15-120, Acadia Center Brief at 21; D.P.U. 15-122, Acadia Center Brief at 15; D.P.U. 17-05, Acadia Center Brief at 21-22).

CLF Brief at 17; D.P.U. 15-121, CLF Brief at 17; D.P.U. 15-122, CLF Brief at 23). CLF recommends the Department require the Companies to submit additional metrics that will allow the Department and stakeholders to evaluate the Companies' performance (D.P.U. 15-120, CLF Brief at 17; D.P.U. 15-121, CLF Brief at 17; D.P.U. 15-122, CLF Brief at 23-24).

NECEC argues that the metrics proposed by the Companies are insufficient to assess whether the proposals achieve grid modernization objectives (D.P.U. 15-120/15-121/15-122, NECEC Brief at 17, 19, 23). NECEC recommends that the Department clarify that the Companies are required to establish outcome-based metrics and link expenditures to satisfaction of those metrics in order to receive targeted recovery of any investments (D.P.U. 15-120/15-121/15-122, NECEC Brief at 28). For National Grid and Unitil, NECEC recommends the Department consider the metrics CLF proposed to address integration of distributed energy resources along with other metrics developed through a comprehensive stakeholder process (D.P.U. 15-120/15-121/15-122, NECEC Brief at 19-20, 23-24, citing Exh. CLF-TW/AH-1, at 29; D.P.U. 12-76-B at 33-34). For Eversource, NECEC contends that the Department should direct the Companies to use this future stakeholder process to develop metrics, in conjunction with the development of a revised grid modernization plan (D.P.U. 15-120/15-121/15-122, NECEC Brief at 18; D.P.U. 17-05, NECEC Brief at 25).

The Compact argues that Eversource should be required to improve its metrics for customer-facing investments (D.P.U. 15-120, Compact Brief at 44). The Compact contends that Eversource's proposed metrics do not sufficiently tie to grid modernization objectives

and recommends the Department take steps to ensure that Eversource includes meaningful outcome-based metrics in its next filing (D.P.U. 15-122, Compact Brief at 45). DOER argues that the Department should require Eversource to develop statewide metrics pursuant to D.P.U. 12-76-B (D.P.U. 17-05, DOER Brief at 36, citing D.P.U. 12-76-B at 32-33).

2. Companies

National Grid states that its proposed infrastructure and performance metrics comply with the Department's directives in D.P.U. 12-76-B, and will provide the Department and stakeholders with insight into (1) implementation of its grid modernization plan, and (2) progress toward meeting the grid modernization objectives (D.P.U. 15-120, National Grid Brief at 37-38; National Grid Reply Brief at 34-35). National Grid asserts that the additional metrics proposed by the intervenors are redundant, unclearly defined, and do not add value (D.P.U. 15-120, National Grid Brief at 38-39; National Grid Reply Brief at 35). For example, National Grid maintains that some proposed metrics are reported elsewhere and, therefore, do not need to be included in grid modernization reports (D.P.U. 15-120, National Grid Reply Brief at 35-36). In addition, National Grid contends that it has appropriately incorporated stakeholder input into the creation of proposed metrics which included "energy influence summits," over 60 community events, and municipal outreach (D.P.U. 15-120, National Grid Reply Brief at 38). Finally, National Grid opposes the adoption of penalties or cost recovery tied to satisfaction of metrics, arguing that metrics should be used to provide insight into grid modernization-technology effectiveness and not to penalize the company (D.P.U. 15-120, National Grid Reply Brief at 42).

Unitil contends that it coordinated ongoing meetings with parties, local government officials, and customers as part of its stakeholder process to develop metrics (D.P.U. 15-121, Unitil Brief at 37). Unitil argues that its proposed infrastructure and performance metrics will allow its customers, interested third-parties, and the Department to understand the impact of its grid modernization projects (D.P.U. 15-121, Unitil Brief at 38). Unitil asserts that its proposed performance metrics address each of the Department's objectives, and will accurately track its progress towards grid modernization (D.P.U. 15-121, Unitil Brief at 38).

Eversource argues that its proposed approach to performance metrics for customer-facing investments is reasonable, including how it proposes to track the effectiveness of its marketing to reach the target audience (D.P.U. 15-122, Eversource Brief at 42-44; D.P.U. 15-122, Eversource Reply Brief at 12-13, 23). Eversource argues that it has proposed customer-facing metrics that are designed to ensure it is meeting its core obligations, while making cost-effective progress toward grid modernization (D.P.U. 17-05, Eversource Brief at 390). Because it proposed to fund the grid modernization investments through its performance based ratemaking mechanism in D.P.U. 17-05, Eversource argues that it was not necessary for it to implement performance metrics for these investments pursuant to D.P.U. 12-76 directives (D.P.U. 17-05, Eversource Brief at 405). However, for additional metrics proposed by stakeholders in D.P.U. 17-05,¹⁰² Eversource maintains that a

¹⁰²

Additional metrics were proposed during the investigation in D.P.U. 17-05 (D.P.U. 17-05, Exh. D.P.U. 41-7; RR-AC-2, Att.; RR-CLF-2, Att.; RR-DPU-2).

subset of these metrics could serve as additional measurement metrics (D.P.U. 17-05, Eversource Brief at 105-106, citing Exh. DPU-41-7 (Supp.)).

D. Analysis and Findings

1. Introduction

Pursuant to the Department's directives in D.P.U. 12-76-B, each company proposed company-specific and statewide metrics for both infrastructure and performance (D.P.U. 15-120, Grid Modernization Plan at 170-174; D.P.U. 15-121, Exh. FG&E-1, at 89-101; D.P.U. 15-122, Exh. Eversource-IGMP at 67-71; D.P.U. 17-05, Exhs. ES-GMBC-3; DPU-41-7). The Department addresses the Companies' metrics proposals here.¹⁰³

A number of intervenors challenged the proposed metrics for customer-facing investments, arguing that they failed to measure customer engagement and distributed energy resource integration (D.P.U. 15-120, Acadia Center Brief at 17-18; Acadia Center Reply Brief at 5; CLF Brief at 16; D.P.U. 15-121, CLF Brief at 17; D.P.U. 17-05, Acadia Center Brief at 19; D.P.U. 15-122, Compact Brief at 44-45; CLF Brief at 23). The Department has not preauthorized any proposed customer-facing investments in this Order and, therefore, we will not address the proposed metrics here. Such metrics, including intervenor concerns, will

¹⁰³ This Order does not address implementation or performance metrics for investments in electric vehicles. In D.P.U. 17-05, the Department stated it would solicit stakeholder input on Eversource's proposed evaluation plan and metrics for electric vehicles. D.P.U. 17-05, at 484-484. The Department intends to establish a separate electric vehicle stakeholder process as a later date.

be addressed in the context of our investigation of the deployment of customer-facing technologies (see Section V.C, above).

In addition, Acadia Center and NECEC argue that the Department should tie targeted cost recovery to the satisfaction of performance metrics or impose financial penalties where performance, as measured by the metrics, has not been achieved (D.P.U. 15-120, Acadia Center Brief at 18-19; D.P.U. 15-122, D.P.U. 15-120/15-121/15-122, NECEC Brief at 28; Acadia Center Brief at 13). Consistent with the Department's finding in D.P.U. 12-76-B at 34, for now, the purpose of metrics will be to record and report information; the metrics will not, at present, be tied to incentives or penalties. As we gain more experience with grid modernization investments, the Department may consider whether a penalty or incentive structure is appropriate for metrics. Further, as discussed in Section VII, below, the purpose of short-term targeted cost recovery is to remove certain barriers to grid modernization investments. We find, therefore, that it is not appropriate to directly tie targeted cost recovery to the satisfaction of performance metrics.¹⁰⁴

While the Companies' proposed metrics for the grid-facing technologies represent a useful first step, with the exception of certain infrastructure metrics, we find that more work is needed to develop appropriate metrics, both substantively and to ensure consistency among the Companies on the type and format of information to be provided by the metrics.

¹⁰⁴ A company's performance in implementing its grid modernization plan, as measured by metrics, may be relevant in determining whether a company's investments were reasonable and prudently incurred.

D.P.U. 17-05, at 440 441. The Department addresses the grid-facing metrics proposals below.

2. Grid-Facing Technology Metrics

a. Infrastructure Metrics

i. Introduction

Infrastructure metrics are intended to track each company's implementation of its Department-approved grid modernization plan. D.P.U. 12-76-B at 30. The information provided through these infrastructure metrics will serve an important role in the evaluation of the deployment of the grid-facing technologies, as the plans are implemented (as reported in the Grid Modernization Annual Reports) and at the conclusion of the three-year grid modernization plan term (as reported in the Grid Modernization Term Reports).

ii. Statewide Infrastructure Metrics

The Companies propose the following statewide infrastructure metrics:¹⁰⁵ (1) system automation saturation;¹⁰⁶ (2) number/percentage of sensors installed versus planned; (3) percentage of circuits with installed sensors; and (4) total number of grid-connected

¹⁰⁵ Eversource and Unitil categorize these metrics as performance metrics D.P.U. 15-121, Exh. FG&E-1, at 91-92; D.P.U. 15-122, Exh. Eversource-GMP at 128). Because these metrics track deployment of investments and implementation of grid modernization plans, as opposed to performance of preauthorized grid-facing technology, we find that these metrics are more appropriately categorized as infrastructure metrics.

¹⁰⁶ System automation saturation measures automation on the system by customers served by fully automated or partially automated device. The terms "fully automated" and "partially automated" refer to feeders for which a company has attained optimal or partial, respectively, levels of visibility, command and control, and self-healing (see e.g., D.P.U. 15-120, Grid Modernization Plan at 171).

distributed generation facilities, nameplate capacity and estimated output of each unit, and type of customer-owned or operated units (D.P.U. 15-120, Grid Modernization Plan at 171; D.P.U. 15-121, Exh. FG&E-1, at 91-92; D.P.U. 15-122, Exh. Eversource-GMP at 128-131). The Department finds that these proposed statewide infrastructure metrics are appropriate and directs all three Companies to report this information. The information from these metrics will provide Department and stakeholders with high-level, system-wide information regarding the number of customers that benefit from the deployment of grid-facing technologies.

For these statewide infrastructure metrics, the Companies shall report information on the deployment of grid-facing technology at the feeder and substation level.¹⁰⁷ We find that reporting this information at the feeder and substation level will provide greater transparency to the Department and stakeholders regarding: (1) the level of visibility, command and control, and self-healing a company has attained on each of its feeders; and (2) the number of customers (and associated load) that are served by these feeders. Further, requiring the Companies to report information at this level of granularity will allow the Department and stakeholders to aggregate the information to view performance at higher levels of the system (e.g., by substation, by region, or system-wide).

¹⁰⁷ For those technologies that a company deploys at the circuit level, the company should report information on a circuit-specific basis. Similarly, for those technologies deployed at the substation level, the company should report information on a substation specific basis.

iii. Company-Specific Infrastructure Metrics

National Grid proposes a number of company-specific infrastructure metrics that track spending associated with, and progress made, installing grid modernization technologies (D.P.U. 15-120, Grid Modernization Plan at 172). Eversource also proposed a number of metrics that measure installation of proposed grid-facing technologies, by year (D.P.U. 17-05, Exh. DPU-41-7, Att. (Supp.)). Finally, Unitil proposed a number of company-specific metrics that measure the number of customers affected by grid-facing technologies or associated spending (D.P.U. 15-121, Exh. FG&E-1, at 91-96).

The Department finds that use of infrastructure metrics that track the deployment of preauthorized grid-facing investments, as well as associated spending and deviation from planned development, will allow the Department and stakeholders to effectively and efficiently compare each company's implementation with its planned implementation (D.P.U. 15-120, Grid Modernization Plan at 170-174; D.P.U. 15-121, Exh. FG&E-1, at 89-101; D.P.U. 17-05, Exh. ES-GMBC-3; D.P.U. 17-05, Exh. DPU-41-7, Att. (Supp.)). After review of the proposals, the Department finds that it is necessary to streamline the metrics that provide this information for Department and stakeholder review. Accordingly, for each category of preauthorized grid-facing investment, each company shall report: (1) the number of devices or other technologies deployed;¹⁰⁸ (2) the associated cost for

¹⁰⁸ For Eversource's propose communication infrastructure, this includes miles of fiber, number of nodes, and percentage of service territory with coverage.

deployment; (3) reasons for deviation between actual and planned deployment for the plan year; and (4) projected deployment for the remainder of the three-year term.¹⁰⁹

Similar to statewide infrastructure metrics, the company-specific infrastructure metrics we approve here shall be reported at the feeder and substation level.¹¹⁰ The Companies will track and report both statewide and company-specific infrastructure metrics as part of their Grid Modernization Annual Reports and Grid Modernization Term Reports to the Department.

b. Performance Metrics

Performance metrics related to the deployment of grid-facing technologies should measure each company's progress towards meeting the grid modernization objectives and, in particular, the objective of optimizing system performance and its associated benefits such as reducing the effect of outages, improving power quality, and operational efficiency. The Companies have identified a number of quantitative benefits of the grid-facing investments that make progress toward the objective of optimizing system performance (D.P.U. 15-120, Exh. AG-3-31(a)-(d); D.P.U. 15-121, Exh. AG-4-27 Att. 12; D.P.U. 17-05, Exhs. ES-GMBC-2, at 33, 38; DPU-42-6, Att.). The Companies have also identified

¹⁰⁹ Given that we will require each company to report on the same categories of information, these infrastructure metrics are now company-specific only in the sense that each company will deploy a different mix of infrastructure investments.

¹¹⁰ For those technologies that a company deploys at the circuit level, the company should report information on a circuit-specific basis. Similarly, for those technologies deployed at the substation level, the company should report information on a substation-specific basis.

quantitative benefits associated with the deployment of VVO, including reductions in energy and peak demand, that make progress towards the objective of optimizing system demand (D.P.U. 15-120, Exh. AG-3-31(a)-(d); D.P.U. 15-121, Exh. AG-4-27, Att. 12; D.P.U. 17-05, Exh. ES-GMBC-2, at 30).

The Department agrees with the Attorney General that more work is necessary to finalize performance metrics for grid-facing investments (D.P.U. 15-120, Attorney General Brief at 51; D.P.U. 15-121, Attorney General Brief at 33; D.P.U. 17-05, Attorney General Brief at 56-57). In particular, additional work is needed to develop metrics that appropriately track the quantitative benefits associated with preauthorized grid-facing investments, as identified by the Companies, and progress toward grid modernization objectives (D.P.U. 15-120, Exh. AG-3-31(a)-(d); D.P.U. 15-121, Exh. AG-4-27, Att. 12; D.P.U. 17-05, Exhs. ES-GMBC-2, at 33, 38; DPU-42-6, Att.). Therefore, the Department will not approve specific grid-facing performance metrics at this time. Instead, within 90 days of the date of this Order, the Companies shall file revised proposed performance metrics designed to address the preauthorized grid-facing investments.¹¹¹ At a minimum, the Department expects to establish performance metrics associated with each of the quantitative benefits the Companies identified for their preauthorized grid-facing investments. The Department will convene a stakeholder process to facilitate review of the Companies' revised performance metrics proposals.

¹¹¹ Consistent with the infrastructure metrics, the Companies shall propose metrics that measure performance at the feeder and substation level.

The Companies will need to establish baselines by which the grid-facing performance metrics will be measured against. This baseline will be filed with proposed performance metrics within 90 days of the date of this Order. To assist in the development of these baselines, the Department directs each company to develop and maintain information on its system design, operational characteristics (e.g., voltage, loading, line losses), and ratings prior to any deployment of preauthorized grid-facing technologies. In developing the proposed baselines, the Department directs the Companies to use, to the extent possible, information reported in the annual service quality filings,¹¹² as well as other publically available information.¹¹³

Finally, in D.P.U. 17-05, the Department approved two energy storage demonstration projects for Eversource. D.P.U. 17-05, at 461-465. The Department stated that we would address performance metrics associated with the energy storage demonstration program in the instant proceeding. D.P.U. 17-05, at 469-470. Accordingly, the Department directs

¹¹² For example, as part of their service quality filings, the Companies currently report information on the average duration and frequency of outages on a feeder-specific basis. See, 2016 Service Quality Reports of the Electric Distribution Companies, D.P.U. 17-SQ-10 through D.P.U. 17-SQ-14 (2017). The Companies provide this information for the applicable service quality year, as well as for the three preceding years.

¹¹³ For example, we expect that the Companies will use information related to the interconnection of distributed energy resources (such as number and location) reported to DOER and interconnection timeframes as reported in the Distributed Generation Timeline Enforcement Mechanism (see e.g., D.P.U. 15-120, National Grid Reply Brief at 34-36).

Eversource to include proposed energy storage performance metrics in its revised performance metrics filing.

3. Evaluation Plan

Although it was not raised in D.P.U. 12-76-B, the Department has determined that it is appropriate to establish a formal evaluation process, including an evaluation plan and evaluation studies, for the Companies' preauthorized grid modernization plan investments.¹¹⁴ An evaluation plan will provide, to the extent possible, a uniform statewide approach and standards to study the deployment of the preauthorized grid modernization investments to ensure that benefits are both maximized and achieved with greater certainty, and that future investments are more effective.

The evaluation process must be performed in a manner that facilitates coordination and maximize comparability among the Companies with regard to the evaluation of the deployment of the grid modernization investments. The plan must be designed to evaluate, measure, and verify the benefits of the grid modernization investments in a way that provides confidence to the Department and stakeholders.

¹¹⁴ For National Grid's and Eversource's smart grid pilot programs, the Department approved evaluation plans which were designed to identify load reductions, confirm the functionality of smart grid technologies for two-way communications and distribution automation, and inform each company's future investment decisions. National Grid Smart Grid Pilot Program, D.P.U. 11-129 (2012); NSTAR Electric Company Smart Grid Pilot Program, D.P.U. 09-33 (2010). In addition, the Companies engage in extensive evaluation, measurement and verification efforts in conjunction with the deployment of their three-year energy efficiency plan investments. See e.g., 2016-2018 Three-Year Energy Efficiency Plans, D.P.U. 15-160 through D.P.U. 15-169, at 30 (2016).

Within 90 days of the date of this Order, the Companies shall submit a joint proposed evaluation plan for the three-year grid modernization investment term for Department review. As part of the evaluation process, the Companies, in consultation with DOER,¹¹⁵ will select an evaluation consultant or consultants to conduct studies on appropriate topics related to the deployment of the preauthorized investments. These studies will be designed to work together with the grid modernization performance metrics to measure the progress made towards the achievement of the Department's grid modernization objectives.

VII. COST RECOVERY

A. Introduction

With traditional cost-of-service ratemaking, the Department found that the Companies may not have the proper incentives for making investments to facilitate the achievement of the Department's grid modernization objectives. D.P.U. 12-76-A at 25. Therefore, the Department determined that some form of short-term targeted cost recovery was warranted to remove the impediments to some grid modernization investments. D.P.U. 12-76-B at 19. In D.P.U. 12-76-B at 19-25, the Department outlined the criteria regarding eligibility for targeted cost recovery of grid modernization investments.

In D.P.U. 12-76-B at 22, the Department determined that a capital expenditure tracking mechanism was the appropriate method for the Companies to recover eligible preauthorized grid modernization investments. The Department concluded that O&M costs

¹¹⁵ Because the Department must ultimately review the appropriateness of the evaluation studies and resulting benefits, we find that we are not the appropriate entity to lead the evaluation process.

were not eligible for targeted cost recovery. D.P.U. 12-76-B at 23. In addition, the Department determined that the Companies could recover grid modernization capital investments only if they were prudently incurred, in service, and used and useful to ratepayers. D.P.U. 12-76-B at 24.

To be eligible for targeted cost recovery, the Department stated that the investment must be made within five years of the Department's approval of the grid modernization plan. D.P.U. 12-76-B at 20. In addition, the Department determined that only investments that are incremental relative to a company's current investment practices would be eligible for targeted cost recovery. D.P.U. 12-76-B at 19. Finally, the Department determined that investments would be eligible for targeted cost recovery if they were: (1) made for advanced metering functionality; or (2) other incremental grid modernization investments, but only if the company also invests in advanced metering functionality. D.P.U. 12-76-B at 20.

In the sections below, the Department addresses the Companies' cost recovery proposals. After review, with two exceptions related to the eligibility of O&M investments for targeted cost recovery and the threshold requirement for investments in advanced metering functionality, the Department approves a short-term targeted cost recovery mechanism for grid modernization investments that is consistent with the parameters described in D.P.U. 12-76-B.

B. Description of Proposals

1. D.P.U. 15-120, National Grid

National Grid proposes to implement a reconciling mechanism to concurrently recover its grid modernization plan capital expenditures (D.P.U. 15-120, Grid Modernization Plan at 17, 202, Exhs. PTZ-1, at 17; CRP-1, at 14). In addition, National Grid proposes to recover grid modernization-related O&M expenditures and plan development costs through the reconciling mechanism (D.P.U. 15-120, Grid Modernization Plan at 202). National Grid also proposes to establish a regulatory asset to recover any remaining undepreciated value (as well as a return on investment) of assets being prematurely retired as a result of grid modernization (D.P.U. 15-120, National Grid Brief at 43).

National Grid proposes to recover: (1) customer-related grid modernization costs through a monthly customer charge; and (2) distribution-related/shared grid modernization costs through a volumetric, per kW-hour charge (D.P.U. 15-120, Grid Modernization Plan at 202). National Grid defines customer-related costs as those costs associated with the provision of metering and billing. It defines distribution-related/shared costs as costs associated with investments in its distribution system, costs to operate and maintain grid modernization plan investments, and costs shared by both customer-related grid modernization plan initiatives and distribution system investments (D.P.U. 15-120, Grid Modernization Plan at 202).

National Grid proposes to submit semi-annual grid modernization cost recovery filings (D.P.U. 15-120, Exh. CRP-1, at 23). In addition, National Grid proposes to implement an

adjustment to address any potential double recovery of capitalized overhead and burdens costs (D.P.U. 15-120, Exh. CRP-1, at 17-18). Finally, National Grid proposes that O&M costs will be eligible for targeted cost recovery if they are: (1) incurred as a result of the implementation of its grid modernization plan investments; and (2) not otherwise recovered through base rates or other cost recovery mechanisms (D.P.U. 15-120, Exh. CRP-1, at 16-17).

2. D.P.U. 15-121, Unitil

Unitil proposes to recover expenditures associated with its grid modernization plan investments through a fully reconciling cost recovery mechanism (D.P.U. 15-121, Exhs. FG&E-1, at 107-108; FG&E-3, at 3). Unitil proposes to recover grid modernization-related O&M as well as capital expenses through its proposed cost recovery mechanism (D.P.U. 15-121, Exh. FG&E-3, at 5). Unitil proposes to collect its grid modernization plan investments and expenses through the reconciling mechanism until at least year ten of its proposed plan, at which point Unitil proposes to incorporate its grid modernization plan investments into base rates (D.P.U. 15-121, Exh. FG&E-3, at 3).

For rate classes currently subject to a distribution demand rate, Unitil proposes to collect eligible grid modernization costs through a demand charge (D.P.U. 15-121, Exh. FG&E-3, at 3-4). Unitil proposes to implement a factor to recover projected grid modernization plan investments and associated expenses to be made in the upcoming plan year (D.P.U. 15-121, Exhs. FG&E-1, at 107-108; FG&E-3, at 3). Additionally, Unitil proposes a separate factor to reconcile the difference between actual cumulative grid

modernization investment revenue requirements for a cost year and billed revenues for that cost year (D.P.U. 15-121, Exhs. FG&E-1, at 107-108; FG&E-3, at 4).

Unitil proposes to submit semi-annual cost recovery filings (D.P.U. 15-121, Exh. FG&E-1, at 130). In addition, Unitil proposes to define eligible O&M expenses as those that are incurred as a result of the implementation of its grid modernization plan investments and not otherwise recovered through base rates or another cost recovery mechanism (D.P.U. 15-121, RR-DPU-5, Att. 1, at 2). Unitil also proposes to recover O&M expenses made for system resiliency prior to the first year of its grid modernization plan (D.P.U. 15-121, RR-DPU-5, Att. 1, at 2). Finally, Unitil proposes to implement an adjustment to address the potential double recovery of capitalized overhead and burdens costs (D.P.U. 15-121, RR-DPU-5, Att. 1, at 8).

3. D.P.U. 15-122, Eversource

In D.P.U. 17-05, the Department determined that it was appropriate to review Eversource's complete grid modernization proposal, including cost recovery, in the instant docket. D.P.U. 17-05, at 441-442. While Eversource initially proposed a different cost recovery method for its grid modernization investments in D.P.U. 17-05, the company maintains that it is not opposed to recovery of its grid modernization investments through a separate cost recovery mechanism (D.P.U. 17-05, RR-DPU-3; Tr. 2, at 252-269).

Eversource proposes to recover grid modernization-related O&M expenditures as well as capital expenses (D.P.U. 15-122, Exh. Eversource-DPH-1, at 7-8; Tr. 2, at 376-380;

D.P.U. 17-05, Exh. ES-GWPP-1, at 53). In addition, Eversource proposes to submit semi-annual cost recovery filings (D.P.U 15-122, Exh. Eversource-RDC-3, at 7).

C. Positions of the Parties

1. Intervenors

a. General Arguments

The Attorney General argues that the Companies' cost recovery proposals fail to conform to the requirements outlined by the Department in D.P.U. 12-76-B with respect to O&M costs. In particular, the Attorney General asserts that the Department found O&M costs were ineligible for targeted cost recovery in D.P.U. 12-76-B at 22-23 (D.P.U. 15-120, Attorney General Reply Brief at 4; D.P.U. 15-121, Attorney General Brief at 6-7; D.P.U. 15-122, Attorney General Brief at 6-7).

In addition, a number of intervenors argue that the Department should not allow targeted cost recovery of Eversource's and Unitil's grid modernization investments because the proposals do not meet the eligibility criteria outlined in D.P.U. 12-76-B with respect to advanced metering functionality. Specifically, the Attorney General, Acadia Center, NECEC, CLF, and the Compact argue that Eversource's and Unitil's proposals must be rejected as neither plan fully achieves advanced metering functionality (D.P.U. 15-122, Attorney General Brief at 11; Acadia Center Brief at 8; Compact Brief at 9, 11; D.P.U. 15-121, Attorney General Brief at 22; D.P.U. 15-120/15-121/15-122, NECEC Brief at 17-18, 21; CLF Brief at 12).

By contrast, NECEC argues that the targeted cost recovery mechanism outlined by the Department to promote grid modernization investments may have distorted the Companies' approaches to their proposed grid modernization investments (D.P.U. 15-120/15-121/15-122, NECEC Brief at 27). NECEC argues that, in order to facilitate non-capital expenditure approaches to grid modernization (including non-wires alternatives, distributed energy resource integration, and third party investments), the Department should not limit targeted cost recovery to capital investments (D.P.U. 15-120/15-121/15-122, NECEC Brief at 29-30). Finally, LEAN argues that the Companies should be required to calculate the cost of proposed grid modernization investments to low-income customers and propose a compensating discount (D.P.U. 15-120/15-122, LEAN Brief at 5).

b. Plan-Specific Arguments

i. D.P.U. 15-120, National Grid

Acadia Center, LEAN, and NECEC argue that the Department should reject National Grid's proposal to recover the cost of AMI meters through fixed customer charges. These parties assert that grid modernization plan costs are more appropriately recovered through a per kW-hour usage charge (D.P.U. 15-120, Acadia Center Brief at 11; D.P.U. 15-120/15-122, LEAN Brief at 10-11; D.P.U. 15-120/15-121/15-122, NECEC Brief at 24). In particular, Acadia Center, LEAN, and NECEC argue that investments in AMI provide numerous system-wide benefits beyond connecting a customer to the grid and, therefore, a fixed customer charge is not the appropriate vehicle to recover these costs (D.P.U. 15-120, Acadia Center Brief at 12, citing Tr. J-1, at 94-95; D.P.U. 15-120/15-122,

LEAN Brief at 11; D.P.U. 15-120/15-121/15-122, NECEC Brief at 24, citing Exh. AC-1, at 3, 16-17).

The Attorney General argues that National Grid improperly seeks to recover O&M costs through its proposed reconciling mechanism despite the Department's clear direction limiting targeted cost recovery to capital costs (D.P.U. 15-120, Attorney General Reply Brief at 4, citing D.P.U. 12-76-B at 22-23). According to the Attorney General, National Grid recognizes that its grid modernization investments should result in avoided or deferred O&M costs which are a ratepayer benefit (D.P.U. 15-120, Attorney General Reply Brief at 4, citing National Grid Brief at 27). The Attorney General maintains, however, that until National Grid files its next rate case, the benefit of those O&M expense reductions will accrue to shareholders, rather than ratepayers (D.P.U. 15-120, Attorney General Reply Brief at 4). Therefore, to the extent that the Department allows National Grid to recover grid modernization-related O&M expenses through the proposed reconciling mechanism, the Attorney General argues that the Department should adopt a mechanism to share any resulting reduction in non-grid modernization-related O&M costs with ratepayers in between rate cases (D.P.U. 15-120, Attorney General Reply Brief at 5, citing Exh. AG-PA-1, at 29-31).

ii. D.P.U. 15-121, Unitil

With the exception of the general arguments summarized above, no party commented on Unitil's individual proposed targeted cost recovery mechanism.

iii. D.P.U. 15-122, Eversource

Several parties argue that a capital cost tracker, as set forth in D.P.U. 12-76-B, is the appropriate ratemaking mechanism for Eversource to recover eligible grid modernization costs (D.P.U. 17-05, Acadia Center Brief at 13-14; CLF Brief at 51; DOER Brief at 20-24; NECEC Brief at 19-26). Acadia Center, CLF, DOER, and NECEC argue that a capital cost tracker will provide Eversource with timely recovery of grid modernization costs, while retaining important ratepayer protections and Department oversight (D.P.U. 17-05, Acadia Center Brief at 13-14; CLF Brief at 51; DOER Brief at 20-24; NECEC Brief at 19-26).

2. Companiesa. National Grid

National Grid asserts that concurrent cost recovery is essential for the successful implementation of any of its four proposed grid modernization plan scenarios (D.P.U. 15-120, National Grid Brief at 39, citing Exh. PTZ-1, at 16). National Grid maintains that base rates (set through a rate case that uses historical test year costs) combined with revenue decoupling are an insufficient source of revenues to fund grid modernization (D.P.U. 15-120, National Grid Brief at 40, citing Exh. PTZ-1, at 16-17).

National Grid argues that the Department's decision to allow targeted cost recovery for capital investments, but not O&M investments, creates a distortion in incentives favoring capital investment over O&M costs (D.P.U. 15-120, National Grid Brief at 40-41, citing Exh. PTZ-1, at 18). National Grid contends that its grid modernization plan takes advantage of third-party services that could be provided faster and with less overall cost to customers

(D.P.U. 15-120, National Grid Brief at 41, citing Exh. PTZ-1, at 17-18). Accordingly, National Grid maintains that when O&M alternatives are in the best interest of customers, the associated costs should be eligible for targeted cost recovery (D.P.U. 15-120, National Grid Brief at 41).

Further, National Grid maintains that it incurs O&M costs on nearly every capital investment project (D.P.U. 15-120, National Grid Brief at 40, citing Exh. PTZ-1, at 17). National Grid argues that it has proposed to include recovery of grid modernization-related O&M expenses in its proposed cost recovery mechanism because, otherwise, it will incur costs that it will not be able to recover or defer (D.P.U. 15-120, National Grid Brief at 40, citing Exh. PTZ-1, at 17).

In addition, National Grid argues that its proposal to recover the customer-related costs of its grid modernization investments through a monthly customer charge is appropriately aligned with the Department's cost causation principles (D.P.U. 15-120, National Grid Brief at 42, citing Grid Modernization Plan at 202; National Grid Reply Brief at 45, citing Exh. CRP-Rebuttal at 12). In particular, National Grid argues that the costs it classifies as customer-related, such as the costs of meters and billing, cannot be saved through a reduction in kW-hour and, therefore, are more appropriately recovered through a per-customer charge (D.P.U. 15-120, National Grid Brief at 42).

Finally, National Grid argues that its proposal to establish a regulatory asset to recover the remaining undepreciated value of any assets prematurely retired as a result of grid modernization is reasonable because, but for the Department's grid modernization

requirements, the company would not prematurely retire these assets (D.P.U. 15-120, National Grid Brief at 43, citing Exh. PTZ-1, at 20). National Grid asserts that a failure to earn a return on the prematurely retired assets would financially penalize it for pursuing grid modernization and increase the risk faced by its investors (D.P.U. 15-120, National Grid Brief at 44, citing Exh. CRP-Rebuttal at 9).

b. Unitil

Contrary to the Attorney General's assertion, Unitil argues that the Department did not require grid modernization plans to achieve 100 percent deployment of advanced metering functionality within five years as a prerequisite for targeted cost recovery (D.P.U. 15-121, Unitil Brief at 45, citing D.P.U. 12-76-B at 47). Accordingly, Unitil asserts that its proposed investments are all eligible for targeted cost recovery, as proposed (D.P.U. 15-121, Unitil Brief at 46).

c. Eversource

Although it proposed to fund the majority of its grid modernization investments through revenues from its performance-based ratemaking mechanism in D.P.U. 17-05, Eversource maintains that it is not opposed to recovery of its grid modernization costs through a capital cost tracker (D.P.U. 17-05, Eversource Brief at 402-403). In addition, Eversource disputes the Attorney General's claim that its investments are ineligible for targeted cost recovery because its grid modernization plan does not achieve full deployment of advanced metering functionality (D.P.U. 15-122, Eversource Brief at 28). In this regard, Eversource argues that the Department did not require the Companies to propose full

deployment of advanced metering functionality regardless of the cost (D.P.U. 15-122, Eversource Brief at 26).

D. Analysis and Findings

1. Introduction

In D.P.U. 12-76-B, the Department determined that, in order to remove what may be impediments to some grid modernization investments, special ratemaking treatment using a short-term targeted cost recovery mechanism was appropriate. D.P.U. 12-76-B at 4. In the sections below, the Department addresses the Companies' cost recovery proposals in consideration of evidence presented in these proceedings and the parameters identified in D.P.U. 12-76-B.

2. Changes to Mechanism Design

Based on our review of the evidence in these proceedings, the Department affirms our findings in D.P.U. 12-76-B that, if correctly designed, a short-term targeted cost recovery mechanism will facilitate the achievement of our grid modernization objectives by reducing the financial risk associated with grid modernization investments, while preserving important ratepayer protections. For the reasons discussed below, the Department finds that two fundamental changes are warranted to the design of the cost recovery mechanism outlined in D.P.U. 12-76-B. First, the Department will replace the capital tracker with a reconciling mechanism that allows targeted cost recovery of eligible grid modernization-related capital expenditures as well as incremental O&M costs. Second, the Department will eliminate the

requirement for investments in advanced metering functionality as a prerequisite for other grid modernization investments to be eligible for targeted cost recovery.

In D.P.U. 12-76-B at 22, the Department found that a capital expenditure tracker was an appropriate targeted cost recovery mechanism. Under this approach, where certain requirements were met, a company would be allowed to recover the revenue requirement associated with eligible grid modernization-related capital projects. D.P.U. 12-76-B at 22. The Department determined that O&M expenditures would not be eligible for targeted cost recovery. D.P.U. 12-76-B at 23.

As described above, the Companies urge the Department to reconsider its decision and allow targeted cost recovery of eligible grid modernization-related O&M costs as well as capital expenditures (D.P.U. 15-120, National Grid Brief at 39; D.P.U. 15-121, Unitil Brief at 43; D.P.U. 15-122, Eversource Brief at 10). The Companies argue that they are likely to incur significant O&M expenses in conjunction with their proposed grid modernization capital investments and recovery of these expenses is essential for the successful implementation of their grid modernization plans (D.P.U. 15-120, National Grid Brief at 39; D.P.U. 15-121, Unitil Brief at 43; D.P.U. 15-122, Eversource Brief at 10). NECEC also urges the Department to make this change (D.P.U. 15-120/15-121/15-122, NECEC Brief at 27). In particular, NECEC argues that a capital tracker may inappropriately discourage investment in non-capital expenditure approaches to grid modernization including non-wires alternatives, distributed energy resource integration, and third-party investments (D.P.U. 15-120/15-121/15-122, NECEC Brief at 29-30).

After review, the Department is persuaded that it is appropriate to include eligible incremental O&M investments, as well as capital investments, in the grid modernization targeted cost recovery mechanism. Such ratemaking treatment will ensure that the Companies can implement their grid modernization investments in a way that maximizes benefits without any improper incentive to favor capital investments over non-capital expenditure approaches.

A representative level of O&M costs is already recovered through base rates. As the Department recognized in D.P.U. 12-76-B at 23, allowing recovery of O&M costs through a targeted cost recovery mechanism increases the risk that a company could recover a portion of these costs more than once. In order to prevent this result, as described in detail below, the Companies must develop a rigorous method to demonstrate that only incremental O&M grid modernization-related costs are proposed for targeted cost recovery.

As the Attorney General correctly notes, the Companies' grid modernization investments, including grid modernization-related O&M expenditures, should result in avoided or deferred O&M costs. Until each company files a rate case, the benefit of any such cost reductions will accrue to shareholders, rather than ratepayers (D.P.U. 15-120, Attorney General Reply Brief at 4). Therefore, the Attorney General proposes that the Companies adopt a mechanism to share with ratepayers any resulting reductions in non-grid modernization-related O&M costs between rate cases (D.P.U. 15-120, Attorney General Reply Brief at 5). The extent to which any O&M expense reductions will materialize is currently unknown and, therefore, we are not prepared at this time to adopt the Attorney

General's proposal. To the extent that such expense reductions prove to be significant, the Department may reconsider this decision in a future grid modernization plan proceeding.

Next, the Department finds that it is appropriate to sever the tie between eligibility for targeted cost recovery and investments designed to achieve full deployment of advanced metering functionality. As discussed in Section V.C., above, the full deployment of advanced metering functionality and its anticipated benefits was a significant focus of the Department's investigation in D.P.U. 12-76. Accordingly, the Department determined that investments would be eligible for targeted cost recovery if (1) they were made for advanced metering functionality, or (2) other incremental grid modernization investments, but only if the company also invests in advanced metering functionality. D.P.U. 12-76-B at 20.

However, after review of the evidence in these proceedings regarding benefits and costs, the Department determined that full deployment of advanced metering functionality is not appropriate at this time (see Section V.C.3, above). Conversely, the Department determined that the Companies' proposed grid-facing investments have considerable benefits that justify the costs (see Section V.C.3, above). In light of these findings, and in order to remove what may be impediments to the grid-facing grid modernization investments, the Department will determine eligibility for targeted cost recovery without regard to the level of investment in advanced metering functionality.

In the sections below, the Department describes the eligibility criteria for short-term targeted cost recovery and the design of the targeted cost recovery mechanism. To reflect the intent of this special ratemaking mechanism to facilitate the achievement of our grid

modernization objectives, the Department will refer to the cost recovery factor as the Grid Modernization Factor (“GMF”).

3. Eligibility for Targeted Cost Recovery

a. Preauthorization

As discussed in Section V.C., above, only investments that are preauthorized by the Department are eligible for targeted cost recovery through the GMF. Preauthorization involves a review of the Companies’ proposed investments and cost estimates, as supported by the business case analysis as described in D.P.U. 12-76-C. Although the Companies will be required to describe their grid modernization planning over a five-year time horizon, only investments made in the first three years of each grid modernization plan will be considered for preauthorization (see Section V.C., above).

As is the case with any costs to be recovered from ratepayers, all grid modernization expenditures must be prudently incurred to be eligible for targeted cost recovery. The Department’s standard of review on prudence involves a determination of whether a 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. Attorney General v. Department of Public Utilities, 390 Mass. 208, 229 (1983). Department preauthorization of grid modernization investments means that the Department will not revisit the prudence of the Companies’ decision to proceed with those investments. The Department will, however, review the prudence of the Companies’ implementation of these investments (see Section V.C, above).

The Department will conduct a cumulative review of all grid modernization expenditures at the end of a three-year term, as described in Section V.C. At that time, the Department will review the actual expenditures to determine if they are reasonable and prudently incurred. All costs recovered from ratepayers for any expenditures determined to be imprudent shall be refunded through the reconciliation component of the GMF, with associated carrying charges. Capital investments will be eligible for inclusion in base rates after the Department has approved final cost recovery in a grid modernization proceeding at the end of a three-year term.

Finally, we emphasize the importance of the Companies' developing and maintaining systematic, ample, and contemporaneous documentation of all grid modernization projects for which they seek targeted cost recovery. A failure to provide clear, cohesive, and reviewable evidence demonstrating eligibility will result in disallowance of targeted cost recovery of the expenditures in question. See 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).

b. Incremental

Only grid modernization capital investments and incremental O&M expenses are eligible for cost recovery through the GMF. First, with respect to capital investments, the Department has defined incremental to mean either new types of technology or the level of investment a company proposes relative to its current investment practices. D.P.U. 12-76-B at 19-20. In other words, capital investments may be treated as incremental if their primary

purpose is to accelerate progress in achieving grid modernization objectives. See D.P.U. 12-76-B at 20. With respect to O&M expenses, the Companies must demonstrate that all O&M expenses proposed for recovery through the GMF are: (1) incremental to the representative level of O&M expenses recovered through rates; and (2) solely attributable to preauthorized grid modernization expenses. Companies must submit contemporaneous project documentation and other evidence demonstrating that each of these conditions has been met. The Department will review the Companies' submissions and disallow targeted cost recovery of all expenses where the proper showing has not been made.

As discussed above, allowing recovery of O&M costs through the GMF increases the potential for double recovery of some of these expenses. Accordingly, to assist the Department in our review of proposed O&M expenditures and to ensure that double recovery does not occur, the Department directs each company to develop and propose a rigorous protocol to demonstrate that the expenses are incremental to the costs already recovered through rates. Each company shall include its proposed protocol together with the exemplar GMF tariff filed in compliance with this Order.¹¹⁶

Although we will not prescribe all elements of the protocol in this Order, the Department identifies certain expectations. First, the Department will limit eligible O&M labor expense to new positions created after the issue of this Order, unless the Companies can demonstrate that the associated costs are attributed solely to grid modernization activities and are not otherwise recovered through rates. Accordingly, each company must be prepared

¹¹⁶ The Department will investigate each company's proposed protocol.

to identify and track the costs for positions created to perform grid modernization activities since the test-year in its most recent rate case. O&M expenses for existing employees who have been moved to a new position performing grid modernization activities will not be eligible for recovery through the GMF as these costs are already recovered through base rates.

In addition, there shall be a presumption that all overhead and burdens O&M expenses are ineligible for recovery through the GMF. These expenses are indirectly incurred and, therefore, will be ineligible for recovery through the GMF unless a company develops a protocol to demonstrate otherwise.

As part of the proposed protocol, we expect each company to provide a detailed description of the method it proposes to implement to track and clearly identify the increase in both capitalized and expensed costs over the costs currently recovered through rates. With this method, the Companies must be able to track the employees who are working specifically on grid modernization activities, and the associated increase in employee hours as well as non-labor costs in a manner that clearly demonstrates that the costs are (1) directly related to grid modernization; and (2) incremental to the costs already recovered through rates.

Finally, we emphasize that the Companies are responsible for tracking such costs in a reviewable manner that reduces the administrative burden for the Department. Accordingly, we expect that the proposed protocol will incorporate a system to clearly segregate

preauthorized grid modernization investments from non-grid modernization investments in the Companies' accounting systems.

4. Targeted Cost Recovery Mechanism

a. Recovery Period

The Companies sought forward-looking cost recovery of preauthorized grid modernization plan investments through the GMF (D.P.U. 15-120, Exh. PTZ-1, at 18; D.P.U. 15-121, Exh. FG&E-3, at 3; D.P.U. 15-122 Exh. Eversource-RDC-1, at 3). Eversource states, however, that it could envision using a factor that was designed to recover investments based on a lag (i.e., recover investments made in one year in the subsequent year) (D.P.U. 15-122, Tr. 2, at 370-371; D.P.U. 17-05, Tr. 15, at 3144).

As discussed above, the GMF is a special ratemaking mechanism designed to remove financial barriers to a reasonable level of investment in grid modernization technologies. While such ratemaking treatment will reduce these barriers, it is not intended to eliminate entirely the regulatory lag that provides an important incentive for a company to spend efficiently. Boston Gas Company, Essex Gas Company and Colonial Gas Company, D.P.U. 10-55, at 132-133 (2010). In addition, in D.P.U. 12-76-B at 21, the Department identified the significant challenges with forward-looking cost recovery that expose ratepayers to unwarranted risk including: (1) the time and resources needed to litigate projected costs and the forecasting methods; (2) the information imbalance; and (3) the administrative burden imposed on the Department and the other parties.

For these reasons, the Department will not adopt a cost recovery mechanism based on projected expenditures and revenue requirements. Instead, we reaffirm our determination that costs shall be eligible for recovery through the GMF only after the expenses have been incurred and the associated investments have been placed in service and are used and useful to ratepayers. D.P.U. 12-76-B at 20-22.

b. Annual Factor Filing

The Companies propose to submit semi-annual cost recovery filings (D.P.U. 15-120, Exh. CRP-1, at 23; D.P.U. 15-121, Grid Modernization Plan at 130; see also D.P.U 15-122, Exh. Eversource-RDC-3, at 7). The Department finds, however, that it is administratively efficient to limit the number of grid modernization rate adjustment filings to one per year.

The Companies shall file annual GMF rate adjustment and reconciliation filings comprised of: (1) actual, eligible preauthorized expenditures from the prior grid modernization plan investment year; and (2) a reconciliation component in the second year and beyond. Interest on over- or under-recovery of the revenue requirement shall be calculated on the average monthly balance using the customer deposit rate. The Department anticipates that in most circumstances, where proper documentation is provided by the Companies, the Department will be able to approve these factors subject to reconciliation based on the results of an investigation that will occur at the end of the three-year grid modernization review term (see Section V.C., above).

With each annual GMF filing, the Companies shall provide testimony and supporting exhibits, including full project documentation of all grid modernization capital projects placed

into service during the plan investment year and documentation of O&M expenses, describing in detail how the Companies' proposed costs meet the eligibility requirements set forth in Section V.C. Specifically, annual filings shall contain testimony and supporting documentation demonstrating that the costs sought for recovery are preauthorized, incremental (consistent with protocol and the tests described above), prudently incurred, in service, and used and useful (where applicable). Additionally, the filing shall also describe any cost variances as defined in the Companies' capital authorization policies, provide a demonstration that the proposed factors are calculated appropriately, and provide bill impacts that meet the criteria outlined below in Section V.C.

c. Revenue Requirement Calculation

i. Eligible Capital Costs

Eligible capital costs shall not include any preauthorized investment that is not in service and used and useful to ratepayers.¹¹⁷ The current calendar year revenue requirement shall be calculated based on cumulative average grid modernization plan plant investments based upon the prior year's beginning-of-the-year and end-of-the-year gross plant, accumulated reserve depreciation, and accumulated deferred income taxes. For the year in which eligible grid modernization plan investment is placed into service, the annual revenue

¹¹⁷ As addressed in Section V.C.2, above, the Department has not preauthorized any investments in advanced metering functionality. For future preauthorized investments in advanced metering functionality, the Department will apply the used and useful standard as outlined in D.P.U. 12-76-B at 24-25 (i.e., where the required showing is made, the investment need not be used and useful by the year for which cost recovery is sought through the GMF so long as the investment is made within the three-year preauthorization period).

requirement will be calculated on a monthly basis. The annual revenue requirement on eligible grid modernization plan investment for subsequent years will be calculated based upon average annual costs.

The annual revenue requirement includes the grid modernization plant investment value upon which the Companies are permitted to earn an authorized rate of return. The Department finds that the weighted average cost of capital approved in the Companies' most recent distribution rate case is the appropriate return to be applied in calculating the GMF revenue requirement.

ii. Annual Depreciation Expense Adjustment

Depreciation expense allows a company to recover its capital investments in a timely and equitable fashion over the service lives of the investments. Fitchburg Gas and Electric Light Company, D.T.E. 98-51, at 75 (1998); Boston Gas Company, D.P.U. 96-50 (Phase I) at 104 (1996); Milford Water Company, D.P.U. 84-135, at 23 (1985); Boston Edison Company, D.P.U. 1350, at 97 (1983). Depreciation expense of eligible grid modernization capital investments shall be set at established depreciation rates as approved by the Department in the company's most recent distribution rate proceeding. For the year during which the eligible grid modernization plant is placed into service, each company shall calculate depreciation expenses for use in the grid modernization plan revenue requirements by (1) dividing the annual depreciation accrual rate by twelve, and (2) applying the resulting rate to the average monthly plant balance over the course of the year. This use of average monthly accrual rates and monthly plant balances will better reflect investments over the

investment year. Depreciation expense for subsequent years shall be calculated based on the average of the beginning and end of year plant balances.

iii. Property Tax Calculation

While municipalities and other taxing authorities operate on a fiscal year basis running from July 1st through June 30th, property valuations used to establish property tax rates are based on assets in place as of January 1st each year. Milford Water Company, D.P.U. 12-86, at 239 (2013). Consequently, taxing authorities customarily bill the first and second fiscal quarter property taxes during the third and fourth calendar quarters of the year being assessed, based on one-fourth of the prior fiscal year's total final amount. New England Gas Company, D.P.U. 10-114, at 263 (2011). Accordingly, the property tax expense for the first year's revenue requirement shall be set to zero. The second year's revenue requirement should be calculated first, by applying the effective property tax rate¹¹⁸ approved in the Company's most recent base rate case to the eligible net plant as of the end of the applicable investment year and, then taking one-half of that amount. The Department will require no change in the method for calculating property tax expense for subsequent years.

iv. Operation and Maintenance Costs

Eligible O&M expenses are defined as the actual monthly grid modernization plan-related O&M expenses incurred throughout the prior twelve month investment year

¹¹⁸ The effective property tax rate was derived by dividing a company's property tax expense by its net plant in service.

related to grid modernization plan implementation and proven to be incremental, preauthorized, and reasonable. As described above, only actual O&M expenses that are supported with appropriate documentation are eligible for recovery through the GMF.

Employee costs will exclude pension and other post-retirement benefit costs recovered through the Companies' pension/post-retirement benefits other than pension adjustment mechanism provisions. Incremental O&M expenses shall be calculated as an annual amount, except for the first year in which a Department approved grid modernization plan investment is placed in service, in which the O&M expense shall be calculated on a monthly basis.

v. Labor Overhead and Clearing Account Burdens

The overhead and burdens test is a two-part test performed to demonstrate that the labor overheads and clearing account burden costs associated with capital investments and recovered through a reconciling mechanism are not over-capitalized and instead are allocated equally to all capital projects. Boston Gas Company/Colonial Gas Company/Essex Gas Company, D.P.U. 14-132, at 47 (2015). In the instant proceedings, the Companies propose to use an overhead and burdens test to ensure against the double recovery of labor overhead and clearing account burdens costs (D.P.U. 15-120, Exh. CRP-2, at 8; D.P.U. 15-121, Exh. FG&E-5, at 8; D.P.U. 15-122, Exh. Eversource-RDC-3, at 6).

When performing the overhead and burdens test, the Companies must first demonstrate that the labor overhead and clearing account burdens costs included in the O&M expense recovered through base rates have not been shifted to grid modernization project

costs.¹¹⁹ D.P.U. 14-132, at 81-82. Second, the Companies must demonstrate that the overall level of the actual capitalized labor overhead and clearing account burdens costs are allocated equally to all capital projects in any given year, including preauthorized grid modernization projects. D.P.U. 14-132, at 77-79, 112.¹²⁰

The Department approves the Companies' use of the overhead and burdens test for the purpose proposed. We find, however, that Companies' proposed exemplar targeted cost recovery tariffs do not contain sufficiently detailed language documenting the operation of the test (D.P.U. 15-120, Exh. CRP-2, at 8; D.P.U. 15-121, RR-DPU-5, Att. 1, at 8; D.P.U. 15-122, Exh. Eversource-RDC-3). Therefore, we direct the Companies to include the following language in their GMF compliance tariffs:

For purposes of GMF calculations, the actual overhead and burdens shall be reduced to the extent that actual O&M overhead and burdens in a given year

¹¹⁹ This showing will be achieved by comparing (1) the overhead and clearing account burdens costs charged to O&M expense and recovered in base rates, with (2) the labor overhead and clearing account burdens costs charged to O&M expense in the grid modernization plan-investment year. In the event that the amount recovered through base rates is greater than the amount charged to O&M expense in the grid modernization plan-investment year, the company will reduce the grid modernization plan project costs to be recovered through the GMF by the difference. In the event that the actual overhead and clearing account burdens costs charged to O&M expense in the grid modernization plan-investment year exceed the amount recovered in base rates, no adjustment is required to the grid modernization plan project costs to be recovered through the GMF.

¹²⁰ The rate at which labor overhead and clearing account burdens costs are allocated to grid modernization plan projects is compared to the rate at which they are allocated to all capital projects. To ensure equal allocation, the percentage of capitalized overhead and burdens assigned to grid modernization plan projects shall be set equal to the ratio of grid modernization plan to non-grid modernization plan direct costs in any given year.

are less than the amount included in base rates as determined in its most recent base distribution rate case. Such reduction shall be the difference between the actual O&M overhead and burdens and the amount included in base rates. In addition, the percentage of capitalized overhead and burdens assigned to GMF projects shall be set equal to the ratio of GMF to non-GMF direct costs in any given year.

In each annual GMF rate adjustment filing, the Companies must document their performance of the overhead and burden test and identify the capitalized overhead and burdens costs attributed to preapproved capital investments.

d. Expenditure Cap

As discussed above, all grid modernization-related capital and O&M expenditures shall be subject to a targeted cost recovery cap, regardless of the prudence of these expenditures. More specifically, the level of grid modernization expenditures eligible for targeted cost recovery through the GMF shall not exceed the preauthorized three-year budgets (see Section V.C.3, above). In each annual GMF filing, and as part of the three-year review, the Companies must demonstrate that their total expenditure for preauthorized investments is under the expenditure cap.¹²¹,

e. Allocation of Grid Modernization Factor

Unitil and Eversource propose to use a distribution revenue allocator for the allocator of grid modernization costs among rate classes (D.P.U. 15-121, Exh. FG&E-3, at 5; see also D.P.U. 15-122, Exh. Eversource-RDC-3, at 4). Alternatively, National Grid proposes to use several different allocation factors including a rate base allocator, a distribution revenue

¹²¹ The expenditure cap approved here supplants the notification process and required showing with respect to material cost overruns described in D.P.U. 12-76-B at 24.

allocator, and two new allocators¹²² to allocate costs among rate classes (D.P.U. 15-120, Exh. CRP-2, at 8).

The Department finds that use of a distribution revenue allocator is the appropriate method to equitably allocate grid modernization costs to the various rate classes. This allocation method is consistent with Department precedent when allocating both capital and O&M expense recovered in a single factor.¹²³ Therefore, the Department directs the Companies to allocate eligible GMF costs using the distribution revenue allocator approved in each company's most recent rate case.

f. Volumetric Rate

National Grid proposes to establish a fixed customer charge to collect customer-facing grid modernization costs (D.P.U. 15-120, Exh. CRP-1, at 11). In addition, for any rate classes currently subject to a demand rate, Unitil proposes to collect grid modernization costs through a demand rate (D.P.U. 15-121, Exh. FG&E-3, at 3-4).

Acadia Center, LEAN, and NECEC, argue that the Department should reject National Grid's proposal to recover the customer-facing grid modernization costs through fixed

¹²² National Grid proposes to use: (1) a meter/billing allocator (comprised of meter-related rate base and customer billing expense) to allocate customer-related capital costs; and (2) a meter/customer expense allocator (comprised of meter-related and customer service O&M expense) to allocate customer-related allowable O&M expense (D.P.U. 15-120, Exh. CRP-1, at 33). As discussed below, the Department does not approve National Grid's proposal to adopt a fixed customer charge to collect customer-related grid modernization costs.

¹²³ See e.g., Solar Cost Adjustment Provision - National Grid (M.D.P.U. No. 1339, at 2), Unitil (M.D.P.U. No. 299, at 2); Eversource (M.D.P.U. No. 66A at 5).

customer charges, arguing that such costs are more appropriately recovered through a per kW-hour charge (D.P.U. 15-120, Acadia Center Brief at 11; D.P.U. 15-120/15-122, LEAN Brief at 10-11; D.P.U. 15-120/15-121/15-122, NECEC Brief at 24). Because the Department has not preauthorized any customer-facing investments, we decline to approve National Grid's proposal to recover any eligible grid modernization costs through a fixed charge. In addition, to be consistent with other cost tracking mechanisms, the Department declines to approve recovery of eligible grid modernization costs through demand charges. See e.g., National Grid M.D.P.U. No. 1303; Unitil M.D.P.U. No. 296. Instead, the Companies shall collect Department-approved grid modernization expenses and revenue requirements from ratepayers using a volumetric rate.

g. Ratemaking Treatment of Premature Asset Retirements

As discussed in Section V.C.3, above, the Department is not preauthorizing any customer-facing investments or otherwise requiring the achievement of advanced metering functionality within a defined timeframe at this time. Accordingly, we decline to address as premature National Grid's proposed treatment of any capital assets that may be prematurely retired as a result of grid modernization (D.P.U. 15-120, Exh. PTZ-1, at 14-15).

h. Other Issues

The Department declines to approve Unitil's proposal to recover O&M expenses made for system resiliency prior to the start of its grid modernization plan (D.P.U. 15-121, RR-DPU-5, Att. 1, at 2). Unitil has not identified any such costs or otherwise demonstrated how they are appropriate for targeted cost recovery through the GMF. Given the purpose of

the GMF as a special remaking mechanism to remove impediments to some grid modernization investments, we find that expenditures made prior to the start of a company's grid modernization plan are not eligible for targeted cost recovery through the GMF.

With respect to National Grid's proposal to receive targeted cost recovery of grid modernization plan development costs, we find that future O&M expenditures related to plan development and implementation are eligible for recovery through the GMF, subject to all other eligibility criteria for grid modernization expenditures described herein (D.P.U. 15-120, Grid Modernization Plan at 202). Expenditures related to plan development incurred prior to the date of this Order, however, are not eligible for targeted cost recovery through the GMF.

Finally, the Department declines to adopt LEAN's proposal to implement a separate low-income discount for grid modernization investments (D.P.U. 15-120/15-122, LEAN Brief at 5). The GMF is part of the total bill amount to which the existing low-income discount is applied. Accordingly, the Department finds that no further discount to the GMF is warranted.

i. Filing Dates

Each company shall submit an annual GMF rate adjustment and reconciliation filing containing its proposed grid modernization factors, as well as testimony and supporting documentation, as outlined above. Each company shall submit its annual GMF filing on or before February 15th of each year for rates effective April 1st.

j. Tariff Expiration Date

The GMF is a transitional, short-term targeted cost recovery mechanism. The Department continues to believe that grid modernization investments will become a company's normal business practice over time. D.P.U. 12-76-B at 19. Accordingly, in D.P.U. 12-76-B at 19-20, the Department determined that only investments made during the first five years of a company's grid modernization plan would be eligible for targeted cost recovery. In the instant proceeding, the Department has reduced the number of years that investments are eligible for preauthorization from five to three (see Section V.C., above). Accordingly, the Department finds that only investments made during the first two preauthorization terms (i.e., six years total) will be eligible for short term targeted cost recovery.

E. Conclusion

The Department directs the Companies to collaborate for the purpose of jointly developing a model GMF tariff for Department review that is consistent with the directives contained herein. Within 90 days of the date of this Order, the Companies shall file the model tariff and each company shall file an exemplar GMF tariff for review based on the model. This filing also shall include each company's proposed protocol for identifying and tracking incremental O&M expenses.

VIII. CONCLUSION

Grid modernization is a complex and long term endeavor, for which the investments preauthorized in these proceedings represent a first step. In the early stages of grid

modernization, it is reasonable to expect a significant level of uncertainty regarding the Companies' implementation of their investments. Given this uncertainty, the Department will establish a process to facilitate stakeholder input into the ongoing implementation of the Companies' grid modernization plans. With a three-year preauthorization of grid-facing investments, the plans we approve today will allow the Companies to adjust their deployment strategies in order to respond to stakeholder input and lessons learned.

The Companies' preauthorized investments in grid-facing technologies are expected to produce significant benefits by reducing outages, optimizing distribution system performance, and optimizing system demand. In addition, the preauthorized grid-facing technologies will lay the foundation to improve the Companies' ability to integrate distributed energy resources onto the electric grid. As a coordinated suite of investments, the grid facing technologies we preauthorize in these proceedings are expected to make measurable progress in achieving the Department's grid modernization objectives.

And although the evidence in these proceedings did not support the preauthorization of any customer-facing investments at this time, the Department is convinced that the cost effective deployment of advanced metering functionality remains an important tool in meeting our grid modernization objectives. The Department intends to engage stakeholders in a subsequent investigation to consider how to enable a successful future deployment of advanced metering functionality where the benefits are certain and they justify the costs.

The Department appreciates the active participation of the intervenors in these proceedings in the review of the Companies' initial grid modernization plans. Through the

various working groups and other processes described in this Order, the Department is committed to working with the Companies and other stakeholders to explore innovative opportunities to cost-effectively deploy advanced metering functionality, integrate distributed energy resources into system planning, and fully engage ratepayers in their energy usage. Through these efforts, we intend to modernize the electric grid to bring the benefits of efficient, clean, and reliable grid to all ratepayers in Massachusetts.

IX. ORDER

Accordingly, after due notice, hearing and consideration, it is

ORDERED: That the grid modernization plans filed by Massachusetts Electric Company and Nantucket Electric Company, Fitchburg Gas and Electric Light Company, and NSTAR Electric Company and Western Massachusetts Electric Company, are APPROVED in part and DENIED in part, consistent with directives contained herein; and it is

FURTHER ORDERED: That Massachusetts Electric Company and Nantucket Electric Company, Fitchburg Gas and Electric Light Company, and NSTAR Electric Company and Western Massachusetts Electric Company shall, within 90 days of the date of this Order, file proposed performance metrics for the preauthorized grid-facing investments consistent with directives contained herein; and it is

FURTHER ORDERED: That Massachusetts Electric Company and Nantucket Electric Company, Fitchburg Gas and Electric Light Company, and NSTAR Electric Company and Western Massachusetts Electric Company shall, within 90 days of the date of this Order, file a joint proposed evaluation plan consistent with directives contained herein; and it is

FURTHER ORDERED: That Massachusetts Electric Company and Nantucket Electric Company, Fitchburg Gas and Electric Light Company, and NSTAR Electric Company and Western Massachusetts Electric Company shall, within 90 days of the date of this Order, jointly file a model Grid Modernization Factor tariff and exemplar tariffs consistent with directives contained herein; and it is

FURTHER ORDERED: That Massachusetts Electric Company and Nantucket Electric Company, Fitchburg Gas and Electric Light Company, and NSTAR Electric Company and Western Massachusetts Electric Company shall comply with all other directives contained in this Order.

By Order of the Department,

/s/
Angela M. O'Connor, Chairman

/s/
Robert E. Hayden, Commissioner

/s/
Cecile M. Fraser, Commissioner

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.