2023 Grid Modernization Annual Report

Eversource Energy

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I. Introduction

On October 7, 2022 and November 30, 2022, the Department of Public Utilities ("Department") approved, with modifications, the second grid modernization plans, including advanced metering infrastructure ("AMI") proposals, filed by NSTAR Electric Company d/b/a Eversource Energy ("Eversource" or the "Company"), Massachusetts Electric Company and Nantucket Electric Company d/b/a National Grid ("National Grid"), and Fitchburg Gas and Electric Light Company d/b/a Unitil ("Unitil") (together, "Distribution Companies") in D.P.U. 21-80, D.P.U. 21-81, and D.P.U. 21-82, respectively. On December 30, 2021, the Department issued an order authorizing the Distribution Companies to continue their respective grid modernization programs and implement investment categories that are consistent with the investment categories previously preauthorized for the 2018-2021 Grid Modernization Plans ("GMPs") until the Department issues its final order on the continuing grid-facing investments contained in the GMPs. NSTAR Electric Company/Massachusetts Electric Company and Nantucket Electric Company/Fitchburg Gas and Electric Light Company, D.P.U. 21-80/ D.P.U. 21-81/D.P.U. 21-82, Order on Interim Continuation of Grid Modernization Programs and Revised Grid Modernization Factor Tariffs at 6-7. The Department's October 7, 2022, Order addressed the Distribution Companies' proposed continuing grid-facing grid modernization investments ("continuing investments"). NSTAR Electric Company/Massachusetts Electric Company and Nantucket Electric Company/Fitchburg Gas and Electric Light Company, D.P.U. 21-80-A/ D.P.U. 21-81-A/D.P.U. 21-82-A, Order on Previously Deployed Technologies (October 7, 2022) ("Track 1 Order"). The Department's November 30, 2022 Order addressed the Distribution Companies' proposed new grid-facing grid modernization investments and AMI (i.e., customer-facing) investments. D.P.U. 21-80-B/D.P.U. 21-81-B/D.P.U. 21-82-B, Order on New Technologies, and Advanced Metering Infrastructure Proposals (November 30, 2022) ("Track 2 Order").

Additionally, the Department required the Distribution Companies to submit an annual report by April 1 for grid modernization plan investments made in the prior calendar year for their grid-facing investments. Track 2 Order at 303, 305; Track 1 Order at 106; see also NSTAR Electric, M.D.P.U. No. 73G at 9; National Grid, M.D.P.U. No. 1497, at 8; Unitil, M.D.P.U. No. 379, at 9. The Department reiterated that the annual report filings are docketed for informational purposes only. Track 2 Order at 303; Track 1 Order at 105. The filing deadline for these annual reports was changed to July 1 pursuant to the Department's January 10, 2024, Memorandum issued in Dockets D.P.U. 21-80/21-81/21-82. See also NSTAR Electric, M.D.P.U. 73I, at 10; National Grid, M.D.P.U. 1539, at 8; Unitil, M.D.P.U. 424, at 13.

On January 25, 2023, the Department issued a memorandum setting forth the proposed form and content of the Grid Modernization Annual Reports for 2022 to 2025. The Department's memorandum also solicited written comment on the proposed narrative and data reporting template. D.P.U. 23-30, January 25, 2023, Memorandum at 2.

Eversource, National Grid, Unitil, the Cape Light Compact ("CLC") and the Department of Energy Resources ("DOER") submitted initial comments on February 15, 2023, with proposed edits to the Department's proposed form and content of the Grid Modernization Term Reports. On March 2, 2023, the Distribution Companies filed reply comments to CLC and DOER. On March 16, 2023, the Department

issued a memorandum finalizing the proposed Grid Modernization Term Report Narrative Outline and data reporting, including minor changes from its January 25, 2023, proposal. D.P.U. 23-30, March 16, 2023, Memorandum at 2-5. The Department issued a Memorandum on November 9, 2023, providing the annual data reporting template for customer-facing investments. The Memorandum issued on November 9, 2023, also directed the Distribution Companies to submit a revised performance metrics compliance filing and the annual data reporting template consistent with the directives set forth in the November 9, 2023, Memorandum by December 11, 2023. The Distribution Companies submitted a joint filing on December 11, 2023, that was stamp approved by the Department on February 1, 2024. Consistent with the November 9, 2023, Memorandum, the Distribution Companies also filed proposed evaluation plans developed with Guidehouse on February 7, 2024.

In D.P.U. 17-05, the Department approved both an electric vehicle ("EV") charging infrastructure program and an energy storage demonstration program. NSTAR Electric Company d/b/a Eversource Energy, D.P.U. 17-05, at 461-465, 470-471, 501-502. The Department also approved an extension of the EV program for 2021. NSTAR Electric Company d/b/a Eversource Energy, D.P.U. 20-74, at 38. The costs of both the EV program and the battery storage demonstration project were approved for recovery through the Company's Grid Modernization Factor ("GMF") tariff. NSTAR Electric Company d/b/a Eversource Energy, D.P.U. 15-122, at 186-187.

The Department approved the Company's Phase II Electric Vehicle Infrastructure Program in Docket D.P.U. 21-90, including an annual reporting requirement. D.P.U. 21-90/21-91/21-92, at 188 (2022). Accordingly, the Company has not included progress related to its EV program in this report because such progress was reported in the Company's May 15, 2024, report filed in Docket D.P.U. 24-42.

In Appendix A, the Company addresses costs associated with the Motion for Clarification and Reconsideration submitted on July 24, 2023 in D.P.U. 22-40/23-49.

In Appendix B, the Company included an update on the Outer Cape Energy Storage. As detailed in Appendix B, the Company incurred costs during 2023 related to its energy storage demonstration project for vendor payments and close out costs. The Company has also provided a brief update as to 2024 cost activity in relation to the Outer Cape Energy Storage.

The Company hereby submits its 2023 Grid Modernization Annual Report.

A. Progress Toward Grid Modernization Objectives

Eversource's 2022-2025 Grid Modernization Plan ("GMP") was designed based on the three defined Department 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 ("DER"). D.P.U. 15-122, at 106.

Achieving advancements in the Department's three objectives has provided benefits to the Company's

customers through the 2018-2021 GMP and will continue to provide additional benefits into the future through the 2022-2025 GMP. Eversource fully supports these objectives and has relied on them as the foundation for building its GMPs. In the process of developing the 2022-2025 GMP, the Company placed particular emphasis on the evolving needs identified through lessons learned, as well as leveraging the technologies and investments already implemented in the 2018-2021 GMP to achieve multiple grid modernization objectives simultaneously. In fact, all but three of the investments included in the GMP satisfy multiple objectives. This section summarizes the Company's actual progress through December 31, 2023, and expected progress toward each objective by the end of the 2022-2025 term. Detailed write-ups for each investment category are included in Section III of this report. Figure 1 below also illustrates the relationship between each investment category and each grid modernization objective.

Figure 1 Matrix of Grid Modernization Investment Categories and Objectives

		Grid Modernization Objectives		
Investment Category	**Investment Type**	**Optimize System Performance**	**Optimize System Demand**	**Integrate DER**
ADMS	DMS	✓	✓	✓
Communications	Wireless Communications Improvements	✓	✓	✓
	Communications System Modernization	✓	✓	✓
Monitoring & Control	Substation Automation	✓		✓
	PQ Monitoring	✓		
VVO	VVO	✓	✓	✓
Advanced Load Flow	Interconnection Automation			✓
	Probabilistic Power Flow Modeling			✓
DERMS	Dynamic DER Interface	✓	✓	✓
	DERMS	✓	✓	✓

1. Optimize system performance (by attaining optimal levels of grid visibility, command and control, and self-healing)

The Company is making substantial investments during the 2022-2025 GMP that are expected to further optimize system performance. Investments within the Monitoring and Control ("M&C"), Volt-Var Optimization ("VVO"), Advanced Distribution Management System ("ADMS"), Distributed Energy Resource Management System ("DERMS") and Communications will contribute toward this objective.

The M&C investment category includes the substation automation and power quality monitoring programs. These are continuing investments that build on the investments deployed under the Company's 2018-2021 GMP. The additional investment into advanced relays is expected to provide the optimal level of visibility, command, and control for the affected feeders. In addition to collecting real-time loading

data that is transmitted back to a centralized energy control system, these relays allow for remote operations such as application of fast-trip and lockout settings for worker safety or changes in protection settings. This substation automation program has resulted in considerable progress towards achieving optimal levels of visibility and control at all feeders in the Eversource territory during the 2018-2021 GMP and the Company is continuing to make further progress during the 2022-2025 GMP term. This progress is being made at a pace that would not have been possible absent the grid modernization program. The power quality program adds high-fidelity metering at substations serving customers sensitive to power quality events. It is becoming increasingly clear that the modern grid must include approaches to provide a higher degree of power quality to meet the needs of customers with sensitive electronic equipment. The benefits of automation in terms of reducing sustained outages are well known. The impact of automation in terms of power quality requires another level of visibility, command, and control.

The Company's VVO program supports all three grid modernization objectives. Prior to the VVO program the Company's substation transformer load tap changers, voltage regulators and capacitor banks were partially automated with limited remote-control capability. As part of the VVO program the Company will continue to deploy fully automated devices that provide enhanced levels of visibility, command, and control required to flatten and reduce voltage profiles along an entire feeder in combination with automated logic provided by VVO software. This level of visibility and control also supports system operators' need to manage two-way power flows in areas with high DER penetration. Data provided by line sensors installed as a part of the VVO program is required to ensure voltage remains in its acceptable range out to the grid edge in pursuit of improved system efficiency.

It is impossible to contemplate a modern grid that does not rely on a robust, high bandwidth, high speed communication system to enable real-time, automated communications to end-use equipment. In fact, it is important to consider the degree to which a strong communications infrastructure builds a foundation for all grid modernization investments. As an enabling technology for the modern grid, system performance will continue to be optimized through the Company's Communications investments. Upgraded node locations have provided increased and more comprehensive coverage in areas where coverage was otherwise limited previously. Through the Communication System Modernization investments, the Company will begin planning the transition to internet protocol ("IP") on its Field Area Network ("FAN") and eliminate data concentrators along the communications path in order to improve the resiliency and reliability of the data path from field devices to the Company's Enterprise Energy Control System ("eECS"). Building out an IP-based communications network will establish a modern communications path for the transmission of data on the distribution system.

The DERMS investment category also supports all three grid modernization objectives. The DERMS application is the tool that will provide the Company's system operations center with the capability to monitor and control the DERs while maintaining safe and reliable power. Balancing load and generation using DERs connected to the distribution system depends on what type of DER is participating and its associated operating parameters and contracts. With this specific data for different types of DER, operating decisions can be made with more precision. The data associated with the DER will also be more efficiently shared between systems because of the common integration platform being implemented and supported by a more modern and scalable information technology architecture. Moreover, each type of DER will have different use cases and using the DERMS as a central control system will be critical to successfully

managing the distribution system for multiple use cases. These multiple use cases at times contradict each other and so the DERMS will be the key to unlocking this complexity and to produce an optimal solution.

In 2023, progress made towards placing the Company's distribution management system ("DMS") in service has established a foundation for these technologies to further optimize system performance after the expected go-live date, later in the GMP term.

2. Optimize system demand

Further progress toward optimization of system demand will be achieved through continued investment into the VVO and advanced distribution management system ("ADMS") investment categories during the 2022-2025 GMP. New investments into the DERMS investment category will also contribute toward reaching this Department objective.

The use of VVO to achieve multiple grid modernization investment objectives remains extremely compelling. The benefits of improving the efficiency of voltage and reactive power flow include cost savings associated with reduced energy consumption, reduced peak demand, reduced line losses and the associated reduction in carbon emissions. As measured by Guidehouse, the investments made during the 2018-2021 GMP VVO program as measured throughout 2022 resulted in a 0.4 percent reduction in end use energy. This estimate provided by evaluators is a conservative estimate considering operational downtime of the system and as such, falls slightly below expected values. Despite the conservative energy reductions, the Company exceeded its projection of conservation voltage reduction ("CVR") factors achieving an approximately 0.6 percent reduction of energy for every percent voltage reduction on feeders evaluated, a 0.1 percent increase from expectations. More detail on these measurements can be found in the Massachusetts Grid Modernization Program Year 2022 Evaluation Report: Volt-VAR Optimization produced by Guidehouse. Although the Company has remained conservative in its deployment of VVO to date in order to ensure no adverse impacts to customers served by VVO feeders, further optimization of the VVO logic has the potential to drive additional savings in energy and demand. Additional investment into VVO at more stations and feeders during the 2022-2025 term will further compound these benefits.

As described above, new DERMs investments will contribute toward all three objectives. This software solution will be a controlling system that will be key to unlocking the various and sometimes contradicting use cases of different types of DERs on the distribution system.

In 2023, progress made towards placing the Company's DMS in service has established a foundation for these technologies to further optimize system demand and reduce peak load after the expected go-live date, later in the GMP term.

3. Interconnect and integrate DER

Given the growing imperative to integrate distributed clean energy solutions, Eversource is actively focused on advancing the Department's grid modernization objective of facilitating the interconnection of DER and integrating these resources into the Company's planning and operations processes. Continued

gains in pursuit of this objective are expected through continued and new investment into M&C, VVO, ADMS, advanced load flow ("ALF"), DERMS, and Communications programs.

Increased visibility, command, and control enabled by M&C programs will further provide system operators with the information needed to understand and act on emerging issues, including reverse flow overload and high voltage concerns in areas of high solar penetration. Data on status and condition provided by devices deployed in this category will support improvements in the DMS optimal power flow capability that will ultimately be integrated into the Company's DERMS used to support the use of DER as grid assets.

One of the objectives of the VVO program is to ensure the distribution voltages remain within prescribed ranges and are not fluctuating as additional DER, characterized by intermittent output, are added to the system. In implementing its 2018-2021 GMP and 2022-2025 GMP, the Company identified feeders with relatively high penetrations of both behind the meter and stand-alone solar facilities. This is helping to provide insight into how VVO technology can be used to increase hosting capacity by providing grid visibility and locally optimizing voltage control.

The Company's new ALF investments into its Interconnection Automation and Probabilistic Power Flow projects are expected to make progress toward this objective as well. The Interconnection Automation project is expected to offer improvements to hosting capacity calculations, customer user flow, and interconnection study time. Through the Probabilistic Power Flow project and developing the proposed probabilistic simulation tools, Eversource will gain capabilities which will help address the challenges of a decentralized generation infrastructure. In addition, Eversource is expecting to improve modelling of the interplay of systems such as VVO with distributed resources.

As an enabling technology for the modern grid, DER integration has also improved due to the Company's Communications investments. Upgraded node locations have provided increased and more comprehensive coverage in areas where coverage was otherwise limited previously.

In keeping with its core focus on Department's three objectives mentioned above, the Company's 2022-2025 GMP was also developed with consideration of the additional following guiding principles:

- Focus on Customers and Advancement in Customer Education – In keeping with its core focus, Eversource developed the 2022-2025 GMP with the customer at the center of its new grid-modernization efforts. Customers have identified service reliability, shorter outage restoration times, and lower, stable prices as their key energy expectations. Investments that: (1) improve reliability and resiliency; (2) optimize demand; (3) increase system efficiency; and (4) integrate DER will provide these benefits to customers across the Eversource system. The Company's 2022-2025 GMP programs will meet customer needs both today and in the future. Eversource tailored its 2022-2025 GMP programs to provide maximum value to customers by choosing investments designed to identify the lowest-cost solutions. The 2022-2025 GMP focuses on further technologies that modernize the grid and provide direct benefits to its customers while also controlling costs.

- Implement Cost-Effective Investments to Maximize Value to Customers – Given the rate at which technology is advancing and the turnover on technologies, it was critical to identify and invest in technologies and programs that will deliver meaningful and sustainable benefits over the full life of the asset. The Company identified investments which have value to customers and will increase the Company's ability to serve them in a safe and cost-effective manner in an ever-changing distribution grid. Further, the Company is required to report on its performance against metrics to illustrate customer benefits and cost containment. Eversource works diligently to meet or exceed these targets. With a continuous focus on capturing opportunities to lower costs and improve program efficiency, the Company works to keep costs in line with projections. The Company expanded on its proven methods for integrated planning and scheduling to integrate grid modernization programs with other infrastructure programs to maximize efficiency and maintain schedule targets for all grid-facing investments. Implementation of software programs have been characterized by similar levels of rigor with respect to maintaining scope, schedule, and budget. For each GMP year, the Company provides the Distribution Companies' third-party measurement and verification ("M&V") consultant, Guidehouse, data supporting the calculation of performance metrics, and Guidehouse produces an evaluation outlining the results of investment areas to show progress, benefits, and cost-effectiveness. This evaluation will continue for the Company's 2022-2025 GMP to illustrate that the 2022-2025 GMP is producing benefits for customers while demonstrating cost oversight and containment.

- Advance Commonwealth Policy Goals – Eversource's 2022-2025 GMP was developed to make further meaningful contributions to advancing the Commonwealth's policy goals. Massachusetts has been at the forefront of policy initiatives that support the advancement of energy efficiency and clean energy resources. Absent more accelerated investment to modernize the grid, it would become increasingly challenging to support customer demand while reducing environmental impact. Eversource is an active partner in achieving the Commonwealth's goal of increasing DER penetration. Many investments included in the 2022-2025 GMP are directly focused on making DER an integral part of a dynamic grid optimized for two-way power flow. This includes investments in the DMS, DERMS, and dynamic DER interface technology. These investments will further the Commonwealth's clean energy policies and initiatives while meeting customer demands.

- Leverage Grid Modernization Experience – Eversource has long been a national leader in grid modernization and has invested in technologies that provide greater awareness of system conditions and automation of the grid. The Company designed and implemented its 2018-2021 GMP to advance the Department's grid modernization objectives to produce tangible benefits for customers and the Commonwealth. There were several lessons learned as a result of the 2018-2021 GMP that will inform continued success going forward. The Company utilized a programmatic framework when implementing the GMP, and the importance of this framework and the Company's top-to-bottom commitment to the program cannot be overstated. It was this framework that allowed for real-time tracking and timely identification of real, or potential, deployment and/or financial challenges and inaccuracies. The investments and experiences identified through the framework for the 2018-2021 GMP influenced the development of the 2022-

2025 GMP and allowed the Company to analyze new and emerging technologies on a robust foundation. The Company will leverage its 2018-2021 GMP to enable the successful execution of its 2022-2025 GMP to further accelerate grid modernization investments in some instances, and to invest in new and different technologies in others.

- Adopt Transformational Technologies – The 2022-2025 GMP includes deployment of transformational technologies that make a meaningful contribution to supporting innovation and finding new and smarter ways to deliver benefits to Eversource's customers. In the Company's 2018-2021 GMP, the Company made significant advances in sensing, communication, and remote intelligence through the following programs: M&C, distribution automation ("DA"), ADMS, VVO, and Communications. The M&C program investments provide additional telemetry to support the DMS, providing a higher fidelity system model to distribution operators. Through the Distribution Automation programs, the Company deployed hundreds of automated overhead devices and met sectionalizing objectives on its overhead distribution system. As a result of the Urban Underground Automation program, approximately 170 antiquated, oil-filled devices were replaced with modern vacuum fault interrupting ("VFI") switches. The path to a truly modern grid will require continued investments in programs to enhance the business of delivering electricity to end-use customers. With these previous advances in sensing, communication, and remote intelligence, Eversource is positioned to leverage these investments and incorporate modern technologies to deliver more benefits of an increasingly modernized grid in its 2022-2025 GMP. This is particularly important given the increasing complexity of the grid due to technological advancements in power distribution equipment and the proliferation of DER.

- Establish a Flexible Foundation for the Future – The 2018-2021 GMP was developed to set the groundwork for further advanced grid modernization using a common platform of investments. Each investment included in the 2018-2021 GMP provided a solid foundation for the future evolution of the modern grid. The 2022-2025 GMP builds upon this foundation to further modernize the grid, providing benefits to customers and aligning with the clean energy initiatives in the Commonwealth. The investments are designed to reliably integrate into the current system, but to also provide the needed flexibility to adapt to changes in the technology landscape to support further innovation over time.

B. Summary of Grid Modernization Deployment (actual v. planned)

Figure 2 below summarizes the Company's cumulative actual and projected Grid Modernization unit deployment, as well as the Department authorized totals for programs that are tracked on a unitized basis. At the end of 2023, there were over 450 pre-authorized Grid Modernization units deployed under the 2022-2025 GMP. Deployments by investment type are also covered in detail within Section III Implementation by Investment Category of this Report.

Figure 2 2022-2025 GMP Unit Deployment (Number of Units)[1]

Unit Deployment (# of Units)							
Investment Category	Preauthorized Device Type	2022 Actual	2023 Actual	2024 Projected	2025 Projected	2022-2025 Projected	2022-2025 DPU Authorized
Monitoring & Control (SCADA and PQ)	Substation Automation	54	36	78	111	279	244
	PQ Monitoring	0	0	4	1	5	5
Volt-Var Optimization	Engo	125	58	64	578	825	840
	VVO - Regulators	0	0	0	55	55	192
	VVO - Capacitor Banks	19	0	17	190	226	224
	VVO - LTC Controls	0	0	1	9	10	28
	VVO - Line Sensors	7	0	18	342	367	1344
	Grid Monitoring Line Sensors	144	0	0	0	144	0
Communications	Wireless Communication Improvements	7	1	16	11	35	24
	Communications System Modernization	0	72	350	530	952	1351
Interface)	Dynamic DER Interface	0	1	2	1	4	24

C. Summary of Spending (actual v. planned)

Figure 3 below shows the Company's cumulative capital and O&M spending, as well as projected amounts for the remainder of the term.[2] The figure also includes the Department authorized budgets for the 2022-2025 GMP Term. Financials by investment type, including plant in-service activity, are also covered in detail within Section III Implementation by Investment Category of this Report.

[1]Figure excludes eight overhead distribution automation units deployed in 2022. These were ordered to be removed by the Department Phase I Order in D.P.U. 23-49 (the Company's 2023 grid modernization cost recovery filing), in which the Department disallowed accelerated cost recovery through the GMF for costs incurred after the conclusion of the first GMP term (i.e., cost incurred after December 31, 2021) for costs related to investment categories not proposed to continue during the second GMP term. D.P.U. 23-49, at 24. There is a pending motion on this matter addressed in Appendix A.

[2] Totals in this figure will not reconcile to the D.P.U. 22-40 Att. B Eversource spending tabs total because D.P.U. 22-40 Att. B Eversource includes energy storage. All other investment categories reconcile.

Figure 3 2022-2025 GMP Summary of Capital and O&M Spending ($)

			Total Spend ($)					
Investment Category	**Investment Type**	**Charge Types**	**2022 Actual**	**2023 Actual**	**2024 Projection**	**2025 Projection**	**2022-2025 Projection**	**2022-2025 DPU Authorized**
Monitoring & Control	Substation Automation	Capital Spend	7,001,098	9,563,227	19,344,000	19,313,000	55,221,325	
		O&M	-	-	-	-	-	
		Total	**7,001,098**	**9,563,227**	**19,344,000**	**19,313,000**	**55,221,325**	**71,500,000**
	Power Quality Monitoring	Capital Spend	64,284	219,563	3,074,000	267,000	3,624,847	
		O&M	-	-	-	-	-	
		Total	**64,284**	**219,563**	**3,074,000**	**267,000**	**3,624,847**	**4,800,000**
Volt-Var Optimization	Volt-Var Optimization	Capital Spend	2,084,231	2,179,368	14,177,000	10,596,000	29,036,599	
		O&M	40,821	14,401	240,000	-	295,222	
		Total	**2,125,052**	**2,193,769**	**14,417,000**	**10,596,000**	**29,331,821**	**40,400,000**
Advanced Distribution Management	DMS	Capital Spend	10,458,847	5,468,811	7,413,692	2,200,000	25,541,351	
		O&M	1,259,174	-	-	-	1,259,174	
		Total	**11,718,021**	**5,468,811**	**7,413,692**	**2,200,000**	**26,800,525**	**21,900,000**
Communications	Wireless Communications Improvements	Capital Spend	618,570	877,845	5,124,000	3,998,000	10,618,415	
		O&M	(40)	199,595			199,555	
		Total	**618,530**	**1,077,440**	**5,124,000**	**3,998,000**	**10,817,970**	**24,000,000**
	Communications System Moderinization	Capital Spend	-	1,475,336	4,628,000	8,203,000	14,306,336	
		O&M	-	14,803	-	-	14,803	
		Total	-	**1,490,139**	**4,628,000**	**8,203,000**	**14,321,139**	**14,000,000**
Advanced Load Flow	Interconnection Automation	Capital Spend	-	171,513	1,586,000	1,513,000	3,270,513	
		O&M	-	-	-	-	-	
		Total	-	**171,513**	**1,586,000**	**1,513,000**	**3,270,513**	**3,000,000**
	Probablistic Powerflow Modeling	Capital Spend	-	543,851	1,161,000	-	1,704,851	
		O&M	-	-	-	-	-	
		Total	-	**543,851**	**1,161,000**	-	**1,704,851**	**2,000,000**
DERMS	DERMs Implementation	Capital Spend	-	31,572	3,774,000	7,258,000	11,063,572	
		O&M	-	-	-	-	-	
		Total	-	**31,572**	**3,774,000**	**7,258,000**	**11,063,572**	**10,000,000**
	Dynamic DER Interface	Capital Spend	6,778	277,138	730,000	400,000	1,413,915	
		O&M	-	-	-	-	-	
		Total	**6,778**	**277,138**	**730,000**	**400,000**	**1,413,915**	**6,000,000**
M&V and Program Management	Third Party M&V Evaluation	Capital Spend	-	-	-	-	-	
		O&M	298,375	511,908	500,000	500,000	1,810,283	
		Total	**298,375**	**511,908**	**500,000**	**500,000**	**1,810,283**	**1,600,000**
	Program Management	Capital Spend	-	-	-	-	-	
		O&M	297,107	116,545	286,000	317,000	1,016,652	
		Total	**297,107**	**116,545**	**286,000**	**317,000**	**1,016,652**	**2,000,000**
	Systems Support and Maintenance	Capital Spend	-	-	-	-	-	
		O&M	-	-	600,000	600,000	1,200,000	
		Total	-	-	**600,000**	**600,000**	**1,200,000**	**4,400,000**
Distribuiton Automation*	Department Authorized Carryover Costs	Capital Spend	858,095	143,680	152,000	-	1,153,775	
		O&M	1,887	-	-	-	1,887	
		Total	**859,982**	**143,680**	**152,000**	-	**1,155,662**	**N/A**
	Total Grid Modernization	Capital Spend	21,091,904	20,951,903	61,163,692	53,748,000	156,955,499	
		O&M	1,897,324	857,252	1,626,000	1,417,000	5,797,576	
		Capitalization Adjustment	(246,310)	$ (19,040)	-	-	(265,350)	
		Total	**22,742,918**	**21,790,115**	**62,789,692**	**55,165,000**	**162,487,726**	**205,600,000**

Since the start of the 2022-2025 GMP term, the Company has spent $45 million, inclusive of capital and O&M. Activities in 2022 were primarily related to planning and initiation of 2022-2025 programs and closing out project work form the 2018-2021 GMP term on continuing investment categories. Due to the timing of the Department's Orders in D.P.U. 21-80, the Company was unable to start significant work until October 2022 (for Track One investments) and November 2022 (for Track Two investments). Following receipt of the Department's Orders in 2022, GMP project and program teams received initial and/or full funding authorizations through the Company's capital authorization process for several Communications, Station Automation, VVO, and Power Quality projects.

During 2023 the Company built off the work completed in 2022. The Grid Modernization team continued progressing projects through the rigorous internal capital project authorization processes, and several distribution and substations projects in the M&C, VVO, and Communications Investment Categories moved into the engineering and construction phases of work. Alongside distribution and substation projects, in 2023, the Company also made progress, meeting several important milestones on IT related projects in the ALF, ADMS as well as DERMS Investment Categories. The work completed, lessons learned, performance on implementation, benefits realized, key milestones, and future projections for each investment are all detailed further in Section III of this Report.

Report also summarizes the Company's updated projected Grid Modernization spending relative to the Department authorized budgets for the 2022-2025 GMP Term. Overall, the Company is projected to spend below the Department authorized budgets, driven primarily from the cancellation of certain site-specific projects discussed later in this Report. While the Company is projected to spend under the budget authorization overall, the ADMS investment category is projected to spend more than the initial estimates, with details provided in section III. The Company also addresses this in the Appendix A at the conclusion of this report.

Figure 4 below summarizes the Company's capital additions placed into service as of December 31, 2023[3]. In-Service projections for the 2022-2025 GMP are provided as well. The in-service projections are slightly higher than the projected capital spend due to spend on continuing investment categories (e.g., M&C, ADMS/ALF, VVO, and Communications) from the 2018-2021 GMP that were started before December 31, 2021, and incurred costs or were placed into service on or after January 1, 2022.

[3] The total 2023 in-service amount presented in Figure 4 below are also shown in the Company's annual GMF filing, D.P.U. 24-58, Exhibit ES-LML-1 (Program Cost Summary 2023), Schedule A, cell S110.

Figure 4 2022-2025 GMP Summary of Plant In-Service, Additions ($)[4]

Investment Category	Investment Type	In-Service Capital Additions				
		2022 Actual	2023 Actual	2024 Projected	2025 Projected	2022-2025 Projected
Monitoring & Control	Substation Automation	7,631,931	4,128,255	17,800,000	28,249,407	57,809,593
	Power Quality Monitoring	64,284	-	2,608,922	951,641	3,624,847
Volt-Var Optimization	Volt-Var Optimization	2,718,008	597,410	5,989,608	21,862,304	31,167,330
Advanced Distribution Management System (ADMS)	DMS	6,067,871	6,728	-	24,123,276	30,197,875
Communications	Wireless Communications Improvements	1,971,659	677,377	3,236,558	6,712,565	12,598,159
	Communications System Moderinization	-	176,111	6,377,542	7,752,683	14,306,336
Advanced Load Flow	Interconnection Automation	-	-	-	3,270,513	3,270,513
	Probablistic Powerflow Modeling	-	-	-	1,704,851	1,704,851
DERMS	DERMS	-	-	-	11,063,572	11,063,572
	Dynamic DER Interface	-	255,526	730,000	428,389	1,413,915
Distribution Automation	Department Authorized Carryover Costs	2,666,213	157,070	150,000	-	2,973,283
M&V and Program Management	Third Party M&V Evaluation	-	-	-	-	-
	Program Management	-	-	-	-	-
	Systems Support and Maintenance	-	-	-	-	-
	Total Grid Modernization	21,119,966	5,998,477	36,892,630	106,119,201	170,130,274

[4] Certain investment type totals in this figure include activity on additional investment types shown in D.P.U. 24-40 Att. B Eversource. For example, to reconcile Substation Automation above to the D.P.U. 24-40 Att. B Eversource spending tabs, one would need to add Substation Automation, Microprocessor Relay, 4kV Circuit Breaker SCADA, as well as the minimal activity on Network Protector SCADA, and Recloser SCADA investment types together. The Company addresses this in further detail in the response to Information Request DPU 1-1 filed n docket DPU 23-30.

II. Program Implementation Overview

A. Organizational changes to support program implementation

To ensure the successful and efficient implementation of the GMP, beginning in 2018, the Company layered the GMP into its existing business practices and leveraged the existing capabilities, processes, procedures, departments, and personnel within the Eversource system. This same framework continued into the 2022-2025 GMP term. Initially three positions were created by the Company for the purpose of developing and constructing the execution approach. These positions also oversee all program and project tracking and reporting, from initiation, to in service and closure. These positions include the Company's Grid Modernization Program Manager, Program Analyst and Financial Analyst. Figure 5 below shows incremental labor dollars and average full-time employee ("FTE") equivalents through December 31, 2023. While all three positions continue to exist and support the Grid Modernization initiatives, Figure 5 shows a reduction in labor and FTE equivalents in 2023 because some of the employees no longer fulfill the requirements included in M.D.P.U. No. 73H Section 4 and the associated incremental O&M expense test; the costs for these employees are now included in base rates.

Figure 5 Incremental Labor Dollars and Average FTE Equivalents

Incremental Labor Charged to O&M		
Charge Types	2022	2023
Internal O&M		
Labor Related	297,107	116,545
Average FTEs (a)	2.25	0.58

(a) Average FTEs represents partial employees due to timing of hire or charges to the program

Similar to the first GMP term and given the scope and breadth of the work, the Company chose to integrate GMP work into Eversource's existing capital controls and processes in an effort to increase efficiency and best utilize specialized technical experts. The Company cannot support GMP work without using the internal functions necessary to complete capital work. Therefore, the Company layered the GMP into its existing business practices and is using its capabilities, processes, procedures, departments, and personnel within the Eversource system to plan, design, execute, and complete GMP work. The Eversource GMP management team coordinates and facilitates oversight and engagement with multiple Eversource departments to implement the GMP, such as Procurement, Planning, Operations, and Information Technology ("IT"). This provides inter-departmental visibility into the various GMP program types and enables more effective and efficient planning of work and deployment of resources. There is significant cross-functional effort within the Company supporting the 2022-2025 GMP execution, with over 1,000 internal Eversource employees directly involved in planning, executing, and monitoring GMP investments in addition to their routine job responsibilities, enabling the Company to ensure the projects are optimally designed and executed with strong project control measures in place. The Company's customers are benefitting from the significant, system-related expertise that these employees bring to the implementation of the GMP. The Company is committed to implementing an innovative GMP in a measured and cost-

efficient manner that benefits customers and continues to advance the Department's grid modernization goals, as well as the Commonwealth's critical energy and environmental policies. The use of these employees is critical to that outcome.

Administratively, to support the integration, the team developed a process framework to implement the 2022-2025 GMP. In 2023, taking lessons learned from the 2018-2021 GMP and during 2022, the Company continued to make improvements to its program management and reporting processes. The Company uses the framework below to ensure that all GMP investments are undertaken in a deliberate and efficient manner.

Program Delivery Management

The GMP represents incremental work that was overlaid onto and integrated with Eversource's existing controls and processes. Therefore, the program management team coordinated and facilitated a blended oversight and engagement of the various departments responsible for the execution of the GMP, such as Procurement, Planning, Operations, IT, and various administrative functions. This provided inter-departmental visibility into the various GMP program types and enables more effective and efficient resource management, communication, risk management, and management of program scopes/schedules/budgets.

In 2022, the Company kicked off several 2022-2025 initiatives with project managers, holding regularly occurring program check-ins with all relevant stakeholders for specific programs (e.g., VVO and station automation). The program management team holds monthly financial review meetings with key team members to facilitate immediate and decisive review allowing for greater understanding and frequent communication of the portfolio financials ensuring alignment across the organization. The team also holds monthly Grid Modernization workplan meetings for program management, program/project leads, Grid Modernization leadership, and other stakeholders to review all program matters and progress toward the plan together. Grid Modernization project managers meet regularly with the Company's Integrated Planning & Scheduling department to evaluate resource needs and availability frequently.

Standards and Processes

The program management team developed numerous standards and processes to manage and monitor the portfolio of investments. As noted above, because of the GMPs scope and breadth of the work, the Company chose to integrate GMP work into Eversource's existing capital controls and processes effort to increase efficiency and best utilize specialized technical experts. This requires the program management team to also work cross functionally and regularly and interface with other project management offices ("PMO") and Departments at Eversource. The team continues to make enhancements and refinements to procedures based on experience, Department directives, and time spent working with Guidehouse on the measurement and verification ("M&V") process.

Portfolio Management

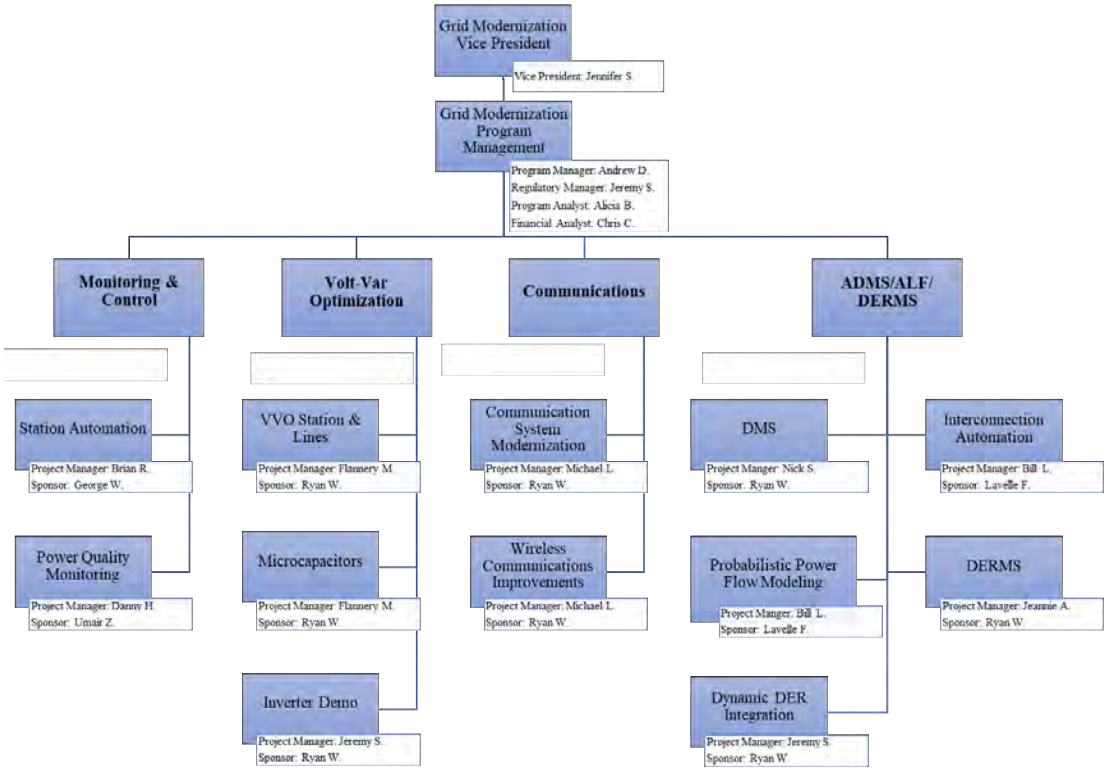
Portfolio management is a critical area the program management team enables. This includes portfolio

reporting, which requires data collection, consolidation, and maintenance. Several sets of internal and external data are needed to monitor and evaluate GMP projects, program scope, schedule, and budget, as well as performance against GMP objectives. The program management team evaluated and inventoried data required to successfully manage the large portfolio of GMP programs/projects and measure performance. This ensures weekly, monthly, quarterly, semi-annual, and annual internal and external reporting needs are aligned, supported, and fulfilled as efficiently as possible. This involves utilizing data from multiple systems and people for program reporting and performance measurement. The systems utilized include the work management system ("Maximo"), the Company's financial reporting system (PowerPlan), the Geographical Information System ("GIS"), the Outage Management System ("OMS"), as well as various other data sources. Data is aggregated for specific purposes to enable report generation and analysis that support GMP program management.

The GMP program management team further refines data allowing for internal monitoring and reporting for and performs quality assurance/quality control ("QA/QC") checks regularly. This step is critical to successful GMP execution as it allowed for visibility into the GMP implementation and enabled the Company to identify potential issues as early as possible during a given investment and develop and apply a resolution before the issue impacted the program.

Figure 6 below shows the Grid Modernization Program Implementation Organization.

Figure 6 2022-2025 Grid Modernization Program Implementation Organization



Operationally, the GMP is being implemented by a combination of internal and contractor personnel, such as line workers, electricians, technicians, IT developers, and commissioning agents. Eversource uses a matrix organizational structure, as can be seen in Figure 7 below, with many support functions cutting horizontally across the various operational resources. This structure promotes consistency across the enterprise and the ability to scale the organization to incorporate significant initiatives, such as the GMP.

Figure 7 Eversource Organizational Structure

Engineering	Grid Modernization
	Distribution Engineering
	System Planning
	Substation Engineering
	Business & Quality Assurance
Operations	Electric Field Operations
	Integrated Planning and Scheduling
	Electric System Operations
	Substation Operations
Safety	Safety
Transmission & Major Projects	Project Controls & Engineering
	Major Projects
	Siting & Permitting
	Project Controls & Engineering
Finance & Regulatory	Controller & Accounting
	Financial Planning & Analysis
	Distribution Rates
	Corporate Finance & Cash Management
	Supply Chain Management
Corporate Relations & Sustainability	Sustainability & Environmental Affairs
	Government Affairs
	Community Relations
	Regulatory Affairs
Customer Experience & Energy Strategy	Electric Service Support & Distributed Generation
	Energy Strategy
	Energy Efficiency
	Strategic & National Accounts
Genneral Counsel & Compliance	General Counsel
	Compliance
Human Resources & Information Technology	Employee & Labor Relations
	Enterprise Business Solutions
	Cyber Security
	Real-Time Business Solutions
	IT PMO

B. Cost and performance tracking measures adopted.

1. GMP Accounting Process

The Company developed an accounting framework to ensure that GMP costs were: (1) isolated from all other non-GMP O&M and capital project costs; and (2) incremental to existing and business as usual investments. The Company first undertook this exercise in the 2018-2021 GMP and has continued it into the 2022-2025 GMP. The GMP accounting framework started with the creation of new cost control centers for both Eastern Massachusetts and Western Massachusetts. Cost control centers are specific areas in which employees can charge time and expenses and help track costs for budget and reporting purposes. Although the GMP was designed and implemented across the Company's service territory, the Company is still required, consistent with the Department's directives, to maintain separate financial records for NSTAR Electric and the former WMECO. D.P.U. 17-05, at 44-45. Next, the Company created separate lines of business to track GMP projects and work orders separately from any base capital work. All GMP

projects link to one of these specific GMP lines of business and all GMP work orders link to a specific GMP project which rolls up to a GMP line of business. The figure below presents the line of business numbers and names, along with the investment categories and investment types associated with that line of business.

Figure 8 Accounting Line of Business, Investment Category, and Investment Type Mapping

Line of Business Number	Line of Business Name	Investment Category	Investment Type
12190	Advanced Sensing Technology	Monitorning and Control	Substation Automation
			Power Quality Monitoring
12180	Communciations	Communciations	Wireless Communications Improvements
			Communications System Modernization
12185	Distribution System Network Operator	Volt Var Optimization	Volt Var Optimization
		Advanced Load Flow	Interconnection Automation
			Probablistic Power Flow Modeling
		ADMS	DMS
		DERMS	DERMS Implementation
			Dynamic DER Interface
12195	Grid Mod Admin & Regulatory	Grid Mod Admin and Regulatory	Third Party M&V Evaluation
			Program Management
			Systems Support and Maintenance

Eversource internal labor direct charges their time to the relevant GMP work orders whenever possible and appropriate. In the event that these individuals cannot direct charge their time, their time is charged to Engineering & Supervision ("E&S") to be assigned across all work orders consistent with Eversource accounting practice for all capital work. The Company has created a project dedicated to incremental O&M labor associated with the Measurement and Verification and Program Management investment category. Prior to any employee charging labor to a work order on this project, they must first pass an incremental test to ensure the labor adheres to the Departments directive on incremental labor charges in M.D.P.U. No. 73H Section 4.[5] All outside services procured to design/implement/construct grid modernization capital units of property charge the GMP capital work orders and those costs are recoverable through the GMF.

2. GMP Cost Tracking Process

a. Total O&M and Capital Spend

The Company created a cost tracking process to track total spending for the entire GMP portfolio. This process was designed to be an accurate and repeatable process requiring minimal manual effort to ensure data consistency and that the spending was incremental. A customized view was created in Eversource's budgeting and financial application, Planning Analytics, which contains only GMP projects and lines of

[5] The Company has provided detailed support including documentation for this incremental labor in its Grid Modernization Factor filing (D.P.U. 24-58; see, e.g., Exhs. ES-ANB at 17 and ES-ANB-3).

business. The view contains monthly actuals, budget, variance, and projection information that are automatically populated in Planning Analytics.

- Actuals – numbers feed into Planning Analytics directly from Eversource's other financial reporting system, PowerPlan.
- Budget – numbers are input into Planning Analytics at the end of each calendar/budgeting year for the following calendar/budgeting year. Budget numbers are locked down so there cannot be any changes to the budget throughout the year.
- Variance – automatically calculated in Planning Analytics (Actuals-Budget).
- Projection – numbers are input into Planning Analytics monthly, based on project plans and actuals from prior months.

As actuals accrue for each project, the projections are updated and manually entered into Planning Analytics. The actuals, budget, variance, and projections populate in both a month-to-date and year-to-date view, and the data from the Planning Analytics view is extracted directly into Excel. On or around business day 4 of each month's accounting close process, the Grid Modernization Financial Analyst extracts the Planning Analytics data to perform a year-to-date and month-to-date variance analysis of the GMP portfolio and reports results to various groups internally. The actuals, budget, variance, and projections are presented and discussed at the Company's monthly Grid Modernization work plan meetings, as well as various other check points within the Company.

b. Total Plant in Service

The Company has created a cost tracking process to track total plant in service dollars for the entire GMP portfolio. This information is extracted from PowerPlan, Eversource's financial reporting system. To populate this information, the Grid Modernization team established a query in PowerPlan to capture all costs distinctly associated with the GMP. The query contains detailed information needed to accurately and comprehensively track GMP costs, such as FERC Account, Accounting Work Order, Entity, Funding Project, Line of Business, etc. FERC Accounts 106010 and 101010 denote that an Accounting Work Order is in service. On or around the fourth business day of the monthly accounting close, a Grid Modernization Financial Analyst will extract from Planning Analytics a plant in-service report using PowerPlan source data at the project level broken out by Line of Business.

c. Controls and Ensuring Data Accuracy

The Company created various informal and formal tracking mechanisms to report on portfolio performance and ensure the accuracy of the data. In addition to the established accounting process described above, the Company scrutinizes and assesses the reported data. Mechanisms were created to track GMP portfolio operational performance and analyze GMP work order activity. The reporting combines both financial and operational metrics of the GMP portfolio. Any identified inconsistencies are addressed and corrected in a timely manner. For example, if it is determined that a work order was

inadvertently written to the wrong GMP project and/or line of business, the analyst would work with Engineering to ensure the work order is moved to the correct GMP project and line of business.

Meetings are held with diverse groups of Eversource personnel on a regularly occurring basis for several GMP programs and on an as needed basis for project and program leads. At these meetings, the Grid Modernization Program Manager shares information related to the program including program risks, issues, and progress towards internally established targets. The individual Grid Modernization Project Managers also report on progress made for their respective areas of responsibility at monthly workplan meetings. These meetings provide a recurring opportunity and platform to discuss any issues related to or potentially impacting the GMP.

In addition, monthly review meetings are held at each accounting close cycle to review and discuss actual costs, budget, and variance to budget explanations. Meetings are held with various project managers and business area support persons. Grid Modernization financials are also presented monthly to various Eversource executives outside of the program.

Informal processes also exist outside of the formal tracking reports and regularly occurring meetings. Integrated Planning & Scheduling, Engineering, Procurement, Corporate Performance Management, and other functional groups across Eversource are in constant communication regarding all aspects of Company business, including the implementation of the GMP. Representatives of these various departments work cross functionally and collaboratively to meet GMP portfolio performance expectations. These departments also maintain their own tracking mechanisms, which are periodically cross-checked against the formal GMP source documents.

d. Grid Modernization Unit Tracking Process

GMP-qualified units are tracked by the Grid Modernization Program Manager and Program Analyst in collaboration with project managers and other functional areas. All GMP work orders are reviewed and analyzed, with any inconsistencies or other issues addressed proactively in a timely manner. Based on the attributes assigned to a GMP work order and depending on the outcome of the discussions and collaborations with the GMP Program Manager and/or Engineering, a GMP-qualified unit(s) is assigned to the appropriate GMP work order.

As described above, Eversource has developed a robust and detailed set of multi-disciplinary processes and procedures to track the costs associated with GMP projects to ensure that the Department's directives from D.P.U. 15-122 and D.P.U. 21-80 are comprehensively addressed. The Company's procedures allow for detailed analysis to support GMP investments and, eventually, cost recovery. During the 2022-2025 GMP, the Company will continuously assess its tracking and reporting processes and, as appropriate, modify those processes and adopt best practices.

C. Project approval process and how it is separate from standard capital investments.

Consistent with the Company's Capital Project Authorization Policy and procedures, all GMP projects that were placed in service in 2022 have received the requisite spending authorization consistent with the requirements under the APS 1 Project Authorization Policy.[6] Effective January 1, 2022, the Company increased the specific project threshold for all distribution operations projects from $100,000 in direct costs to $500,000 in total costs, aligning the requirements of distribution, transmission, and shared services projects. The Company's APS 1 policy was updated to align capital approval thresholds across all areas, streamline the project authorization forms to reduce any redundancies of information, and update the policy language to clarify financial versus operational protocols. The operations' approval levels increased to address inflationary impacts on costs over the years, and the change to a total cost basis brings the approval requirement more in line with the focus on the Company's customers.

[6] A copy of this policy was included in D.P.U. 24-58, the Companies annual Grid Modernization Factor Filing.

III. Implementation by Investment Category

A. System Level Narrative for Monitoring & Control

1. Substation Automation

a. Description of work completed.

In 2023, the program team began engineering development for the first five (5) Eastern Massachusetts projects and continued onsite constructability reviews of the remaining eight (8) Eastern Massachusetts projects to confirm applicability with program objects and assess construction feasibility. Following the portfolio and constructability reviews, individual capital funding requests and corresponding program releases for the remaining eight (8) Eastern Massachusetts projects were approved. In Western Massachusetts, one (1) project was approved for full capital funding.

In Eastern Massachusetts, the project team issued three (3) engineering packages for construction and subsequently initiated construction activities at the corresponding project sites. Engineering for two (2) project sites continues into 2024 and the project team plans to issue the packages for construction in Q1 of 2024. To facilitate the construction starts for the two (2) projects in 2024, the project team initiated the material procurement processes for miscellaneous substation materials as outlined in the Substation Design engineering package. Following the capital funding release for the outstanding eight (8) projects in the Substation Automation Program, the project team developed engineering milestone schedules and initiated the review of substation documentation to facilitate the development of the engineering scopes of work.

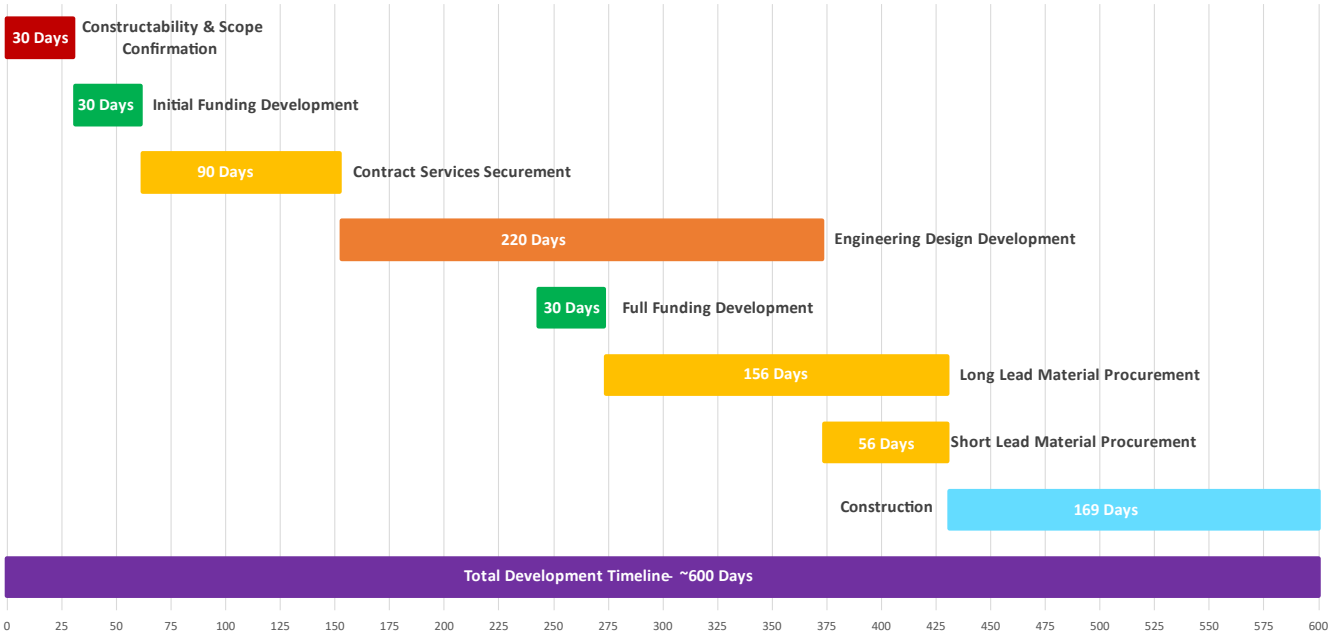
In Western Massachusetts, two (2) projects were placed in-service in parallel with other non-GMP projects within the same two (2) substations. The costs associated with any parallel work streams, both GMP and non-GMP-related, follow the Company's rigorous cost tracking protocol to ensure that only GMP-related work is charged to the relevant lines of business. For both the Breckwood 20A and Silver 30A Projects, engineering package design, procurement of long-lead materials, and outage construction activities were completed to place each project in-service in June 2023 and December 2023, respectively. For the Amherst 17K Project, engineering package development and procurement activities were continued in 2023.

In Q4 of 2022, competitive pricing for contracted engineering support was requested to support the Eastern Massachusetts Substation Automation portfolio of projects. Based off the competitive bid process, a contract was awarded in Q1 of 2023 to an engineering firm to complete the entirety of the Eastern Massachusetts scope of work. Additionally, as part of a separate competitive bid process in Q4 of 2022, a contract was awarded in Q1 of 2023 to a panel fabrication and engineering firm to procure the materials and fabricate the relay panels associated with the Eastern Massachusetts scope of work. Due to the extended lead-time associated with the relay panel materials, the project team coordinated a procurement solution with the internal Project Solutions Team to mitigate concerns with material lead-times and ensure the fabricated panels arrive in an expedited manner.

b. Lessons learned/challenges and successes.

For the 2022-2025 substation automation program, the Company considered all lessons learned from the 2018-2021 GMP and applied the best practices toward the 2022-2025 GMP term. Work completed within a substation typically requires significant coordination between Company departments. Due to the complex nature of each of the substation projects, ensuring tight coordination presents challenges throughout the program. See Figure 9 below for more detailed perspective on the end-to-end lifecycle of a standard Substation Automation Project. The contracted resources required for this work are both highly specialized, and limited within the marketplace. To compete for services and receive competitive pricing, it was important for the Company to solicit multiple projects to provide a definitive pipeline of work that could be completed in succession under a single mobilization as opposed to single projects spread out over the year with numerous mobilizations/demobilizations in between projects.

Figure 9 Standard Substation Automation Project Lifecycle Timeline (days)



Lifecyle Item	Comment
Contract Services Securement	Project team solicited bids for material procurement and engineering services for all prospective projects withing the project portfolio to ensure competitive pricing and a consistent, knowledgeable team of vendors to execute the scope of work.
Engineering Design Development	Lessons learned from past projects have been leveraged to streamline the engineering process and accelerate engineering deliverables.
Full Funding Development	Request to fully fund a project is completed after the scope of work is finalized through multiple onsite constructability reviews and the project team has a high level of confidence in the project scope / costs. Requests for funding follows the company's rigorous funding protocols to ensure budget, schedule, and scope are well-defined prior to funding being awarded.
Long Lead Material Procurement	Project team has prioritized the ordering of long-lead materials to ensure material readiness for construction starts.
Constructability Review / Construction	Multiple onsite constructability reviews are held with Station Operations and Field Engineering to solicit their feedback on the engineering design

	and ensure constructable designs to prevent design comments and delays during the construction activities.

While the project team has mitigated the risk associated with certain conventional long-lead items (e.g., the various specialized relay related equipment), miscellaneous substation materials such as cable tray and conduit still pose a risk to project execution due to the complexity of the station designs resulting in unanticipated material requirements and extended lead-times. The problem is further exasperated due to the accelerated timeline between issuing the projects' engineering designs for construction and commencing construction activities at the sites. In a conventional project workflow, miscellaneous materials would not be placed on order until the design has been issued for construction. To mitigate this risk of extended material lead-times, the project team has developed a workflow with internal and contracted engineering that allows for material ordering at an earlier point in the design process. This allows for the subsequent material purchase orders to be executed well in advance of project start.

Due to conflicting projects at multiple stations, the project team cancelled two sites under the Substation Automation Program at Station 636 Industrial Park and Station 65 Medway. Due to extensive costs required, the project team cancelled one site at Station 913 Osterville. To mitigate the risk of additional cancellations, the project team has increased engagement with key functional groups, ahead of project execution to determine if other projects will conflict with planned work under the Grid Mod Substation Automation Program. As a result of this engagement, two projects have been identified as having potential conflicts with planned large-scale capital projects, Station 20 Dedham, and Station 106 Andrew Square. The project team has increased communication with the key stakeholders of these projects to limit the impact to the Substation Automation Program.

One of the primary objectives of the Substation Automation program is to establish SCADA visibility to facilitate remote operations and enable investments for predictive outage detection and adaptive protection. Six (6) of the Eastern Massachusetts substations require fiber communications to be established prior to executing the Grid Mod Substation Automation scope of work. After a review of the project scopes with Communications Engineering, the project team was informed that extended project execution timelines for fiber installations (18-24 months) could place the Substation Automation project scope at risk. In response, the project team has increased engagement with key-stakeholders responsible for executing the fiber scope of work. This in-turn increases visibility on the critical nature of the fiber project to ensure the execution timelines support the construction sequences of the Grid Mod Projects within the Grid Modernization timeline. Additionally, as a secondary option to fiber connectivity, the project team has commenced development of a cellular connectivity design to serve as a solution for stations that have considerable constraints to establishing fiber connectivity. Additionally, the project team has increased communication with the key stakeholders of the fiber installation projects to ensure their expedited execution.

In Western Massachusetts, the project team successfully placed two (2) projects fully in-service in accordance with each project's schedule. Through lessons learned from previous Grid Modernization projects, the project team was able to align engineering, procurement, and construction efforts with non-GMP base capital projects to efficiently execute the GMP scope of work for each project on-time and under-budget. For example, in WMA, the Company is replacing outdoor circuit breaker configurations

with switchgear enclosures as a part of its base capital investments. The Grid Modernization project team is able to align with non-GMP base capital projects, by sharing construction and testing resources where there are overlapping scopes of work. This effort leads to increased efficiency and lowers costs. Also, the project team utilizes one (1) comprehensive engineering package for each station, instead of issuing multiple engineering packages for similar scopes of work.

In 2022 and early 2023, the project team also placed continuing projects that commenced during the 2018-2021 GMP into service at Stations 831, 53, and 34.

c. Actual v. planned implementation and spending, with explanations for deviation and rationale.

Figure 10 below shows the Company's cumulative capital and O&M spending, plant in-service, as well as projected amounts for the remainder of the term for the Substation Automation Program. Figure 11 below shows the actual and projected unit deployment.

Since the start of the 2022-2025 GMP term, $16.6 million of capital was spent and $11.8 million was placed into service on the Substation Automation Program. While the Station Automation Program is behind the initially filed plan for the 2022-2025 GMP, the team is working to complete all remaining station upgrades except for the three cancelled sites discussed above. These projects are also discussed below in Section h (Updated Projections for remainder of the four-year term).

Figure 10 Substation Automation Capital, O&M, and In-service Spending Summary (Shown in Dollars $) [7]

Investment Category - Monitoring & Control (SCADA and PQ)						
Preauthorized Device Type - Substation Automation						
	2022 Actual	**2023 Actual**	**2024 Projected**	**2025 Projected**	**2022-2025 Projected**	**2022-2025 DPU Authorized**
Captial Spend ($)	7,001,098	9,563,227	19,344,000	19,313,000	55,221,325	
O&M ($)	-	-	-	-	-	
Captial Spend + O&M ($)	**7,001,098**	**9,563,227**	**19,344,000**	**19,313,000**	**55,221,325**	71,500,000
Plant In-Service ($)	7,631,931	4,128,255	17,800,000	28,249,407	57,809,593	

[7] Spending totals in this figure include activity on additional investment types shown in D.P.U. 24-40 Att. B Eversource. To reconcile Substation Automation above to the D.P.U. 24-40 Att. B Eversource spending tabs, one would need to add Substation Automation, Microprocessor Relay, 4kV Circuit Breaker SCADA, as well as the minimal activity on Network Protector SCADA, and Recloser SCADA investment types together.

Figure 11 Substation Automation Unit Summary (shown in Number of Units)

Investment Category - Monitoring & Control (SCADA and PQ)						
Preauthorized Device Type - Substation Automation						
	2022 Actual	2023 Actual	2024 Projected	2025 Projected	2022-2025 Projected	2022-2025 DPU Authorized
Number of Units	54	36	78	111	279	244

d. Performance on implementation/deployment

Despite industry-wide resource constraints, the Company was able to place 54 feeders into service in 2022 and 36 feeders into service in 2023. This was consistent with the Company's projection for 2023. The Company looks forward to maintaining the detailed planning and momentum created in 2023, in its 2024 implementation. This was made possible by the continued efforts of the project team to coordinate outages, procure long-lead materials ahead of schedule, and secure contracts that support the efficient delivery of this program's scope of work. The project team continues to identify opportunities to increase project execution efficiency and coordination between the multi-disciplinary project team.

As discussed above, as part of a comprehensive review with the Company's internal Asset Management and Project Solutions teams, the project team has removed three (3) projects from the Substation Automation portfolio. Station 636 Industrial Park and Station 65 Medway were removed from the portfolio due to conflicts with planned projects at the sites which address the vintage and functionality of the relay protection scheme. Station 913 Osterville was removed from the portfolio due to the extensive costs required to achieve the upgrades at the station, as well as, requiring a separate project to establish a SCADA communication path. Due to resource limitations and engineering development timelines, additional projects were not added to the portfolio. As a result of these cancellations, the project team is now targeting a total of 16 stations for the Substation Automation portfolio (three (3) projects in Western Massachusetts and 13 projects in Eastern Massachusetts).

e. Description of benefits realized as the result of implementation

One of the most important characteristics of the modern grid is the use of advanced sensing technology to provide visibility and control to the grid edge. Area wide visibility into system conditions is the foundation upon which all advanced intelligence and real-time response depends. These investments will provide additional telemetry to support the DMS, improving the system model for distribution operators. The goal is to provide system operators with remote visibility and control of power flows required to optimize performance and reliability of the grid. The program advances this goal by increasing the penetration of remote telemetry devices in substations. These devices provide system operators with remote visibility and control of power flows on the grid required to optimize system performance and reliability. Figure 12 below highlights the feeders in which the Company installed devices as a part of the 2023 Substation Automation program. The Company upgraded 13 'spare' feeders in 2023, which are not reflected in the figure. These 'spare' feeders are located at the Breckwood 20A (6), Sliver 30A (4) and Brighton 36 (3) substations. When choosing which relays to upgrade at a station, the Company only upgrades operational

positions, a definition that includes spares. If the Company targets a spare breaker, it is because that position will be used if needed to support planned maintenance, equipment failure, or to support future growth. Figure 12 also provides the number of customers, peak demand, and interconnected DER on said feeders. More data on feeders benefiting from the Substation Automation program can be found in the Attachment B.

Figure 12 2023 Substation Automation Feeder Deployment[8]

Investment Category - Monitoring & Control (SCADA and PQ)					
Preauthorized Device Type - Substation Automation					
Feeder	**Substation**	**Towns Served**	**Number of Customers**	**Peak Demand (MVA)**	**DER Facilities Interconnected on Feeder**
3603	BRIGHTON 36	BOSTON, BROOKLINE	45	0.48	0
3604	BRIGHTON 36	BOSTON	1641	1.95	3
3605	BRIGHTON 36	BOSTON	330	0.47	0
20A11	BRECKWOOD 20A	SPRINGFIELD	0	1.30	0
20A12	BRECKWOOD 20A	SPRINGFIELD	862	2.00	36
20A13	BRECKWOOD 20A	SPRINGFIELD	1358	3.10	161
20A14	BRECKWOOD 20A	SPRINGFIELD, WILBRAHAM	1849	6.00	279
20A21	BRECKWOOD 20A	SPRINGFIELD	2558	7.10	276
20A22	BRECKWOOD 20A	SPRINGFIELD	2034	5.50	165
20A23	BRECKWOOD 20A	SPRINGFIELD	710	1.60	60
20A31	BRECKWOOD 20A	SPRINGFIELD	1599	4.90	69
20A32	BRECKWOOD 20A	SPRINGFIELD	2465	5.90	355
20A33	BRECKWOOD 20A	SPRINGFIELD	2712	9.80	269
20A34	BRECKWOOD 20A	EAST LONGMEADOW, SPRINGFIELD	1971	6.40	289
20A35	BRECKWOOD 20A	SPRINGFIELD	1665	4.20	204
30A1	SILVER 30A	AGAWAM, WESTFIELD	2528	6.80	253
30A2	SILVER 30A	AGAWAM	2303	8.80	66
30A3	SILVER 30A	AGAWAM	237	7.80	17
30A4	SILVER 30A	AGAWAM	805	4.60	55
30A5	SILVER 30A	AGAWAM	1665	4.40	150
30A6	SILVER 30A	AGAWAM	1025	5.50	116
34-1352H	LEXINGTON 320	LEXINGTON	0	0.00	0
34-1385	LEXINGTON 320	LEXINGTON	0	0.00	0

[8] Feeder 20A11 is a transfer feeder for a large customer in Springfield. Feeders 34-1352H and 34-1385 are Distribution System Supply ("DSS") feeders, therefore, show as zero customer feeders.

f. Description of capability improvement by capability/status category

The Company continued its implementation of the Substation Automation Program in 2023 with the expected delivery of the following capabilities starting in 2024. The Substation Automation Program increases SCADA visibility and control capabilities at the distribution circuit / feeder level. In many areas of the grid, system operators lack adequate visibility and control required to optimize the modern grid. Many feeders on the Eversource system still rely on older electromechanical relay technology that does not allow for remote operations, such as application of fast-trip and lock-out settings for worker safety or changes in protection settings. These older relays are not capable of remote interrogation for engineering analysis, requiring a crew to visit the substation to collect the necessary data to diagnose power quality events. In distribution substations in Eastern Massachusetts, several critical 4kV substations remain without any remote telemetry. Although these stations are among the most heavily loaded on the system, operators must dispatch crews to collect basic loading information.

The upgrades implemented as part of the Substation Automation Program will improve reliability, facilitate remote operations, and enable investments for predictive outage detection and adaptive protection capabilities. Enabling monitoring and control (SCADA) on distribution system equipment provides Eversource with accurate minimum load data for circuit segments. This data is required for Eversource to perform load flow analysis in support of Demand Response ("DR") integration and automated feeder reconfigurations within a centralized, real-time logic system like a DMS.

a) Key milestones

2023

- February 2023 – Following a competitive bid process, the program team awarded a contract to an engineering vendor for the engineering package development of all Eastern Massachusetts projects.
- February 2023 – Following a competitive bid process, the program team awarded a contract to a relay panel manufacturer for the procurement and fabrication of the upgraded relay panels for all Eastern Massachusetts projects.
- June 2023 –Project at Breckwood 20A Substation was placed into service.
- July 2023 – Full funding was approved for the one (1) remaining project located in Western Massachusetts ("WMA").
- July 2023 – Full funding was approved for the first five (5) projects located in Eastern Massachusetts.
- July / August / September 2023 – Constructability walkdowns were performed to confirm the construction feasibility and aid in the development of engineering packages on the remaining eight (8) sites in Eastern Massachusetts.
- September 2023 – Construction commenced for the first project in Eastern Massachusetts (Station 36 Commonwealth Ave).
- October 2023 – Partial funding was approved for the remaining eight (8) projects located in Eastern Massachusetts.

- November 2023 – Engineering development commenced for the remaining eight (8) Eastern Massachusetts projects.

2022

- December 2023 – Substation Automation Project at Silver 30A Substation placed into service.
- May / June 2022 – Portfolio review of targeted stations to confirm adherence with Program objectives and identify any overlapping non-GMP capital work.
- July / August 2022 – Development of program level authorization documents and individual station initial funding requests. September 2022 – Program level authorization / funding approval. October 2022 – Individual station initial funding approval for six eastern Massachusetts substation automation projects.
- November 2022 – Issuance of request for proposal packages for engineering services and materials to request competitive pricing to support the entirety of the eastern Massachusetts program and increase team efficiencies by building a partnership with vendors throughout 2025.
- December 2022 – Individual station full funding approval of two western Massachusetts substation automation projects.

g. Updated Projections for remainder of the four-year term

Refer to Figure 10 and Figure 11 for the Company's capital and O&M spending, plant in-service , and unit deployment projections for the remainder of the four-year term. Overall, the Company is projected to spend under the Department authorized budget. This underspend is driven by the cancellation of projects at Station 636 Industrial Park, Station 65 Medway, and Station 913 Osterville discussed above.

2. Power Quality Monitoring

The Power Quality Monitoring program is an M&C investment; however, it is detailed within Section VI. Company of this Report as requested by the Department.

B. System Level Narrative ADMS

1. DMS

a. Description of work completed

The DMS Project commenced in September 2021 and the initial schedule was finalized in 2022. During 2023, the Company was able to continue the data analysis cycles ("DAC") for region one (Southeast Massachusetts, Plymouth, Yarmouth, and New Bedford Stations) in preparation for the Distribution management model build cycles that make up the bulk of the DMS Program schedule. With the data available from the GIS Consolidation Project, the DMS team was able to progress through the DAC cycles 1, 2, and 3 out of 5 total cycles.

During the 2023 plan year, there was time spent creating a list of DMS points needed from all the separate databases within the Company. These points include things like voltage, watts, vars, amps, and fault data.

Ensuring the points being fed into the DMS system are essential for the DMS system to function. Once the team was confident in the points list, they identified which databases within the Company held these points. They then worked with different departments within the Company to assess the databases necessary for the DMS points list to transfer data effectively.

Differing standards and naming conventions exists across the Company's systems and regions. Therefore, in 2023 the DMS team focused engineering efforts on data analysis and designing a mapping configuration from the Company's SCADA, PowerClerk, Materials Master and CASCADE systems into the new DMS system. The DMS team worked alongside the SCADA team to create standardized naming conventions within the system across the state. The engineering team also focused on ensuring the Materials Master system is correct and up to date. Materials Master is a database within the Company that hosts the devices and settings of the devices on the distribution line. Alongside the SCADA and Materials Master, the project team worked on reviewing and updating attributes in the CASCADE database. CASCADE is a database that hosts substation information. This effort has resulted in a standardized approach to the CASCADE data. MA Powerclerk is another system that contains critical information needed for the DMS to function properly. The team also completed field review, designed mapping strategies, and tested the PowerClerk Data.

As GIS data became available, the project team went through a testing process as well extensive training on the application to ensure successful integration into DMS. This included training and testing on how to map the GIS data from the consolidated database into the DMS. As data configuration and integration between systems is an integral portion of the DMS system, the DMS team has worked extensively to ensure proper connection between systems.

Due to delays in the GIS data delivery schedule, the DMS team was forced to place the model build components of the DMS project on temporary hold as of September 2022. The restart of model build cycles and testing of the DMS project occurred in February 2024. The anticipated milestones for 2024 and 2025 are set forth in Section g below.

Figure 13 DMS DAC Schedule and Descriptions

	Description	Date started
DAC 1	Analyze Eversource data and extraction	Q2 2022
DAC 2	Analyze revised data (from DAC 1) and validation report.	Q2 2022
DAC 3	Analyze revised data (from DAC 2) and revised data extraction	Q3 2022
DAC 4	Basic topology and SCADA mapping (Completed GIS data necessary)	Q1 2024
DAC 5	Topology including customers and steady power flow.	Q2 2024[9]

GIS data is a critical piece of the MA DMS system as it provides a real time mapping display of field assets. The GIS system contains the data that is essential for the DMS to function (i.e., voltage data, single versus three phase lines, distributed power flow, fault location, fault isolation and service restoration

[9] Q2 2024 is an anticipated start date.

(FISR)). The data integration from GIS to DMS is critical. As the program is currently set, the MA DMS will not function properly without GIS data. In 2023, the Company experienced delays on the GIS consolidation project[10]. This, in turn, delayed the model build and testing portions of the DMS project.

The Company has also incorporated previous knowledge on a prior DMS project, specifically around IT infrastructure and firewalls. In 2023, the DMS project was heavily focused on the IT components of the project. Using knowledge and experience from a prior DMS project completed by the Company has enabled a more expedient rollout of the IT components on the MA DMS project. However, the MA DMS project does include differing components from the Company's prior DMS project. Where prior knowledge and experience could be applied, they were. In newer components, the Company has planned these components using industry standard framework and works to find creative and succinct solutions when problems arise.

The Company has also included personnel from the prior DMS project on the MA DMS project team. This has proved to be integral in knowledge and resource development. This included hands on training where applicable. Where the Company was not able to utilize the same internal resources, they ensured the internal resources from the prior project were available for knowledge transfer and training for the five new engineers on the MA DMS project.

b. Lessons learned/challenges and successes.

In 2022, the team learned that there was an increased need to integrate schedules more tightly with other non-grid modernization projects upon which the DMS project is dependent. The Eversource team was successfully able to adjust to changes in program priorities and to work with its vendor to continue to make meaningful progress with shifting priorities and resources.

In 2023, the DMS team was able to successfully mitigate a continued interdependent GIS project delay by rethinking the project deliverables and completing the required IT components. The IT work completed in 2023 enabled the DMS team to focus on the model build work when the data from the interdependent GIS project became available in Q1 2024.

c. Actual v. planned implementation and spending, with explanations for deviation and rationale.

Figure 14 below shows the Company's cumulative capital and O&M spending, plant in-service, as well as projected amounts for the remainder of the term for the ADMS Investment Category.

Since the start of the 2022-2025 GMP term, $15.9 million of capital was spent and $6.1 million was placed into service in the ADMS Investment Category. These amounts also include $3 million of capital and $6 million of in-service in 2022 on Advanced Forecasting and PI Asset Framework. These two investments originated in 2021 were not placed into service until 2022. More information on these projects can be

[10] Prior to the GIS Consolidation Project, the Company relied on multiple GIS systems. In 2024, the GIS Consolidation Project went live (into service), and the Company now has a consolidated GIS system for its Massachusetts territory.

found in the Company's 2022 GMP Annual Report filed in D.P.U. 23-30, at page 45, and the Company's revised 2018-2021 GMP Term Report at 85-97. The revised 2018-2021 GMP Term Report was filed in Docket D.P.U. 22-40 on April 19. 2022.

The DMS project schedule has been delayed by more than six months due to an interconnected project dependency delay, which resulted in lower than planned spend activity in 2023. Though DMS project work has continued, the DMS project has been delayed as result of the interdependent GIS project delay. Without the necessary input of the completed interdependent project, the DMS team was not able to move forward on a critical portion of the project until Q1 2024. Therefore, the overall schedule has been delayed, and the "Go-Live" date has been affected. The DMS team, however, has worked diligently to complete all tasks available during the interdependent GIS project delay, including all IT infrastructure and IT design components as well as all IT firewall implementation to ensure a successful and accelerated restart in Q1 2024. The work completed in 2023 will ensure an expedited go-live. . As expected, the spending has been under budget for this year.

Figure 14 ADMS Capital, O&M, and In-service Spending Summary (Shown in Dollars $)[11]

Investment Category - Advanced Distribution Management System (ADMS)						
Preauthorized Device Type - Distribution Management System						
	2022 Actual	**2023 Actual**	**2024 Projected**	**2025 Projected**	**2022-2025 Projected**	**2022-2025 DPU Authorized**
Captial Spend ($)	10,458,847	5,468,811	7,413,692	2,200,000	25,541,351	
O&M ($)	1,259,174	-	-	-	1,259,174	
Captial Spend + O&M ($)	**11,718,021**	**5,468,811**	**7,413,692**	**2,200,000**	**26,800,525**	21,900,000
Plant In-Service ($)	6,067,871	6,728	-	24,123,276	30,197,875	

d. Performance on implementation/deployment

Not applicable for year ending December 31, 2023.

e. Description of benefits realized as the result of implementation.

Not applicable for year ending December 31, 2023. The DMS has not been implemented yet. The expected in-service date is Q1 2025. The Company has identified no variances to planned benefits that will be delivered at program completion. Those benefits include:

- Computer-Assisted decision making for the Distribution system operators to minimize electrical losses, improve full system reliability, and asset utilization.
- Provide Operators with a system-wide, real time load flow model to provide opportunities to optimize systems and utilization.

[11] Spending totals in this figure include activity on additional investment types shown in D.P.U. 24-40 Att. B Eversource. To reconcile ADMS above to the D.P.U. 24-40 Att. B Eversource spending tabs, one would need to add five ADMS preauthorized types (DMS, Advanced Forecasting, Synergi Upgrades, PI Asset Framework, and GIS Verification) together.

f. Description of capability improvement by capability/status category

Not applicable for year ending December 31, 2023. The Company has commenced its implementation of the DMS for its control centers with the expected delivery of the following capabilities by Q1 2025:

- System-wide three-phase unbalanced power flow calculation in real time.
- System-wide fault location, isolation, system restoration ("FLISR") capability.
- Model-based VVO application within DMS.
- Electronic switch order management.
- A study mode that allows a user to evaluate a system condition prior to acting; and
- Distribution operator training simulators to enhance the training program for operators.

g. Key milestones

Not applicable for 2023. Below are the scheduled milestones for 2024 and 2025.

- Data analysis complete 8/14/24
- Modeling complete 10/14/24
- Pre-system acceptance test complete 11/1/24
- System acceptance testing complete 1/2/25
- Final system acceptance (Go-Live) 2/28/25

h. Updated Projections for remainder of the four-year term

Refer to Figure 14 for the Company's cumulative capital and O&M spending, plant in-service, as well as projected amounts for the remainder of the term. Overall, the Company is projecting to be over budget in the ADMS investment category by $4.9 million. The DMS project alone is close to budget for the term at $22.6 million capital spend and $24.1 million in-service, and the overage in the AMDS investment category is due to projects that were started and planned for under the 2018-2021 GMP term being placed into service in 2022. Please also refer to Section c Actual v. planned implementation and spending, with explanations for deviation and rationale above. Pursuant to the Department's Order issued in D.P.U. 23-49, costs on work orders placed into service after December 31, 2021 are subject to the 2022-2025 GMP budgets if the costs were planned for and commenced as part of the 2018-2021 GMP term.[12]

C. System Level Narrative VVO

1. VVO

a. Description of work completed.

In 2022, the project team initiated the program with a detailed portfolio review of stations targeted by the 2022-2025 Volt-Var Optimization ("VVO") program to confirm applicability with program objectives

[12] Treatment of these costs is addressed in the Company's pending July 24, 2023 Motion for Clarification and Reconsideration filed in D.P.U. 22-40 and D.P.U. 23-49.

and to identify any overlapping scope relative to existing initiatives. Preliminary selection of substations was completed by analyzing characteristics such as peak load, number of customers, and circuit construction. The Company also utilized lessons learned for VVO substations deployed in the 2018-2021 term. The program team coordinated with the Company's key functional area leads across Eastern Massachusetts and Western Massachusetts to finalize the scope of the VVO program for each substation.

Program-level capital funding authorization was received in August 2022, which was then followed by individual initial funding requests and program releases for the first installment of VVO substations. In Eastern Massachusetts, Wareham 714, Cross Rd 651, and Mashpee 946 received initial capital funding authorization of $200,000 per substation. In Western Massachusetts, Breckwood 20A, Doreen 19A, Franconia 22H, and Orchard 27A received initial capital funding authorization of $200,000 per substation. Work completed on the VVO program in the first half of 2022 focused on executing field deployment of 2021 carryover devices as well as measurement and verification activities as a continuation of the 2018-2021 GMP.

In October 2022, the VVO program team held project kick-offs with the key functional area leads and technical stakeholders to review the program objectives, scope, and device deployment schedule to support the 2022-2025 effort. The distribution device location analyses were initiated for each VVO substation and circuit to finalize the distribution device counts, exact installation location, and circuit voltages for each unit to proceed with the design and engineering efforts.

The program team commenced the long lead procurement process with the Material Logistics team for an initial number of 50 capacitor banks and capacitor controls. This order was placed to get ahead of long lead times while the new material standard was in development. This allows the team to order the remainder of the deployment needs quickly once the material standards are finalized. The development of new material standards was deemed necessary considering the extended lead times for materials seen in the 2018-2021 GMP deployment. To mitigate the potential risk of untimely material deliveries and subsequent project delays, the Company decided to standardize third-party capacitor and regulator controls that can interface with a variety of capacitor and regulator head units, thereby allowing for flexibility in sourcing the head units from multiple manufacturers and therefore improving on the lead time constraints. By adopting this approach, Eversource will be better positioned to address the issue of extended lead times by diversifying its vendor base.

At the time of the new material standard development, the project team was quoted 40 weeks for new capacitor head units from the supplier. However, when the orders for the units were placed, the lead time had increased to 70+ weeks and growing. The project team placed the required capacitor head unit and control orders from Q4 2022 to Q2 2023, which targeted material delivery in 2024 and 2025.

The VVO program team made considerable progress with resource on-boarding, engineering development, material procurement, and distribution pilot processes in 2023. In January 2023, on-site kickoffs were held with key functional area leads and technical stakeholders to review scope and verify existing substation assets and facilities. During this process, the team confirmed that the load tap changer ("LTC") controllers at Breckwood 20A, Orchard 27A, Montague 21C, Doreen 19A, and Wareham 714 were already upgraded to the M2001-D series by other base capital programs. With these facilities already

being in place, no units of property were required to be installed by the VVO program. However, in support of VVO, the assets would need to be reprogrammed to provide all data points necessary for DMS to function properly, which would be captured as O&M expense cost versus capital. In collaboration with the DMS team, the VVO team has worked to train and educate the Company's key functional areas around DMS requirements, purpose, and implementation needs. Previous projects did not have DMS requirements or objectives, which gave the VVO project team the opportunity to commission the station LTCs and relays into DMS.

In addition to the stations that had existing Beckwith M2001-D controls, two (2) VVO stations, Sherborn 274 and Industrial Park 636, were cancelled due to performance issues with the existing infrastructure and conflicting projects, respectively. As a result of this final substation analysis, the Program updated the number of LTC controller replacements from 26 units to 13 units. In parallel, the program team proceeded with on-boarding Eversource Engineer-of-Choice vendors to support the station engineering development at Cross Rd 651 and Mashpee 946. Both stations progressed to the 30% design phase by the end of the year.

By Q3 2023, all distribution line devices had been placed on order with the Company's Procurement and Material Logistics teams. Capacitor bank lead times were quoted up to 70+ weeks, which emphasized the importance of ordering all material in 2023. As previously mentioned, newly standardized capacitor banks were originally quoted at a 40-week lead time. With the significant increase in lead time, the project team re-baselined the deployment schedule to accommodate for the delay. The material ordering process was in direct relationship to the Grid Modernization engineering team completing the device location analyses based on the circuit models and VVO needs on the system. All device location analyses were completed in 2023 for capacitor banks, voltage regulators, and voltage sensors. A portion of the microcapacitor/ENGO location analyses were also completed prior to year-end. The Company's Eastern Massachusetts ("EMA") Distribution Engineering team completed all distribution sketches and work orders in December 2023, totaling four out of four stations in EMA. Four out of the seven WMA station work orders and design sketches were also completed in 2023 and progressed to construction-ready status.

The VVO program team was able to make considerable progress with the pilot / demo installations in both EMA and WMA for capacitor banks in 2023. With the new equipment standards finalized and in alignment with the Company's process for implementing new equipment standards, the team worked through the demo process to pilot test the third-party controller. This allowed the key functional areas to receive training, education, and a better understanding of the new control and its capabilities. With this greater understanding, it would allow each group to commission each device successfully into SCADA and DMS. The WMA capacitor bank demo location was successfully commissioned in December 2023, with the EMA demo process near completion. The voltage regulator demo process was also kicked off in 2023 with full completion anticipated in July 2024.

The VVO program team also secured full funding authorization through the Company's approval process for five out of 11 distribution line projects as well as initial funding authorization for all stations and microcapacitor/ENGO projects. Full funding authorization allows projects to proceed to construction while initial funding authorizes engineering resource on-boarding and progression to preliminary design.

b. Lessons learned/challenges and successes.

Continuing from the 2018-2021 GMP into 2022 and 2023, the Company has observed significant supply chain challenges related to the distribution-line portion of the VVO initiative. From a planning perspective, the unprecedented increases in material lead times and shortages have led to reassessment of device deployment and planned installation schedules. Most of the distribution equipment planned to be installed under the VVO program currently have lead times of at least 70 weeks. At the time of procurement in 2022 and 2023, the lead time was quoted by the vendor at 40 weeks. After placing orders, the anticipated delivery dates were delayed by the vendor on more than one occasion, pushing the time of anticipated delivery up to 96 weeks. In order to track and mitigate delivery delays the project team established a monthly meeting series with the vendor, which allowed for additional visibility into the delays. Figure 15 below shows the growing lead times of the capacitors from 2019 to final orders placed in 2023. This data is based upon latest vendor delivery dates. This challenge has impacted logistics regarding resource planning and device deployment planning for 2023 and persists into 2024. The Company also worked to find alternatives, such as standardizing regulator and capacitor controls, which are compatible with units from other manufactures. This would allow the Company to diversify suppliers and potentially mitigate some of the delays associated with long lead times. While this flexibility with suppliers will be beneficial for the Company going forward, the impact during the 2022-2025 GMP is limited.

Figure 15 Capacitor Lead Time from 2019-2023

Year Order Placed	Delivery Lead Time (weeks)
2019	40
2020	40
2021	40
2022	96
2023	83

Throughout 2023, the VVO program team has put a significant amount of focus on the pilot / demo and training processes for capacitors and regulators. The team has found it effective to hold weekly meetings with all technical stakeholders in order to leverage resource-sharing, iterations of lab-testing, and training across various teams. Due to the level of involvement around the pilot and training processes, construction installations were re-aligned to start in 2024.

Regulators

The lessons learned from 2018-2021 GMP relate to the potential for extended planning and permitting processes for large platform-mounted voltage regulators, as well as very long lead times, leading the Company to continue to carefully evaluate the number and type of voltage regulators required to provide VVO benefits. As part of an overall strategic approach, the Company also utilized microcapacitors/ENGOs in lieu of regulators to bolster voltage support for 2022-2025 GMP VVO stations

and feeders experiencing low voltage. Because of this approach, only one new voltage regulator will be installed during the 2022-2025 GMP term. By focusing on the deployment of capacitors and microcapacitors/ENGOs, the Company also predicts that it can be more aggressive with its VVO control schemes, which will lead to additional voltage reduction benefits.

Capacitors
The lessons learned from the 2018-2021 GMP related to factory-caused communications and wiring discrepancies, as well as incompatible sensors, are being considered for the 2022-2025 GMP term. Thoughtful engineering design has allowed the Company to standardize on sizes of capacitor banks and order material earlier in the deployment schedule. Early arrival of devices helps to mitigate long material lead times as well as to incorporate adequate time for field testing and any applicable mitigations that may be needed prior to full commissioning.

Line Sensors
The lessons learned from the 2018-2021 GMP VVO line sensors include discovery of communication errors surrounding the head end sensors and manufacturing defects with the end-of-line/grid-edge sensors. These errors caused erroneous voltage reads at the sensor locations. The Company worked with the sensor vendor to design changes to mitigate these issues. All future end-of-line/grid-edge sensors purchased from the vendor will incorporate these design changes. A manufacturer-led refurbishment plan is being implemented for all previously deployed end-of-line/grid-edge sensors; all previously deployed sensors are expected to completely be refurbished by Q2 2025. Expenses related to this effort are not a part of any GMF filing. The manufacturer is paying for any costs related to the refurbishment. The costs related to removing/reinstalling the defective/refurbished line sensors is non-grid modernization O&M.

Going forward in the 2022-2025 GMP term, the Company plans to utilize relay-based sensors located at the feeder breaker rather than line sensors to eliminate these issues.

LTC
The lessons learned from the 2018-2021 GMP LTC program are being considered for the 2022-2025 GMP. Specifically, the Company is focused on ensuring it has sufficient time to plan and allocate the correct resources, as well as ensuring close coordination between Company departments.

Microcapacitors/ENGOs
Expanding the microcapacitor/ENGO deployment to new operating areas of the Company had provided challenges engaging new stakeholders and incorporating new technologies into preexisting processes. Lessons learned relative to identification of key stakeholders in each area, as well as further effort from the project team to require regular updates, have been utilized to mitigate any potential future challenges. Lessons learned from the 2022 GMP deployment of the microcapacitors/ENGOs will be utilized in 2023-2025 for both future deployments of microcapacitors/ENGOs as well as the rest of the VVO portfolio.

Advanced Inverters
The Advanced Inverters program is a VVO investment; however, it is detailed within Section VI. Company-Specific Reporting – NSTAR Electric of this report as requested by the Department.

c. Actual v. planned implementation and spending, with explanations for deviation and rationale.

Figure 16 below shows the Company's cumulative capital and O&M spending, plant in-service, as well as projected amounts for the remainder of the term for the VVO Investment Category. At the end of 2023, approximately $1.3 million was spent on VVO projects which is less than originally planned. Figure 17 shows the cumulative and projected unit deployment.

Figure 16 VVO Capital, O&M, and In-service Spending Summary (Shown in Dollars $)

Investment Category - VVO						
Investment Types - Various						
	2022 Actual	2023 Actual	2024 Projected	2025 Projected	2022-2025 Projected	2022-2025 DPU Authorized
Captial Spend ($)	2,084,231	2,179,368	14,177,000	10,596,000	29,036,599	[redacted]
O&M ($)	40,821	14,104	240,000	-	294,925	[redacted]
Captial Spend + O&M ($)	**2,125,052**	**2,193,472**	**14,417,000**	**10,596,000**	**29,331,524**	40,400,000
Plant In-Service ($)	2,718,008	597,410	5,989,608	21,862,304	31,167,330	[redacted]

Figure 17 VVO Unit Summary (Shown in Number of Units)

Investment Category - VVO						
Preauthorized Device Type	2022 Actual	2023 Actual	2024 Projected	2025 Projected	2022-2025 Projected	2022-2025 DPU Authorized
Engo	125	58	64	578	825	840
VVO - Regulators	0	0	0	55	55	192
VVO - Capacitor Banks	19	0	17	190	226	224
VVO - LTC Controls	0	0	1	9	10	28
VVO - Line Sensors	0	0	18	342	360	1344
Grid Monitoring Line Sensors	144	0	0	0	144	0

d. Performance on implementation/deployment

Throughout the scope verification process in 2023 for the VVO station scope, two of the VVO substations in EMA, Sherborn 274, and Industrial Park 636, were removed from the portfolio and will not be proceeding to completion. Sherborn 274 would require a full transformer replacement in order to implement VVO to its full benefit. At the time of the on-site project kickoffs, the transformers at Sherborn 274 were exhibiting performance issues and therefore it was not favorable to only replace the LTC controllers as it would not fulfill the objective of improving voltage control. At Industrial Park 636, all Grid Mod scope, inclusive of VVO, was cancelled due to a battery energy storage project in progress, which would prevent the Substation Automation scope from being complete by December 2025.

e. Description of benefits realized as the result of implementation.

Benefits realized from the 2018-2021 GMP related to VVO enabled feeders continued to be realized through 2023. Like the 2018-2021 GMP implementation, once devices are installed and commissioned, the immediate benefits of increased visibility and control of devices will be realized.

Additional measurable benefits will be realized through reduction in energy and reduction in peak load reduction. These benefits will be measured as part of the Company's proposed performance metrics. The Company expects to reach a 2.2 percent reduction in energy and 1.8 percent reduction in peak load demand for every percent voltage reduction from the VVO circuit deployed[13]. For the substations selected during preliminary analysis, a total of 506 MW of peak load and 1,996 GWh of energy were consumed in 2022. Based off the expected estimates of power and energy reduction, the Company estimates 3.0 MW and 43.9 GWh, or peak reduction and energy reduction, respectively. It should be noted that these values are projections based off 2022 loading data of preliminarily chosen substations with a one percent voltage reduction, changes in station selection or customer load at these stations will affect the savings projections.

The investments made during the 2018-2021 GMP VVO program as measured throughout 2022 resulted in a 0.4 percent reduction in end-use energy. This estimate provided by Guidehouse is a conservative estimate taking into account operational downtime of the system and, as such, falls slightly below expected values. Despite the conservative energy reductions, the Company exceeded its projection of CVR factors achieving an approximately 0.6 percent reduction of energy for every percent voltage reduction on feeder evaluated, a 0.1 percent increase from expectations. Although the Company has remained conservative in its deployment of VVO to date in order to ensure no adverse impacts to customers served by VVO feeders, further optimization of the VVO logic has the potential to drive additional savings in energy and demand.

The 2022 performance metric results were shared through the Massachusetts Grid Modernization Program Year 2022 Evaluation Report – Volt Var Optimization" by Guidehouse, the program evaluator, in June 2023.

f. Description of capability improvement by capability/status category

Capability improvements made during the 2018-2021 GMP related to VVO enabled feeders continued to be realized through 2023. No capabilities improvements have been made for the 2022-2025 VVO stations and circuits as none of the station or line devices have been commissioned. Once commissioned, the capability improvements are expected to be similar to improvements experienced at the 2018-2021 GMP targeted stations and circuits.

Metering of VVO field devices at the stations and along the circuit, which are timestamped and archived by the VVO control software, delivers a level of visibility and monitoring into the distribution system that was previously unavailable. In addition to understanding and quantifying the benefits of VVO, the Company is using this data to gain additional insight into energy use patterns along the feeder. This

[13] D.P.U. 21-80, page 65

capability is available at VVO enabled circuits targeted by the 2018-2021 GMP and will eventually be available at more VVO circuits targeted by the 2022-2025 GMP.

Performance metrics related to VVO have shown reduction in energy usage, lines losses, and greenhouse gas ("GHG") emissions on 2018-2021 GMP VVO enabled circuits. These capability improvements are expected to be realized at 2022-2025 GMP VVO enabled circuits.

g. Key milestones

2022

- August 2022 – Program level authorization / funding approval and individual station initial funding approval / initial procurement activities commenced.
- October 2022 – Eastern and Western Massachusetts VVO Engineering program kick-off meeting held.
- November/December 2022 – Preliminary engineering design completed and preliminary purchase orders for long leading material issued.

2023

- January 2023/February 2023 – Site walkdowns were held at all VVO stations to engage key technical stakeholders as well as confirm existing facilities and scoping items.
- October 2023 – Distribution line device location analyses completed for all VVO circuits in EMA and WMA.
- August 2023 – Direct awarded contracts to EOC vendors to support VVO Station Upgrades projects at Mashpee STA 946 and Cross Rd STA 651.
- November 2023 – Successful on-boarding of Sentient Energy to manufacture and provide Microcapacitor/ENGO units as well as engineering/placement analysis support for 2.0 deployment.
- December 2023 – Completion of all EMA work order/design development for capacitors, regulators, and sensors.
- December 2023 – Completion of WMA capacitor pilot/demo process for 2.0 program by way of successful installation and SCADA commissioning.

h. Updated Projections for remainder of the four-year term

Refer to Figure 16 and Figure 17 for the Company's projections for the remainder of the four-year term. Overall, the Company expects to finish the term below budget, primarily driven by the site cancellations discussed in the above sections as well as an overall lower than originally planned for number of devices expected to be needed to enable the planned benefits of VVO. In Figure 17, the Company is projecting to require significantly less regulator, lines sensor, and LTC control installations versus the original plan.

D. System Level Narrative Communications

1. Wireless Communications Improvements

a. Description of work completed.

In 2022, the Company completed an analysis of its private radio spectrum strategy resulting in a decision to utilize the 220 MHz frequency for its Wireless Communications Improvement Program. This analysis considered latency and bandwidth requirements for field devices communicating into the Company's eECS (SCADA) system that will drive power flow and automation capabilities of the DMS. Based on the results of this analysis, the Company initiated the initial 220 MHz spectrum planning and design. The Company also started the design phase for three new master radio sites continued to work on 2018-2021 GMP projects that were not fully implemented and closed by the end of the 2018-2021 term. In 2022, the Company commissioned seven node sites that were not implemented by the end of 2021. One node was commissioned in each of the following sites: Nobscott, Zion Hill, Prudential Center, Shoot Flying Hill, and the Southborough Service Center. The last two nodes were in East Springfield.

During 2023, much of the work focused on implementation of the design completed during 2022 utilizing the 220 MHz spectrum for wireless data communications in Massachusetts.

In parallel with implementation of the 220 MHz design, previously identified 450 MHz base radio stations in WMA were also pursued.[14] The 450 MHz wireless data base station at the Pittsfield area work center was placed into service in August 2023. Another base station located at the Agawam substation was constructed and commissioned by March 2024.

In order to implement the previously completed design, a review of existing Eversource facilities to determine if they were suitable for use as 220 MHz base radio sites was completed. When evaluating a facility to determine if it is a viable candidate for a base radio site, the Company evaluates several key items. The structure must be in good condition and capable of supporting the proposed equipment additions at the required heights to be useful. There must also be a large density of field devices in the vicinity of the proposed base radio. Locating a structure on property owned by the Company both mitigates risk and is more cost effective than pursuing a location owned by a third party. If no Company assets are identified in an area of high density of field devices, then third-party facilities are considered and evaluated.

To determine site feasibility, the Company completes engineering design visits to gather detailed information on each candidate site. During the site visit, structure condition and mounting space availability are assessed. Equipment shelter availability, power requirements, interconnection options and emergency power availability are also investigated. The detailed information gathered during these site visits is used to evaluate the structural capability of the facility to ensure it can safely support the proposed equipment additions. The information is also used to generate construction drawings depicting the

[14] The Company has seen similar results with both 450MHz and 220MHz radio frequencies. Deploying both frequencies simultaneously will increase the Company's overall wireless communications capacity.

proposed equipment installation. Facilities that fail structural analysis or cannot meet any of the other site requirements are removed from consideration.

Once these investigations are completed and a site is determined to be a viable candidate for base radio location, a project budget is developed and authorized through the Company's Project Authorization Policy.

As of the end of 2023, 16 locations have been identified as good candidates for wireless data base stations operating at 220 MHz. At thirteen (13) of these locations Eversource will deploy 220 MHz equipment for the first time. At the remaining three (3) locations existing equipment will be modified to allow for the addition of new 220 MHz data radios. The Company anticipates that these sites will be brought into service during 2024 and 2025.

The Company continues to investigate additional candidate evaluations and up to four more locations may be pursued. In some instances, it may be prudent to increase the capacity of one of the new 220 MHz sites by adding in a second frequency for data communications. Deploying equipment capable of utilizing multiple frequencies is cost effective and the Company seeks to employ this methodology wherever appropriate.

Figure 18 and Figure 19 below show the expected radio frequency coverage, shown in green, at 220 MHz from the proposed base radio sites. The dots on these maps illustrate field devices which may communicate with the 220 MHz base radio sites. Each potential candidate's coverage was analyzed using radio frequency propagation modeling software and geographic information on existing and proposed field devices. Candidate sites that provided reliable radio coverage to the largest number of field devices and had no impediments to construction were selected.

Figure 18 Coverage from Proposed 220 MHz Data Sites in Eastern Massachusetts Northern Territory

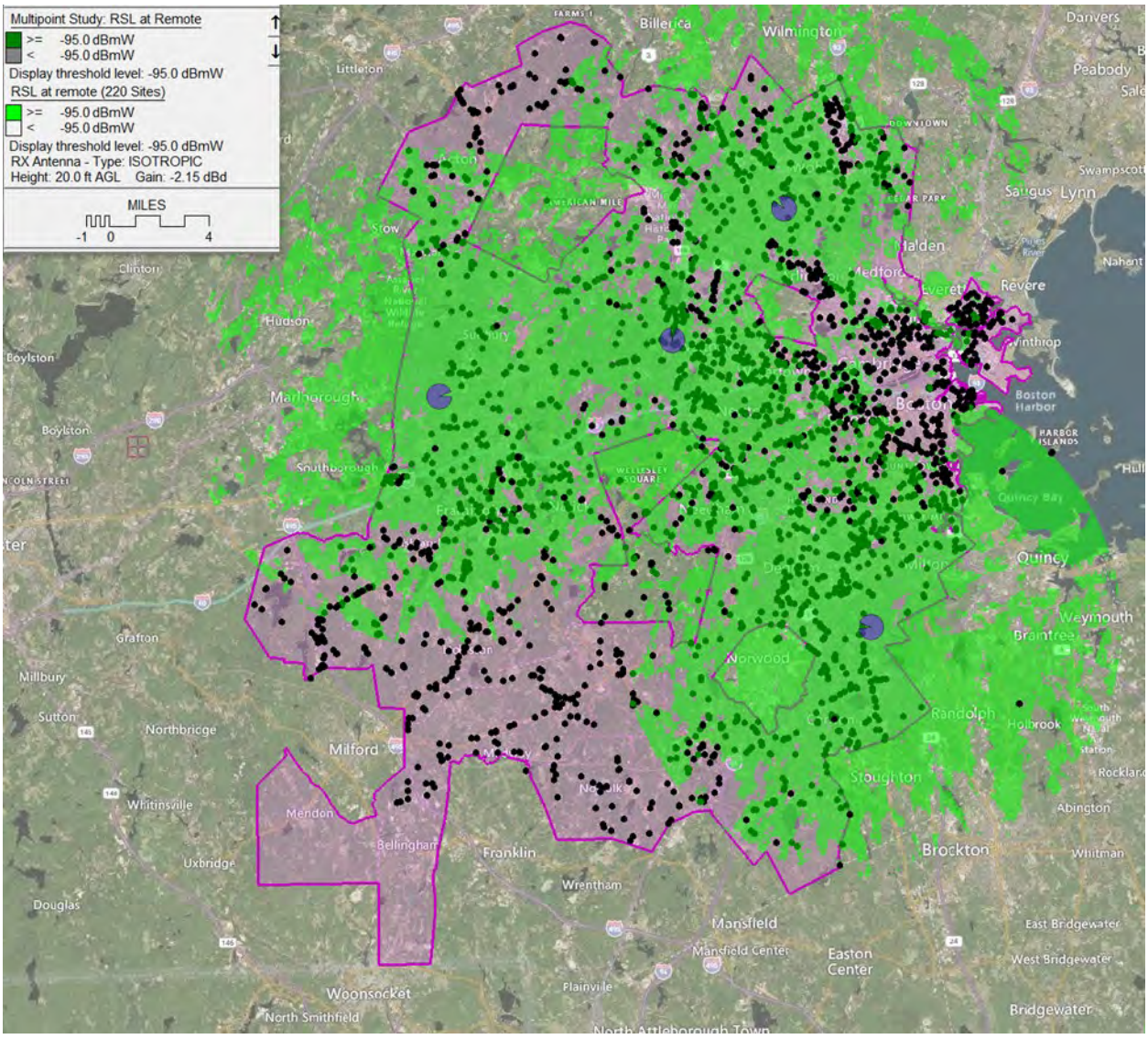
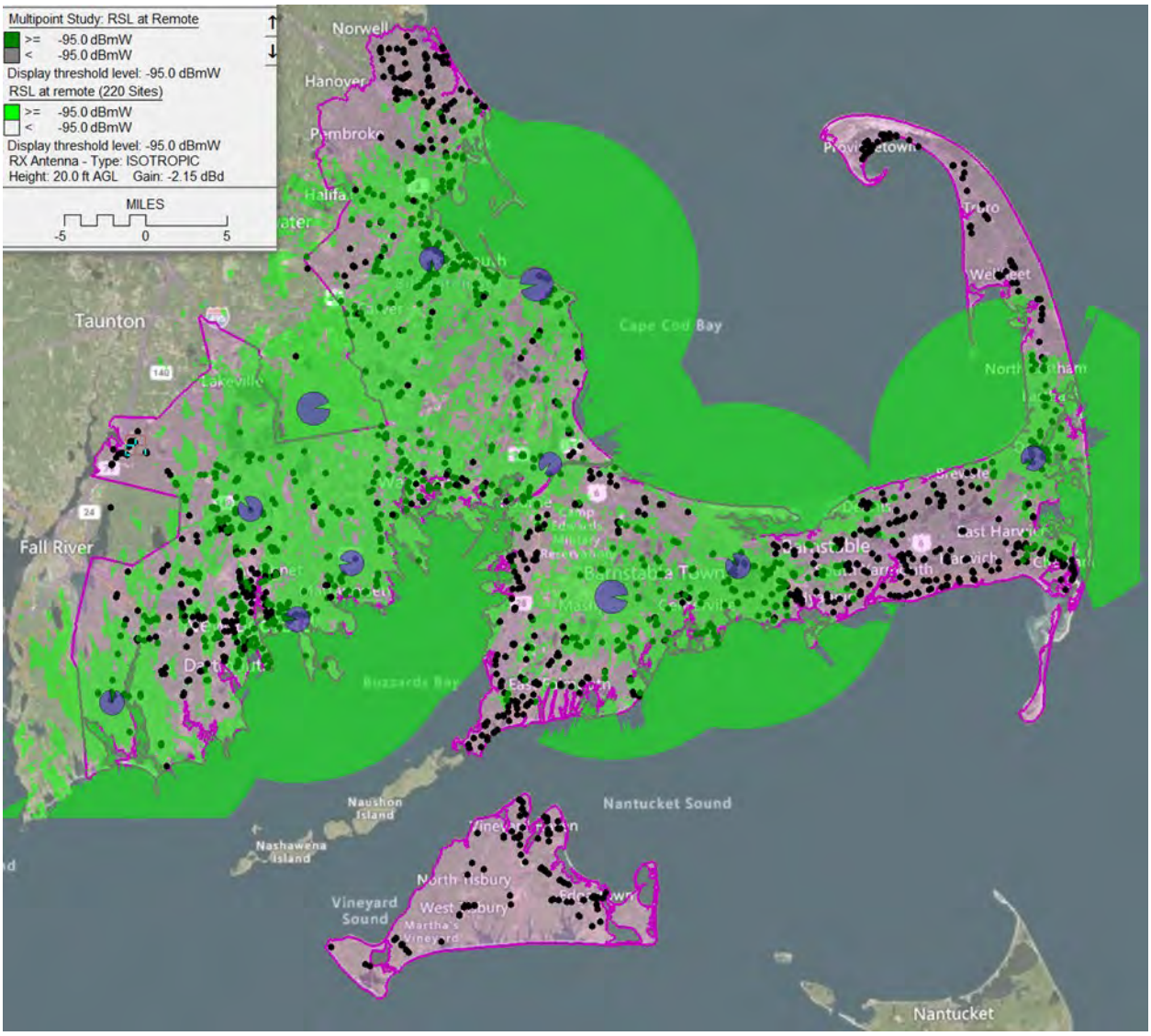


Figure 19 Coverage from Proposed 220 MHz Data Sites in Eastern Massachusetts Southern Territory



b. Lessons learned/challenges and successes.

In 2022, the Company experienced several delays in commissioning devices onto new master radios. The commissioning delays were largely driven by a lack of internal technical field communication resources to test the end-to-end transmission of data from field devices into the eECS system. This reduced the number of devices that were able to be commissioned onto the new master radios. A lesson learned that has been included in the planning for the remainder of the term is to ensure the Company has detailed plans to start commissioning devices as soon as the master radio is available to ensure no down time between the activities.

The Company successfully engineered a design for the 220MHz spectrum to enable secure and efficient transmission of data from field devices to the SCADA system. Selecting and licensing the 220 MHz spectrum for use with the SCADA communications network was a major milestone enabling the Company to design the remaining locations planned for in the 2022-2025 GMP. The new 220 MHz spectrum will augment the existing 450 MHz and 900 MHz spectrums to create a comprehensive approach to wireless communications.

Throughout 2023, the Company has documented many factors that can impact the project's timeline and will account for these factors in future planning. An initial list of factors that can cause project delays includes the following: long lead time on certain equipment that caused delays in the start of construction; rescheduling of numerous site inspections due to weather; resource alignment necessary to collaborate with external entities to develop a non-Eversource owned site; time necessary for Federal Communications Commission ("FCC") review of TV Interference studies (up to nine months to complete); and Osprey seasonal nesting.

c. Actual v. planned implementation and spending, with explanations for deviation and rationale.

Figure 20 below shows the Company's cumulative capital and O&M spending, plant in-service, as well as projected amounts for the Wireless Communications Program. Figure 21 below shows the actual and projected unit deployment. Since the start of the 2022-2025 GMP term, $1.5 million of capital was spent and $2.6 million was placed into service in the Wireless Communications Program.

Figure 20 Wireless Communication Improvements Capital, O&M, and In-service Spending Summary (Shown in Dollars $)[15]

Investment Category - Communications						
Preauthorized Device Type - Wireless Communications Improvements						
	2022 Actual	**2023 Actual**	**2024 Projected**	**2025 Projected**	**2022-2025 Projected**	**2022-2025 DPU Authorized**
Captial Spend ($)	618,570	877,845	5,124,000	3,998,000	10,618,415	
O&M ($)	-40	199,595	-	-	199,555	
Captial Spend + O&M ($)	**618,530**	**1,077,440**	**5,124,000**	**3,998,000**	**10,817,970**	24,000,000
Plant In-Service ($)	1,971,659	677,377	3,236,558	6,712,565	12,598,160	

[15] Spending totals in this figure include activity on additional investment types shown in D.P.U. 24-40 Att. B Eversource. To reconcile Wireless Communications above to the D.P.U. 24-40 Att. B Eversource spending tabs, one would need to add Wireless Communication Improvements, Fiber, and Nodes preauthorized device types together.

Figure 21 Wireless Communication Improvements Unit Summary (Shown in Number of Units)[16]

Investment Category - Communications						
Preauthorized Device Type - Wireless Communications Improvements						
	2022 Actual	2023 Actual	2024 Projected	2025 Projected	2022-2025 Projected	2022-2025 DPU Authorized
Number of Units	7	1	16	11	35	24

a. Performance on implementation/deployment

This program work is progressing on schedule but has lagged behind the original timeline. In 2022, the Company focused on completing work previously planned during the first term Grid Modernization Term. Concerning work preauthorized for the 2022-2025 GMP, the Company focused on the planning and design phase after receiving the Track 1 Order in October 2022. In 2023, the Company focused on site visits, securing leases where necessary and completing construction packages for field installation on the 220MHz spectrum sites. This included 15 additional sites in EMA and six (6) additional sites in WMA. Of the 15 additional sites procured and designed in EMA, six (6) of these sites will host two frequencies. This creative solution will increase the effectiveness of the spectrum allowing deployment of additional radios in the area as well as reduce the unit cost for customers. The Company also placed one site into service in 2023 in Pittsfield (WMA).

b. Description of benefits realized as the result of implementation.

The implementation of the Pittsfield base radio station will benefit customers in the surrounding area by improving wireless communications to field devices in this area and increasing the capacity for communications to field devices operated by the Company. The new base radio utilizes digital technology and replaces older, slower analog technology previously deployed in this area. The changes will lead to improved electrical system reliability by allowing the remote isolation and/or resolution of fault conditions that may occur.

c. Description of capability improvement by capability/status category

Capability improvements will be realized throughout the deployment of each base station. Those improvements will be:

- Larger coverage area.
- Higher signal strength to remote end points; and
- Increased reliability.

The capability improvements associated with the upgrade or addition of base radio stations within the territory provide for an expanded coverage area and increased data capacity which will allow locations

[16] Units in this figure are presented in number of channels. Some Wireless Communication Improvement sites utilize more than one channel.

that may have previously been inaccessible by radio to now have remotely monitored and/or control equipment installed and commissioned into the Company's system in an efficient and effective manner. The digital technology will facilitate the introduction of new capabilities to existing equipment and the introduction of new types of equipment to the electric system.

d. Key milestones

2022:

- October 2022 – Project kickoff and initiation
- November 2022 – Design started for three master radio sites.
- December 2022 – Design started for 220 MHz licensed spectrum.

2023:

- January 2023 – Design 220 MHz spectrum for use in MA
- January 2023 – Six 220MHz master radio sites chosen.
- June 2023 – Construction started on three sites.
- August 2023 – Pittsfield placed in service.
- September 2023 – Six PAFs submitted for approval and approved.
- October 2023 – Three PAFs submitted for approval.
- October 2023 – Completed site visits for 2 additional sites.
- November 2023 – Submitted TVI studies for nine sites.
- December 2023 – Completed site visits for 7 additional sites.

e. Updated Projections for remainder of the four-year term

Refer to Figure 20 and Figure 21 for the Company's cumulative capital and O&M spending, plant in-service, as well as projected amounts for the remainder of the term.

2. Communications System Modernization

a. Description of work completed.

The Company focused on the Wireless Communications Improvement investment to start the 2022-2025 implementation due to the complexity and necessity of building out new master radio sites prior to commissioning radio devices under the Communications System Modernization investment.

During 2023, the Company focused on deploying remote radios to the 450 MHz data sites previously constructed. Throughout 2023, the Company established a new project process to coordinate the multi-stage, multi-organization effort to successfully commission a new device on to the 450 MHz network.

In early 2023, the Company learned that the preferred 450 MHz remote antenna vendor would no longer supply the antenna the Company planned to use at its remote radio locations. As a result, remote 450 MHz

antenna options had to be reviewed and a replacement was selected. An agreement was reached with the new vendor to reduce lead time for procurement of these antennas in support of this project. A bulk order for a quantity of antennas needed to meet the expected remote radio deployments was created to mitigate this concern.

The Company also began to undertake planning for the deployment of 220 MHz remote radios, set to begin deployment in 2024. Due to the frequency of operation, the remote antennas available at 220 MHz are larger than the antennas used at 450 MHz and 900 MHz radio sites and most likely will require a different mounting approach. The Company is in the process of assessing the implications of these larger antennas.

In Eastern Massachusetts, a total of 67 devices were migrated from other SCADA networks to the 450 MHz wireless data network. In addition, the 450 MHz network deployed as part of the 2018-2021 GMP has additional bandwidth and is available for new devices as needed. The Company had originally planned to complete the deployment of 450 MHz remote radios in 2023. However, due to resource constraints and a large number of weather events, the Company was unable to complete its original goal. The Company anticipates that all planned 450 remote radio deployments in EMA will be completed in 2024.

In Western Massachusetts, a total of 16 devices were migrated from existing SCADA networks to the new 450 MHz wireless data network. An additional 15 new devices were commissioned onto the 450 MHz network. Work continues on the 450 MHz base radios in WMA but unforeseen delays in construction at the Agawam and Beckett base radio locations has limited the deployment of 450 MHz remote radios in WMA. Work to deploy 450 MHz remote radios in WMA will continue throughout 2024.

The Company plans to begin deployment of 220 MHz remote radios beginning during the third quarter of 2024.

b. Lessons learned/challenges and successes.

Unanticipated material delays (e.g., antenna vendor discontinuing equipment) can greatly impact overall construction schedules. To minimize this impact, the Company negotiated exclusive vendor agreements with a new vendor to purchase all necessary material on an expedited delivery schedule. Inclement weather also negatively impacted the deployment of remote radios as the crews who install the remote radios in field devices are also relied on for Emergency Restoration. Revised schedules have been created to accommodate this support of Emergency Restoration.

c. Actual v. planned implementation and spending, with explanations for deviation and rationale.

Figure 22 Communications System Modernization Capital, O&M, and In-service Spending Summary (Shown in Dollars $)

Investment Category - Communications						
Preauthorized Device Type - Communications System Modernization						
	2022 Actual	2023 Actual	2024 Projected	2025 Projected	2022-2025 Projected	2022 - 2025 DPU Authorized
Captial Spend ($)	-	1,475,336	4,628,000	8,203,000	14,306,336	
O&M ($)	-	14,803	-	-	14,803	
Captial Spend + O&M ($)	**-**	**1,490,139**	**4,628,000**	**8,203,000**	**14,321,139**	14,000,000
Plant In-Service ($)	-	176,111	6,377,542	7,752,683	14,306,336	

Figure 23 Communications System Modernization Unit Summary (Shown in Number of Units)

Investment Category - Communications						
Preauthorized Device Type - Communications System Modernization						
	2022 Actual	2023 Actual	2024 Projected	2025 Projected	2022-2025 Projected	2022 - 2025 DPU Authorized
Number of Units	0	71	350	530	951	1,351

d. Performance on implementation/deployment

No devices were deployed in 2022. In 2023, the Company was able to successfully deploy 72 radios in the EMA. The Company anticipates maintaining the detailed planning and momentum created in 2023, in its 2024 and 2025 implementation.

a) Description of benefits realized as the result of implementation.

Customers will benefit from the deployment of this equipment through improved system reliability due to better performing data communications to remote field devices. The new radios utilize a less congested network resulting in a higher rate of successful communications with the Company's Control Centers. The migration of devices off of the existing data communication networks will also reduce congestion on these existing networks leading to their improved performance.

e. Description of capability improvement by capability/status category

Capability improvements will be realized throughout the deployment of each individual unit. Those improvements will be:

- Improved security monitoring.

- Upgrade of obsolete technology; and
- Redundant communications path.

The newly deployed equipment utilizes digital technology which replaces older "analog" radio equipment and provides enhanced features and capabilities including improved signal security and increased communication network capacity.

f. Key milestones

No key milestones were achieved in 2022.

Milestones for 2023 included the following:

- March 2023 - 450 MHz remote radio successfully tested with SCADA in EMA
- May 2023 - Replacement antenna agreement reached, and initial order placed.
- June 2023 - First 450 MHz remote radio deployed in EMA.
- September 2023 - Pittsfield, MA 450 MHz remote radios begin deployment.

g. Updated Projections for remainder of the four-year term

Refer to Figure 22 and Figure 23 for the spending and unit projections for the Communications Systems Modernization program.

E. System Level Narrative Advanced Load Flow

1. Interconnection Automation

a. Description of work completed.

The project team utilized the responses from the Request for Information ("RFI") and feedback from other EDCs and solar developers to create the Request for Proposal ("RFP") documentation and requirements for this project. This enhances the Company's ability to specify an accurate timeline for the best collaborative solution for DER planning and developers. The team has selected a vendor who will help integrate and consolidate Eversource's external facing applications and websites, apply upgrades to the hosting capacity maps, and apply automation steps to reduce engineering review time per application.

b. Lessons learned/challenges and successes.

The project team collaborated with the System Planning teams to showcase the preferred vendor's solution in interconnection process and workflow. Along with receiving feedback from renewable developers and nearby EDCs, Eversource was able to finalize business and IT requirements. These additional requirements identified are now in scope for the expansion/upgrades to the current interconnection process and software used by Eversource. The developers will benefit from the consolidated workflow, which will include

simulation capability of the Hosting Capacity maps to their project under application.

c. Actual v. planned implementation and spending, with explanations for deviation and rationale.

Figure 24 below shows the Company's 2023 capital and O&M spending, plant in-service, as well as projected amounts for the Interconnection Automation Investment Type. As of December 31, 2022, $172 thousand of capital was spent. The Interconnection Automation project as filed was initially planned to be a 2022-2023 project, however, the Track 2 Order was not received until November 2022. Upon receipt of the Track 2 Order, the Company began the project initiation and planning process, which took place in 2022. The project is now anticipating an in-service date in 2025.

Figure 24 Interconnection Automation Capital, O&M, and In-service Spending Summary (Shown in Dollars $)

Investment Category - Advanced Load Flow						
Preauthorized Device Type - Interconnection Automation						
	2022 Actual	**2023 Actual**	**2024 Projected**	**2025 Projected**	**2022-2025 Projected**	**2022-2025 DPU Authorized**
Captial Spend ($)	-	171,513	1,586,000	1,513,000	3,270,513	
O&M ($)	-	-	-	-	-	
Captial Spend + O&M ($)	**-**	**171,513**	**1,586,000**	**1,513,000**	**3,270,513**	3,000,000
Plant In-Service ($)	-	-	-	3,270,513	3,270,513	

d. Performance on implementation/deployment

Not applicable for year ending December 31, 2023.

e. Description of benefits realized as the result of implementation.

Not applicable for year ending December 31, 2023.

Future benefits are expected to include:

- Hosting Capacity data to show time series and seasonal layers and include load or storage interconnection.
- Automation steps for executing studies with reduced engineering study effort.
- Consolidation of external and internal applications for streamlined and single sign-on workflow.

f. Description of capability improvement by capability/status category

The Company will commence its implementation of the Interconnection Automation project in 2024 with the expected delivery of the following capabilities later in the 2022-2025 term:

- Interconnection Turn Around Time - Through automation of all feasible study steps and improved case management, Eversource expects a reduction of effort, and consequently time, required to review the interconnection request. Impacts on the review time will depend on the type of interconnection request (simplified, expedited, and standard) and what parts of these processes can be automated.
- Customer User Flow – Through consolidation of currently already available interfaces for customers, a streamlined user flow will be achieved from identifying ideal locations to requesting interconnections.
- Improvements to Customer Provided Data - By merging hosting capacity information into the interconnection platform and providing users the ability to interact with the hosting capacity data, users will be able to evaluate different options (location, curtailment, active management, storage, etc.) directly during the interconnection process.
- Procurement of Software Solution - The intention is to provide a dedicated and specifically tailored solution to DER planners while leveraging investments made into Synergi, PSCAD, and Power Clerk by increasing integration and automation between the tools.

g. Key milestones

- December 2022 – RFI issued and vendor responses received.
- December 2022 – Scheduled kickoff for Business and IT requirements
- April 2023 – EDC and developer feedback on requirements
- July 2023 – Onboarded project manager.
- November 2023 – RFPs issued.
- December 2023 – Software vendor finalist selected.

h. Updated Projections for remainder of the four-year term

Refer to Figure 24 above for the Company's projections for the Interconnection Automation project.

2. Probabilistic Power Flow Modeling

a. Description of work completed.

The team selected a contractual services partner who will assist with development of the Probabilistic Loadflow Integrated Development Environment ("PLF IDE"). This vendor will develop the user interface that will manage the complex simulations and mathematical concepts required for Probabilistic Loadflow. Eversource will be collaborating with the vendor as it advises and assists with preparation of architecture

and planning documents for the development of the PLF IDE. The integration of the technical computing environment and the completion of training for our team will accelerate the grid modeling automation and analysis interpretation.

The team also developed a standardized model management process for Synergi multiyear models in the Synergis-Adept management system. This standardization will enable engineers to collaborate effectively on forecasted and future iterations of the electric system's digital twin.

b. Lessons learned/challenges and successes.

The team analyzed different development environments and computational strategies to meet the requirements for the probabilistic load flow project. Based on vendor and IT feedback, Eversource determined that on premise devices with licensed software would reduce the financial impact in the long term and enable more flexibility on the use of the developed product. Although this proved to be time intensive, there were no impacts on the delivery timetable. The team actively worked with the Company's legal department in selecting the right vendor partnership and ensuring that Eversource Intellectual Property and development ownership would be maintained.

c. Actual v. planned implementation and spending, with explanations for deviation and rationale.

Figure 25 below shows the Company's 2023 capital and O&M spending, plant in-service, as well as projected amounts for the Interconnection Automation Investment Type. As of December 31, 2023, $544,000 of capital was spent. The Probabilistic Power Flow project was initially proposed for implementation during 2022-2023. However, due to the timing of the Department's Order in D.P.U. 21-80, the project is now anticipated to be placed in-service in 2025.

Figure 25 Probabilistic Power Flow Capital, O&M, and In-service Spending Summary (Shown in Dollars $)

Investment Category - Advanced Load Flow						
Preauthorized Device Type - Probabilistic Power Flow Modeling						
	2022 Actual	**2023 Actual**	**2024 Projected**	**2025 Projected**	**2022-2025 Projected**	**2022-2025 DPU Authorized**
Captial Spend ($)	-	543,851	1,161,000	-	1,704,851	
O&M ($)	-	-	-	-	-	
Captial Spend + O&M ($)	**-**	**543,851**	**1,161,000**	**-**	**1,704,851**	2,000,000
Plant In-Service ($)	-	-	-	1,704,851	1,704,851	

d. Performance on implementation/deployment

Not applicable for year ending December 31, 2023.

e. Description of benefits realized as the result of implementation.

Not applicable for year ending December 31, 2023.

f. Description of capability improvement by capability/status category

Not applicable for year ending December 31, 2023. The Company will commence its implementation of the Probabilistic Power Flow Modeling project in 2023 with the expected delivery of the following capabilities during the 2022-2025 GMP:

- Ability to evaluate scenarios and projected grid conditions based on their probability to occur through development of a risk-based assessment. This will inform investment decisions and prioritization.
- Advancement of the use case for alternative solutions to system constraints because the Company will be able to identify all scenarios causing the constraint and implement very targeted programs to address these constraints.
- Ability to simulate thousands of scenarios for bulk energy market participation of aggregated resources. This is a capability that Eversource currently does not have. Improved modelling of the interplay of systems such as VVO with distributed energy resources.

g. Key milestones

- July 2023 – Onboarded project manager.
- August 2023 – Prototype demo completed.
- October 2023 – Integrated development environment standardized.
- November 2023 – Technical computing environment implemented.
- December 2023 – Computational machines delivered.

h. Updated Projections for remainder of the four-year term

Refer to Figure 25 for the Company's projections for the Probabilistic Power Flow Modeling project.

F. System Level Narrative DERMS

1. DERMS

a. Description of work completed.

In 2023, the project team and its DERMS planning vendor, held requirements gathering workshops with the Energy Efficiency, DMS, and Grid Modernization teams to document the needs within the Company for the DERMS.

Using the results of this requirements gathering phase, the team and the DERMS planning vendor executed a full market review for DERMS vendors, requesting information in a formal RFI from 17 grid and aggregator DERMS vendors. These vendors were selected using internal knowledge of DERMS vendors (e.g., Energy Efficiency Team), DistribuTech vendor discussions, as well as the Guidehouse Insights Leaderboard for DERMS. 13 DERMS vendors responded, and the team selected the vendors with sufficient experience and good solutions to the DERMS to participate in a selective RFP. Having selected and begun deployment of the Eversource DMS using GE's eTerra product, any solution proposed was graded on the ability to integrate with this DMS. Many vendors can provide some DERMS functionality, but not as a Grid DERMS that can integrate with the DMS to meet the need of the Company's control system operations.

Using the RFI results, the top four ranking solutions were invited to participate in the RFP. As the result of final RFP scoring, the GE response was superior in all technical categories, including technical merit/use cases, system interfaces, implementation, and schedule. The final decision to select the GE Grid DERMS was made in November of 2023, and the Statement of Work ("SOW") negotiation began in December. The contract will be finalized in 2024.

In parallel with the RFI/RFP process for the DERMS vendor, the team held a competitive RFP for DERMS implementation services to acquire a contractor project manager for the project. The RFP was completed over the summer of 2023, and the vendor was onboarded in December of 2023, and immediately began assisting with SOW negotiation with the DERMS software vendor.

The team also attained internal project approvals to begin and implement the project, soliciting input from the IT organization for needed roles in the project to obtain financial approval for the project. The project was initiated from an internal financial standpoint with appropriate work orders in late November 2023.

In 2022, the team onboarded a DERMS planning vendor who will assist with the RFP process for implementing a DERMS. This vendor will help develop requirements for the RFP based on the existing and planned systems with which Eversource will require the DERMS to integrate, as well as the commitments Eversource has made in the Grid Modernization filing. The DERMS planning vendor's experience with Eversource systems and in the DERMS industry will help Eversource better understand the available DERMS offerings presently available and the way a DERMS vendor might implement Eversource requirements and commitments. As part of the contract finalization process, the vendor and Eversource developed a high-level schedule for the 2023 RFP process. The team also explored how behind the meter and standalone/larger DERs could help alleviate distribution system constraints if they were to be controlled by the DERMS, and what barriers there might be to participation. The team also analyzed a specific existing customer's solar and storage facility for how it could benefit the distribution circuit to which it is connected as an example use case of the DERMS.

b. Lessons learned/challenges and successes.

In 2023, the team refined and finalized the DERMS architecture design, incorporating both Grid and Aggregator DERMS into a coordinated solution integrated with the DMS. This Grid DERMS makes the

Aggregator data usable in the DMS and can allow operators the 'single pane of glass' to see distribution assets and DER/DR assets in the DMS and have available DERs capacity presented in an actional format for operators, without requiring control of individual behind-the-meter ("BTM") devices. The DERMS/DMS can then send signals to the Aggregators to request the desired amount of generation support, and the Aggregators send signals to the customer devices to achieve the results.

The team was challenged by the small number of DERMS vendors that have sufficient DERMS experience to quickly complete a DER-enabled DMS, with a tight integration between the two in order to achieve the desired visibility and control for both BTM and front-of-meter ("FTM") DERs. No projects with this type of integration had been completed at the time of the RFP with the GE Grid DERMS and the GE eTerra DMS system. Southern California Edison's project was in progress at the time of the RFP.

The team learned that not all deployment vendor experience is the same – several vendors have sufficient high-level project planning and preparation experience, but few seemed to have experience with the actual execution of a DERMS project and understanding the IT software integrations (data flows between pieces of software) that would be required to succeed.

The project schedule experienced challenges due to the time required to select the final vendor. One major factor involved in this RFP process was the length of time to implement the project – the Company sought a vendor with experience deploying the DERMS software to ensure the 2025 GMP deadline would be met. Many vendors involved in the RFP process did not demonstrate the experience necessary to implement a large-scale project in the given timeline. This presented a risk to the project's success and the project budget, as the vendors were not able to base the proposals on historical information. Incremental due diligence was required in the procurement process to gain confidence that the selected vendor would be capable of meeting all requirements.

In 2022, the team analyzed a potential participant customer's 499kW solar/storage facility in an area that experiences an elevated level of distribution constraint. Based on the customer's measured output from the solar/storage facility, the team observed that if other local DER were also controlled by the DERMS, Eversource could reduce the need for diesel use on the distribution feeder for local distribution peak constraints. In areas of specific distribution need such as this one, using the DERMS to control local customer-owned DER could help reduce greenhouse gas ("GHG") emissions and conventional fuel generation from being used when distribution constraints exist. This can help as both a temporary solution where it may be difficult to install new needed distribution upgrades, as well as potentially being a permanent non-wires alternative for upgrades. Based on this preliminary analysis, the team is anticipating a project with the MassCEC in 2023 to explore DER compensation for participation in programs controlled by the DERMS and plans to actively participate in this project.

c. Actual v. planned implementation and spending, with explanations for deviation and rationale.

Figure 26 below shows the Company's cumulative capital and O&M spending, plant in-service, as well as projected amounts for the DERMS project.

Since the start of the 2022-2025 GMP term, $32,000 of capital was spent and zero dollars have been placed into service on the DERMS project. After receiving the Department authorization in Q4 2022, the Company spent most of 2023 in the initiating and planning phases of the project.

Financial actuals started being realized after the project was fully approved internally in Q4 2023. While the DERMS project is behind the initially proposed timeline included in the 2022-2025 GMP, the team is working to complete all milestones by December 31, 2025.

Figure 26 DERMS Capital, O&M, and In-service Spending Summary (Shown in Dollars $)

Investment Category - DERMS (including Dynamic DER Interface)						
Preauthorized Device Type - DERMS						
	2022 Actual	2023 Actual	2024 Projected	2025 Projected	2022-2025 Projected	2022-2025 DPU Authorized
Captial Spend ($)	-	31,572	3,774,000	7,258,000	11,063,572	
O&M ($)	-	-	-	-	-	
Captial Spend + O&M ($)	**-**	**31,572**	**3,774,000**	**7,258,000**	**11,063,572**	10,000,000
Plant In-Service ($)	-	-	-	11,063,572	11,063,572	

d. Performance on implementation/deployment

The DERMS plan as initially filed in the 2022-2025 GMP was originally expected to be implemented in the New Bedford area in EMA. Based on a review of the SCADA versions and the available DERMS capabilities, as well as the quantity of DERs in both regions and change management risks, the team changed the planned project area from EMA to WMA. This change was made to ensure successful project implementation within the project timeframe and to demonstrate more DERMS capabilities than those available with an older version of SCADA presently in use in the New Bedford and EMA area. Although both regions have sufficient DER to test the DERMS functionality, the updated SCADA version in WMA allows for testing of more use cases than would be available in EMA.

e. Description of benefits realized as the result of implementation.

Not applicable for year ending December 31, 2023.

Future benefits of the DERMS are expected to include:

- Visibility of DER assets for control room operators helps them maintain safety and reliability on the distribution grid. The assets in the Demand Response and other future BTM programs, as well as larger DERs connected to the SCADA system will be visible in the DERMS system and for control room operators and allow for decisions to be made with more precision.
- Forecasting capability for control room operators – the DERMS will forecast the available DER and allow operators to utilize that DER to alleviate system constraints, potentially reducing the cost of upgrades for new DERs.

- Reduce system demand by allowing system operators (and/or automated functions in the DERMS software) to calculate the optimized use of resources to reduce system peak load use.
- Reducing greenhouse gas emissions – by reducing peaks, load variability, and demand as stated above, the DERMS system can help reduce the use of fossil fuel generation by better utilizing and predicting the output from intermittent renewable generation.
- Allows more customers to participate in programs that can earn them money and help alleviate constraints on the distribution grid – this does require that programs be designed to allow for this DERMS capability to be fully utilized.
- Bulk system benefit: DERMS can be used to support DER participation in the wholesale market in the future.

f. Description of capability improvement by capability/status category

When the DERMS is implemented, it will have the following capabilities and capability improvements:

- Optimize system performance: Control room tools to manage, monitor, and dispatch DER based on real-time system conditions modeled in the Company's DMS.
- Optimize system demand & integrate DER: Development of operational forecasting capabilities to predict near-term (hour-ahead, day-ahead) load and generation impact on power flows based on weather conditions and other related factors.
- Capability to monitor BTM and FTM DERs from the control room using the DERMS software, with a tight integration to the DMS.
- Capability to create DER groups from the control room to optimize distribution constraints.
- Ability to forecast load and DER on a day-ahead and week-ahead basis.

g. Key milestones

2023 Milestones

- April 2023 – Completed requirements gathering phase.
- June 2023 – Completed DERMS software RFI.
- May 2023 – Senior Data Engineer onboarded to project team.
- July 2023 – DERMS software RFP issued to vendors.
- July 2023 – Implementation services RFP issued (for project manager, other roles)
- September 2023 – Completed RFP team recommendation.
- November 2023 – Executive approval for software vendor and approved to start SOW negotiation.
- November 2023 – Project funding approved; project financials complete.
- December 11, 2023 – Implementation services vendor onboarded.

2022 Milestones

- September 2022 – Onboarded a lead for the project.
- December 2022 – Project team developed a contract with a DERMS planning vendor to assist with developing an RFP for the DERMS solution.

h. Updated Projections for remainder of the four-year term

Refer to Figure 26 for the Company's projections for the remainder of the four-year term. The total cost projection was updated from $10 million to $11 million after the project went through the Company's rigorous capital project authorization process. That process resulted in an increase of $1 million due to higher expected costs across all cost types.

2. Dynamic DER

a. Description of work completed.

In 2022, the Dynamic DER Interface Project at Southampton secured authorization for capital funding and subsequently proceeded with the onboarding of vendors for the installation and design of a Real-Time Automation Controller ("RTAC") at the Eversource-owned 2MW solar site. A thorough verification process was conducted on all existing equipment, after which the team formulated a preliminary design package and placed orders for the necessary materials.

To highlight the enhanced control and monitoring capabilities of the RTAC device over the inverters, the team organized a demonstration for all relevant stakeholders. The presentation effectively showcased the RTAC's potential for optimizing energy production and streamlining operations.

In 2023, the Company successfully deployed the first iteration of the Dynamic DER Interface program at the Southampton site. This involved seamlessly integrating the site into the Company's SCADA system and establishing direct communication with site inverters using a RTAC. Through the SCADA system, setpoints were effectively dispatched to control the output of the inverters. Notably, the site's inverters exhibited compatibility with the Gridconnect Library's Reactive Power ("VAR") and Power Factor ("PF") correction modes. Following a meticulous commissioning acceptance/witness test, the site was deemed operational and ready for service. The Company obtained the necessary capital funding authorization for two additional Eversource owned photovoltaic system sites, Sunderland and Hatfield. To ensure a comprehensive understanding of the existing equipment, thorough site visits were conducted and meticulously reviewed which verified the infrastructure. In parallel, the preliminary engineering phases were initiated, and vendors were onboarded and entrusted with the project's design. Engagement with customers continued diligently throughout 2023, with the goal of finding suitable candidates to integrate into the program.

b. Lessons learned/challenges and successes.

In 2023, the Company was able to identify both lessons learned as well as move the project through the detail design phase to gain valuable experience. The detailed design of the RTAC's control modes and selecting the data points to provide to the Company's control room was a success. This activity further established the Company's understanding of the RTAC's distributed network protocol capability in this use case as well as proved out the configuration of the Company's SCADA system to receive this data.

One challenge at this location was the wiring connection from an external meter into the RTAC to provide the proper inputs for the logic. The solution for this site identified the potential for pre-existing site-specific configurations that need to be reviewed in detail during the design phase of the project. Lastly, utilizing the vendor's product expertise to apply the RTAC in this particular use case was invaluable to the Company. Overall, additional challenges exist in the selection of the remaining sites including customer sites. Engagement with customers is critical to the success of this program.

Throughout the implementation process, the Company encountered several challenges, which were successfully addressed. The following are key lessons learned:

- Proper configuration of the Modbus to Transmission Control Protocol ("TCP") converter is crucial for effective communication.
- Calculate and optimize delays for triggering control commands to ensure optimal performance.
- Consider the inverter's response time when setting mode and setpoints.
- Unexpected behaviors may arise during specific operating conditions, requiring further investigation and collaboration with equipment manufacturers.
- Conduct on-site testing to determine precise limits and resolve any issues.
- Smooth transitions between PF mode and reactive power (VAR) mode require specific actions and considerations.
- Challenges may arise when sending controls to multiple devices simultaneously, necessitating thorough testing and troubleshooting.
- Consider implementing email alerts for inverter alarms and establish a separate cell modem connection.
- Remote engineer access and File Transfer Protocol ("FTP") Data Disturbance Recorder ("DDR") can enhance monitoring and troubleshooting capabilities, but security considerations must be addressed.

These lessons provide valuable insights for future projects involving the implementation of dynamic DER interfaces, ensuring smoother integration and operation of distributed energy resources.

c. Actual v. planned implementation and spending, with explanations for deviation and rationale.

Figure 27 below shows the Company's 2023 capital spending and in-service spending, as well as projected amounts for the Dynamic DER Interface Program. Figure 28 below shows the actual and projected unit deployment.

Since the start of the 2022-2025 GMP term, $284,000 of capital was spent and $256,000 was placed into service on the Dynamic DER Interface Program. The Company's plan for Dynamic DER integration started with an initial project kickoff in October 2022, and the design review was completed in December 2022. The Company completed the kickoff with onboarding project resources, developing the detailed project plan, and executing the design phase of the project. As part of the design phase, a site visit and

product demonstration were completed to aid in completing the specific design for the Southampton site. The discrepancy between actual spending and projection for 2022 was related to when the Company kicked off this project in the Q4 of 2022. The planned spending had an assumption of starting at the beginning of 2022 and completing multiple sites. The Company only completed the design of one site by December 31, 2022.

The Company diligently adhered to the updated plan from 2022 for integrating the Dynamic DER Interface in 2023. Nonetheless, deviations in the schedule arose due to conflicting timelines with the commissioning and witness testing vendor. Additionally, some minor modifications were implemented on the SCADA screens after the commissioning test to ensure full capture of essential information for operators. The variance between actual spending and the plan in 2023 can be attributed to invoicing issues encountered with the vendor, necessitating cancellation and resubmission. Consequently, the projected spending expected to occur in 2023 was delayed and materialized in 2024. Additionally, the Company reduced the projected number of Dynamic DER Interface sites to five versus the originally filed plan of 24 sites. The reduction in sites is due to challenges with customer recruitment, driven in part by (1) the absence of a compensation mechanism to support customer payments for grid services (e.g., curtailment, reactive power support); and (2) concern about need to complete implementation by the end of 2025.

Figure 27 Dynamic DER Interface Capital, O&M, and In-service Spending Summary (Shown in Dollars $)

Investment Category - DERMS (including Dynamic DER Interface)						
Preauthorized Device Type - Dynamic DER Interface						
	2022 Actual	**2023 Actual**	**2024 Projected**	**2025 Projected**	**2022-2025 Projected**	**2022-2025 DPU Authorized**
Captial Spend ($)	6,778	277,138	730,000	400,000	1,413,915	
O&M ($)	-	-	-	-	-	
Captial Spend + O&M ($)	**6,778**	**277,138**	**730,000**	**400,000**	**1,413,915**	6,000,000
Plant In-Service ($)	-	255,526	730,000	428,389	1,413,915	

Figure 28 Dynamic DER Interface Unit Implementation Summary (Shown in Units)

Investment Category - DERMS (including Dynamic DER Interface)						
Preauthorized Device Type - Dynamic DER Interface						
	2022 Actual	**2023 Actual**	**2024 Projected**	**2025 Projected**	**2022-2025 Projected**	**2022-2025 DPU Authorized**
Number of Units	0	1	2	2	5	24

d. Performance on implementation/deployment

The Company was able to execute on the project kickoff and design phase activities with success on the first site. Material and services procurement was completed as expected. The design review and integration design into the Company's SCADA system were important milestones to ensure the project progressed on track. No site construction was completed in 2022 per the plan, however the site visit has positioned the Company well for construction and commissioning in 2023.

The Company adeptly executed the construction, integration, and commissioning phases of the project, culminating in a successful outcome at the first site. Construction progressed seamlessly, with minor adjustments made prior to SCADA integration and commissioning testing. The design review and seamless integration into the Company's SCADA system represented significant milestones that ensured the project remained on track. Although no site construction took place in 2023 at the Sunderland and Hatfield sites, the comprehensive site visits positioned the Company favorably for construction and commissioning in 2024.

e. Description of benefits realized as the result of implementation.

The full benefits of the Dynamic DER Interface will be realized once a robust DERMS is implemented, facilitating dynamic adjustments of inverter-based resources in real-time. However, even at this stage, enhanced visibility for system operators is available, enabling more informed decision-making and improved grid management.

f. Description of capability improvement by capability/status category

The implementation of the Dynamic DER Interface has yielded significant capability improvements across various categories:

- Enhanced Operational Visibility: The integration of the interface with our SCADA system has significantly improved the visibility and monitoring capabilities for system operators, empowering them to make more informed decisions and respond promptly to grid conditions.
- Integration with Grid Management Systems: The successful integration of DER assets with the eECS, DMS, and future DERMS has strengthened grid management capabilities, enabling efficient coordination, optimization, and control of inverter-based resources.
- Dynamic Dispatching and Control: The Dynamic DER Interface has provided the capability to dynamically dispatch and control inverter-based assets, allowing us to actively manage and leverage these resources to meet grid requirements and optimize their utilization.

g. Key milestones

2022 Milestones

- October 2022 – Southampton project kickoff
- December 2022 – Southampton design review complete
- December 2022 – Southampton material ordered.

2023 Milestones

- January 2023 – Completion of field design at Southampton
- April 2023 – Completion of construction at Southampton
- April 2023 – Completion of the commissioning at Southampton
- November 2023 – Project Kickoff for Sunderland & Hatfield

- December 2023: Preliminary Design Engineering at Sunderland & Hatfield

h. Updated projections for remainder of the four-year term

Refer to Figure 27 and Figure 28 for the Company's and capital spending, in-service spending, and unit deployment projections for the remainder of the four-year term. Overall, the Company is projected to spend under the Department authorized budget, driven by the reduction in sites mentioned above.

IV. Performance Metrics

On November 9, 2023, the Department issued a memorandum in Dockets D.P.U. 21-80/D.P.U. 21-81/D.P.U. 21-82 requesting that the EDCs submit updated metrics for the 2022-2025 GMP Term. The Department's memorandum included specific directives including the removal of CAIDI/CAIFI metrics, the inclusion of additional case studies, and the addition of low income/economic justice metrics. The EDCs jointly submitted revised performance metrics on December 11, 2023, that were stamp-approved by the Department on February 1, 2024.

A. Statewide Performance Metrics

2.1 VOLT VAR OPTIMIZATION AND CONSERVATION VOLTAGE REDUCTION BASELINE – Calculation of this metric for feeders equipped with VVO in 2023 are in process and will be published by Guidehouse in the 2023 Massachusetts Grid Modernization Program Evaluation Report, expected in July 2024.

2.2 VOLT VAR OPTIMIZATION (VVO) ENERGY SAVINGS – Calculation of this metric for feeders equipped with VVO in 2023 are in process and will be published by Guidehouse in the 2023 Massachusetts Grid Modernization Program Evaluation Report, expected in July 2024

2.3 VVO PEAK LOAD IMPACT – Calculation of this metric for feeders equipped with VVO in 2023 are in process and will be published by Guidehouse in the 2023 Massachusetts Grid Modernization Program Evaluation Report, expected in July 2024

2.4 VVO – DISTRIBUTION LOSSES WITHOUT AMF (BASELINE) – Calculation of this metric for feeders equipped with VVO in 2023 are in process and will be published by Guidehouse in the 2023 Massachusetts Grid Modernization Program Evaluation Report, expected in July 2024

2.5 VVO POWER FACTOR– Calculation of this metric for feeders equipped with VVO in 2023 are in process and will be published by Guidehouse in the 2023 Massachusetts Grid Modernization Program Evaluation Report, expected in July 2024

2.6 VVO ESTIMATED VVO/CVR ENERGY AND GHG IMPACT– Calculation of this metric for feeders equipped with VVO in 2023 are in process and will be published by Guidehouse in the 2023 Massachusetts Grid Modernization Program Evaluation Report, expected in July 2024

2.7 INCREASE IN SUBSTATIONS WITH DISTRIBUTION MANAGEMENT SYSTEM ("DMS") POWER FLOW AND CONTROL CAPABILITIES – There are no results to report on this metric due to the planned go-live date of this project, which is later in the GMP term.

2.8 CONTROL FUNCTIONS IMPLEMENTED BY CIRCUIT (VVO, AUTO RECONFIGURATION) – There are no results to report on this metric due to the planned go-live date of this project, which is later in the GMP term.

2.9 NUMBERS OF CUSTOMERS THAT BENEFIT FROM GMP FUNDED DISTRIBUTION AUTOMATION DEVICES – At the end of the 2021, over 249,000 customers had benefited from GMP-funded overhead DA devices. In 2022, over 5,000 additional customers benefited from GMP-funded overhead DA devices. In total, approximately 255,000 customers are benefitting from these devices. As noted in other sections of this Report, the Company successfully commissioned the final GMP-funded DA devices in 2022, and there are no future results to report on this metric. The circuit-level details can be found in "Att B (Data Reporting Template) Eversource" tab 3a. Feeder Status-2022.

2.10 VVO RELATED VOLTAGE COMPLAINTS PERFORMANCE METRIC AND BASELINE – Calculation of this metric for feeders equipped with VVO in 2023 are in process and will be published by Guidehouse in the 2023 Massachusetts Grid Modernization Program Evaluation Report, expected in July 2024

2.11 DERMS SOFTWARE – There are no results to report on this metric due to the planned go-live date of this project, which is later in the GMP term.

2.12 THE NUMBER OF EJ AND LI CUSTOMERS, RESPECTIVELY, IMPACTED BY THE COMPANIES' DISCRETE INVESTMENTS – At the end of 2023, the total number of EJ customers, LI customers and LI customers residing and in an EJ community impacted by the Company's discrete investments deployed during the 2022-2025 GMP are in the table below. Further details at the circuit level are reported in "Att B (Data Reporting Template) Eversource" tab 10a.

	Total Customers Impacted by Discrete Grid Modernization Investments	**EJ Customers Impacted by Discrete Grid Modernization Investments**	**LI Customers Impacted by Discrete Grid Modernization Investments**	**LI Customers residing in an EJ Community Impacted by Discrete Grid Modernization Investments**
Customer Count	180,422	66,805	17,247	9,675
Percentage of Customers	100%	40.81%	9.08%	5.36%

B. Eversource-Specific Performance Metrics

APP.A.1.0 EVERSOURCE ADVANCED LOAD FLOW – PERCENT MILESTONE COMPLETION – At the end of the 2018-2021 GMP term, the Eversource Advanced Load Flow percent milestone complete was 100% fully automated. There are no further results to report on this metric after reaching the fully automated milestone in 2021.

APP.A.2.0 EVERSOURCE CUSTOMER OUTAGE METRIC – The average circuit zone size baseline calculated in 2018 prior to any GMP device deployment was 359 customers. During the 2018-

2021 period, the average circuit zone size decreased to 285 customers. At the end of 2022, the average zone size decreased to approximately 277 customers. This represents a reduction of 82 customers compared to the baseline. The Company successfully commissioned the final nine DA devices in 2022 and successfully met sectionalization goals under the GMP program. There are no future results to report on this metric after 2022. The circuit level details can be found in "Att B (Data Reporting Template) Eversource."

APP.A.3.0 EVERSOURCE POWER QUALITY MONITORING – The number of power quality triggering events is provided by year in Figure 29 below. The average number of days to provide root cause analysis was five.

Figure 29 Power Quality Number of Triggering Events[17]

Year	Number of Events
2021	7
2022	5
2023	6

C. Supplemental Case Studies

The supplemental case studies for 2023 will be provided as part of the Guidehouse Program Year 2023 Evaluation Reports expected in July 2024.

[17]Number of events is based on reported events from Harvard in the Smartsheet

V. Evaluation Consultant Recommendations

The following section includes narrative and explanations on the implementation of Guidehouse's recommendations on investments approved as part of the Company's 2022-2025 GMP. This section also includes recommendations on continuing Track 1 investment from the 2018-2021 evaluation years as filed by the Company in D.P.U. 20-46, the Company's 2019 GMP Annual Report; D.P.U. 21-30, the Company's 2020 GMP Annual Report; and D.P.U. 22-40, the Company's 2018-2021 GMP Term Report.

On November 9, 2023, the Department issued a memorandum in Dockets D.P.U. 21-80/D.P.U. 21-81/D.P.U. 21-82 requesting that the EDCs submit updated metrics for the 2022-2025 GMP Term. The Department's memorandum included specific directives including the removal of CAIDI/CAIFI metrics, the inclusion of additional case studies, and the addition of low income/economic justice metrics. The EDCs jointly submitted revised performance metrics on December 11, 2023 that were stamp-approved by the Department on February 1, 2024.

All the recommendations made by Guidehouse through the 2022 program year have been included in the narrative below. Recommendations are pulled from the Guidehouse Massachusetts Grid Modernization Program Evaluation Reports that are filed annually. Due to the timing of the Department's November 9, 2023 memorandum and subsequent stamp-approval of updated metrics, some of the below recommendations made by Guidehouse are no longer applicable. Narrative and explanations regarding the implementation of Guidehouse's recommendations for the 2022-2025 term will be included each year as those recommendations become available. The section is arranged by Investment Category and evaluation year. For each consultant recommendation, the Company responds in three parts as outlined below.

1. Assessment of Guidehouse's recommendations during both the 2018-2021 term (for continuing investments) and the 2022-2025 term.
2. Explanation of whether and how the Company considered each recommendation during 2022-2025 investment plan development and implementation.
3. Implementation status of each recommendation.

A. Communications

1. 2019 Recommendation: Guidehouse should work with the EDCs to implement an updated data collection template and format, using experience gained during the Q2 2019 data collection process, to streamline data collection and make the process more efficient.

    a. Eversource agreed with this recommendation made during the 2019 evaluation.
    b. Eversource has considered this recommendation in all subsequent years after the recommendation was made to ensure the Company can provide Guidehouse with detailed and accurate data required for the measurement and verification process of all project and programs.

c. Eversource collaborated extensively with Guidehouse and the other EDCs to implement an updated data collection template and format using experience gained during the Q2 2019 data collection process to streamline data collection and make the process more efficient. The updated process has been in place since this recommendation was made, and Eversource continues to work with Guidehouse if any modifications are needed.

2. 2020 Recommendation: Eversource should consider reevaluating the substations that are currently on copper communication lines or shared communication lines, to determine if dedicated fiber will provide improved performance for GMP.

   a. The Company acknowledges the recommendation and has commenced an initiative to evaluate and replace the copper communications lines.
   b. The Company has an ongoing project with Verizon to migrate most of the copper connections and replace them with a fiber optic connection using their network. In parallel, Eversource had already planned to cut the existing copper connections over to the Eversource-owned fiber network and is evaluating the existing copper connections and plans to continue this process going forward.
   c. This is an established process going forward. Eversource put a plan in place for the coming years to evaluate the copper connections and migrate them to the Company's fiber network.

3. 2021 and 2022 Recommendation: Eversource provided coverage studies (coverage maps) showing the communications performance before the investment and expected improved performance after the investment is completed. These coverage studies were not available or performed for each of the communications investments. To validate the performance and value of the investment, coverage studies should be performed prior to implementation of base station radios. Field signal strength measurements should be taken to validate acceptable communications performance. To improve speed of communications and restoration, a study should be performed to determine if ADA devices on each specific circuit should use a different communication medium. For example, the first device on the circuit uses 450 MHz RF, second device uses 900 MHz RF, third device uses 5G, etc. (multiple paths for each FLISR scheme).

   a. Eversource utilizes EDX Signal Pro radio frequency modeling software to estimate radio coverage from potential candidates for base station locations. As part of the commissioning process for remote field devices, field strength measurements are made to determine the best radio system for reliable communications. Once radio communications are established, the device is tested to ensure proper operation and performance of the communication path. Reliable radio coverage from the various systems used for interconnection is not necessarily available at each field device. Experience has shown that most field devices will have only one viable option for interconnection due to lack of coverage or high interference. Eversource strives to utilize its own private radio systems wherever possible, supplementing with cellular and other interconnection methods when

necessary. Eversource's experience is that the Company's private networks have proven to be more reliable than third-party networks during outage restoration activities.

b. Eversource does perform engineering coverage analyses and field surveys to validate the engineering model as well as confirm that a specific device location will perform reliably on the selected communication medium. For communication speed, the Company has designed into the radio solution a maximum latency requirement for data to be sent from field devices to the control room so that it meets the needs of system operators to enable them to take timely action. This latency requirement has also been evaluated against the time requirement for the Company's centralized DMS system which will be processing field data and operating devices in an automated fashion (FLISR scheme) while trying to restore customers as quickly as possible.

c. Eversource has implemented the recommendations regarding the production of coverage studies to evaluate prospective base station radio candidates and the performance of field measurements to validate predicted radio coverage. Eversource has not implemented the recommendation to study utilizing a different means of communication for each device on a circuit because the design of the private radio system is intended to meet the Company's time requirements for sending data back to its control systems.

4. 2022 Recommendation: No new recommendations were made in 2022.

B. Advanced Distribution Management System/Advanced Load Flow

1. 2019 Recommendation: The EDCs should plan out each investment moving forward to explicitly include capital and operational components of ADMS/ALF to insure complete visibility both internally and externally.

    a. Eversource agreed with Guidehouse's 2019 recommendation to provide greater detail into the capital and expense allocations for the ADMS/ALF programs.

    b. Eversource maintains a holistic view of all capital and expense costs on all Grid Modernization projects and programs and monitors these costs closely on a regular basis. Eversource plans out each investment as part of the capital and expense budgeting process in the fall of each year, for the following year, and closely monitors actual versus budgeted costs.

    c. Eversource worked with Guidehouse to enhance the data collection templates to show capital and expense spending information on all Grid Modernization projects and programs at a detailed level to ensure Guidehouse had the desired level of visibility into all costs. Eversource continues to provide this information for the 2022-2025 term.

2. 2019 Recommendation: The EDCs should continue to keep investments in cleaning data to support ADMS/ALF separate from investments in the actual ADMS software implementation.

a. The DMS software is a system that utilizes many different data sets to enable its functionality. The Company has worked with its vendor to identify the data mapping required to enable each specific functionality of the software. For each data set, the Company provides a substantial quantity of data to prove that the behavior of the software is repeatable and meets its operational requirements. Once the functionality is proven, then the Company approves it for final implementation. In order to have a substantial data set, the Company does work to collect and organize data for this purpose. The Company does agree that full data cleanup is an ongoing effort which requires an overall data governance structure in place, and the work associated with ongoing data cleanup is outside of the project implementation.

b. The Company has considered this recommendation in the project planning for design and implementation of the DMS solution. For each data set, the Company has built in an approach to prove that the software functionality works when provided with the correct data and that any functionality issues found in the DMS are triaged to determine if it is a software bug or a data issue. If it is a data issue, then it is evaluated to determine a corrective action and managed so that software implementation is not impacted.

c. This recommendation is currently implemented as part of the project implementation approach.

3. 2020 Recommendation: Continue progressing circuits into go-live status (i.e., full operation) within ADMS/ALF to confirm complete understanding of the challenges, barriers, and costs associated with fully operationalizing ADMS/ALF. Guidehouse found that as each Distribution Company gets closer to operationalization of the ADMS/ALF, more challenges and unknowns appear. Getting visibility into these early can help ensure that Distribution Company plans remain on track.

   a. Eversource agreed with the Guidehouse 2020 recommendation to continue to progress circuits in-go live status to ensure the challenges and barriers as circuits go live will be visible early and can serve as lessons learned going forward. To place a circuit into DMS production, there are many phases of the project implementation that start in lower environments and are then progressed up through to production. At each step of the way, the Company is introducing additional complexity until the final go-live. With each step, the Company continuously looks for issues at the circuit and substation level and compares with other substations to find global trends. The final go-live will be undertaken in a controlled manner to identify by circuit and substation any issues and then again reviewed globally to ensure that resolution is addressed across all circuits as applicable.

   b. The DMS program is working, as circuits progress, to ensure challenges and barriers are documented and communicated as valuable lessons are learned.

   c. The ALF system has been implemented for all substations and circuits at this time. For the DMS program, the Company does not have any circuits in production. The Company's go-live approach is broken down by control center jurisdiction and further

by substation and circuit. This approach will ensure system operations centers are ready as well as providing an opportunity to capture any best practices that are gained from previous go-live activities.

4. 2020 Recommendation: As the Distribution Companies see more mature ADMS/ALF performance on circuits and substations, it will be important to have full clarity on data that supports enhanced system performance. For Eversource, this means ensuring clarity on where ALF optimizes the DG interconnection queue process and being able to show that within the publicly available data.

    a. The Company agrees with the Guidehouse 2020 Recommendation that full clarity of data quality is critical to build a robust process around keeping data quality high. With high quality data, the ALF and DMS tools can provide optimized results for many use cases. For the ALF investment, the Company believes the high-quality data and batch processing provided by ALF gives more granular results for hosting capacity maps that are currently publicly available with the intended result to better optimize where developers are choosing to connect to the distribution system. The Company further expects high-quality data to provide the foundation for any automation of interconnection studies. Additional clarity on how the ALF optimizes the interconnection queue will need to be developed.
    b. For the 2022-2025 GMP, the Company's DMS project implementation is working to build data dashboards to provide clear visibility into the many data attributes that are needed for a functioning system. These tools will be utilized to show trends very clearly in the data that is needed for continued performance of the DMS system. These trends will help drive ongoing corrective actions. The Company is further implementing features to automate interconnection processes in the 2022-2025 GMP utilizing investments into ALF as well as building on work of the DMS project's data clean-up efforts.
    c. Currently, the Company is still in the build phase of the DMS implementation. The tools to observe data quality are also being built. As the program proceeds and the DMS system becomes more mature, the performance of the DMS system, as well as the underlying data, will be visible through reporting dashboards. Furthermore, the Company has kicked off the interconnection automation projects and is working closely with various departments, as well as external stakeholders, to understand detailed requirements. In its end stage, the project is expected to handle most interconnection requests by volume in an automated fashion.

5. 2020 Recommendation: The Distribution Companies should work to explicitly track how this process is helping better achieve DER integration (e.g., lower costs or faster queue times). Expand the ALF development to include an external website where DER developers can log in and determine location and size of interconnections that are possible (similar to what is being done in Eversource Connecticut). Track, as a metric, how many individuals are accessing the website for feeder information. Perform a survey both internal to the company (Eversource)

and external to DER developers on the effectiveness and recommended changes to the ALF. For ADMS Eversource, Guidehouse recommends conducting extensive pilot testing of the ADMS software prior to any cutover or go-live and conduct a survey of other users (Utilities) that have cut over to an ADMS for lessons learned.

a. The Company agrees with Guidehouse's recommendation to develop advanced tools for developers to better site their projects. Given the size of interconnection queues, it is vital that developers have a clear understanding of potential interconnection complications before submitting a request. For the DMS program, the Company agrees that an extensive testing period of the DMS software is required to ensure the system is ready for real-time operations and that a survey of other utilities does provide some insight into the behavior of the software as well as lessons learned for cutover activities.

b. The Company has already developed a hosting capacity map in Massachusetts, as well as a tool under gridtwin.eversource.com that allows developers to perform detailed parcel analysis across the entire service territory to aid in finding the best property in correlation to available hosting capacity and expected interconnection cost. In addition, the Company has deployed PowerClerk in Massachusetts to streamline the interconnection application process. The Company has further been approved to develop an automated interconnection concept which will consolidate all external interfaces (GridTwin, Hosting Capacity, PowerClerk, and Tariff information) to streamline information for developers, improve data provided through time series hosting capacity and load hosting capacity for EVs, and automate interconnection studies to significantly improve study turnaround time.

c. For the DMS implementation, the Company has a detailed testing plan that includes three phases (Factory Acceptance Testing, Pre-Site Acceptance Testing, and Site Acceptance Testing). Each phase has a defined testing strategy as well as scope of testing to be performed. The phases happen in sequential order with a period to perform the testing and resolve any software defects that are found. For each phase, there is entrance and exit criteria established to provide the project with a control mechanism to progress to the next phase.

d. The Company has, as mentioned, already deployed hosting capacity maps, PowerClerk, and GridTwin for developers and is now working on developing the requirements for the automated interconnection process as part of the 2022-2025 GMP. As for surveying other utilities that have deployed DMS, the Company interacts with multiple utilities through vendor user group meetings, industry conferences, as well as direct scheduled meetings with our counterparts. In addition, Eversource Energy has deployed a DMS in New Hampshire. Lessons learned from all these sources are combined and inform the plan for the Company's DMS deployment.

6. 2021 Recommendation: The Distribution Companies must internalize that ADMS will continue to be foundational for other programs and technologies (e.g., Distribution Automation, M&C, and VVO) and plan for this dependency in future technology implementation.

a. The Company agrees that the DMS is the foundational real-time system that other advanced functionality will be built upon. The DMS is a critical piece of the Company's overall technology roadmap in real-time systems.
b. The Company has actively planned around the implementation of the DMS. Since the DMS is a foundational system, it has been connected to other 2022-2025 GMP investments to ensure that those investments are being implemented with the DMS in mind. For example, the Company's plans to implement a DERMS has an integration into the DMS. Another example is the Company's plans to further deploy VVO functionality based on using the capabilities within the DMS. In addition, the Company continues to communicate with other programs to ensure full understanding of the DMS program and how all the other programs (e.g., distribution automation, M&C, and VVO) intersect with DMS. The Company has implemented cross-program communications to illuminate dependencies and possible resource cross-utilizations.
c. This recommendation has been implemented. The coordination of multiple investments with the DMS is critical to the overall success and will continue to be a focus point throughout the 2022-2025 GMP implementation time-period.

7. 2021 Recommendation: As the scope of ADMS implementations increases at the EDCs, continuing to capture, clean, and mature data is of paramount importance. The level of effort required to capture, clean, and mature data can become an impediment to successful ADMS implementation and managing this proactively is critical to success.

    a. The Company agrees with this recommendation as the DMS is heavily dependent on the quality of data and the level of effort required to maintain can be very challenging if not managed effectively from the beginning.
    b. Managing the level of effort in data capture and cleaning is a critical path item in the DMS project and will continue to be a priority as the program restarts following the GIS data delivery to begin data analysis cycle 4 and model build activities (all 2023 activities).
    c. The Company anticipates this recommendation will be accomplished during the implementation of the DMS project. With great dependencies on quality data, the project will continually manage the level of effort and efficiency of the data capture and cleaning efforts.

8. 2022 recommendations: No new recommendations were made.

C. VVO

1. 2019 Recommendation: To provide results for reporting of performance metrics in 2021, continue with rapid pace of VVO device deployment in early 2020 to ensure adequate data (specifically VVO On / Off data) are collected for the analysis.

    a. Eversource agrees to the recommendation for the 2018-2021 term and will apply it to the 2022-2025 term as applicable.
    b. The Company has taken the lessons learned from the challenges of the 2018-2021 GMP deployment and incorporated them into the planning and implementation phases of the 2022-2025 GMP term.
    c. The Company incorporated this recommendation into the 2018-2021 GMP deployment, and similarly, the Company has incorporated lessons learned from the first VVO deployment to continue the 2022-2025 GMP deployment.

2. 2019 Recommendation: Where possible, conduct VVO device deployment and VVO IT system commissioning in tandem to reduce the amount of time needed for post-deployment VVO commissioning.

    a. The Company agrees to the recommendation for the 2018-2021 and 2022-2025 GMP terms.
    b. The Company will commission VVO devices and VVO IT in tandem where possible.
    c. The Company planned to deploy the 2018-2021 GMP VVO devices and IT system commissioning in tandem. However, due to this system being a first-of-its-kind at Eversource, issue troubleshooting resulted in certain devices requiring multiple visits to ensure correct interoperability. For the 2022-2025 GMP term, the VVO IT system will be a part of the ADMS deployment. As such, the VVO IT deployment is dependent on the ADMS deployment.

3. 2019 Recommendation: Each EDC should discuss the role of load balancing, phase balancing in the deployment of VVO, and why neither were chosen to be conducted.

    a. The Company acknowledges the recommendation for the 2018-2021 and 2022-2025 GMP terms. For the initial deployment, load and phase balancing were not done specifically in the deployment of VVO. Distribution engineers regularly go through the exercise of load and phase balancing on feeders, and for the 2018-2021 GMP term, the Company assumed that all feeders VVO was deployed on were up to date with load and phase balancing.
    b. For the 2022-2025 GMP term, phase and load balancing has been included in the planning studies for each feeder.

c. This recommendation has been implemented and internal processes have been adjusted as needed.

4. 2019 Recommendation: Once VVO is ready for On / Off testing, the EDCs follow VVO On / Off cycling for at least nine months, covering one full summer, one full winter, and one of either the spring or fall shoulder seasons.

    a. The Company acknowledges the recommendation for the 2018-2021 and 2022-2025 GMP terms.
    b. The Company follows this recommendation as applicable, in parallel with lessons learned from the measurement and verification process of the stations deployed within the 2018-2021 GMP term, in consideration for the testing phase for the 2022-2025 GMP term.
    c. The recommendation has been implemented, and over nine months of data have been collected and provided to Guidehouse for evaluation. The Company plans to do the same in the 2022-2025 GMP term.

5. 2019 Recommendation: The EDCs should continue tracking complaints along feeders receiving VVO investment to ensure the analysis of voltage-related complaints is feasible in 2021.

    a. The Company acknowledges the recommendation for the 2018-2021 and 2022-2025 GMP terms.
    b. Voltage complaints continued to be tracked for the stations deployed in the 2018-2021 GMP term and are expected to continue to be tracked throughout the 2022-2025 GMP term.
    c. The recommendation has been implemented, and voltage complaints are tracked.

6. 2019 Recommendation: The EDCs should continue discussions with Guidehouse throughout 2020, as analysis of performance metrics will begin to be fine-tuned around nuances surrounding each of the VVO feeders, including: construction of baselines for analysis of performance metrics; distributed generation penetration, and effects of feeders with high penetration rates on analysis of performance metrics; and customer counts per feeder, especially where some feeders have <10 customers.

    a. The Company acknowledges the recommendation for 2018-2021 GMP term. It is not applicable for the 2022-2025 GMP because it references discussions in 2020 that are complete.
    b. When applicable, Eversource discussed with Guidehouse the analysis of performance metrics.
    c. The recommendation has been implemented for the 2018-2021 GMP term, and the results will carry forward into the 2022-2025 GMP term.

7. 2020 Recommendation: The EDCs should explore voltage setpoints to determine whether further voltage reductions can be achieved when VVO is engaged.

    a. The Company acknowledges the recommendation for the 2018-2021 and 2022-2025 GMP terms.
    b. During the measuring and vetting process of the VVO substations to be deployed during the 2022-2025 GMP term, the Company will investigate voltage setpoints to determine if further voltage reductions can be achieved.
    c. Further voltage reductions, where applicable, have been implemented on the 2018-2021 GMP substations.

8. 2020 Recommendation: The EDCs should identify whether there is an impact of reverse power flow from distributed generation on VVO operation. The impact of reverse power flow on VVO operation may have a significant impact on the evaluated performance of VVO for the upcoming spring and summer 2021 M&V periods.

    a. Eversource agrees with the recommendation for the 2018-2021 GMP term and has observed the impacts of reverse power flow from distributed generation on VVO operation.
    b. The Company will observe the stations deployed within the 2022-2025 GMP term to identify whether there is an impact of reverse power flow from distributed generation on VVO operation, similar to the process done for the stations deployed within the 2018-2021 GMP term.
    c. Reverse power flow from distribution generation has been seen to have a significant impact to VVO operation.

9. 2020 Recommendation: Guidehouse and the EDCs agreed to the plan for VVO On/Off testing to continue for at least nine months, covering summer (June, July, and August), winter (December, January, and February), and one of the spring (March, April, and May) or fall (September, October, November) shoulder seasons. To provide results for reporting of Performance Metrics later in 2021 and 2022, the EDCs should continue with this plan.

    a. Eversource agrees with the recommendation for the 2018-2021 GMP term and will apply it toward the 2022-2025 GMP term.
    b. The Company will work with Guidehouse to ensure testing requirements for the 2022-2025 GMP term are completed.
    c. On/Off testing has been implemented for the substations deployed prior to 2022 and has continued for the full duration recommended. Based on feedback and communication between Eversource and Guidehouse, On/Off testing was further extended to ensure quality data for the evaluation analysis.

10. 2020 Recommendation: The EDCs should identify and take additional steps to balance load across feeders and phases before the deployment of VVO. This step can yield energy savings that could be attributed to VVO investment.

    a. Eversource agrees to this recommendation for the 2018-2021 and 2022-2025 GMP terms.
    b. Load and phase balancing has been incorporated into the planning process of the 2022-2025 VVO substations.
    c. The Company has implemented process changes into the VVO planning studies to further emphasize load and phase balancing prior to the locational analysis of field devices.

11. 2020 Recommendation: The EDCs and Guidehouse should work to update stamped-approved performance metrics after completing analysis of all VVO performance metrics, based upon methods included in this evaluation report.

    a. Eversource agrees with this recommendation for both the 2018-2021 and 2022-2025 GMP terms.
    b. Performance metrics have been updated for the 2022-2025 GMP term and will be reevaluated as necessary.
    c. The recommendation has been implemented. The Company updated its performance metrics in the response to Information Request DPU-EP-1-1 in D.P.U. 15-122. The metrics were further updated in docket D.P.U. 21-80.

12. 2021 Recommendation: Ensure that VVO On / Off testing is running according to plan, with limited pauses to the VVO On / Off testing schedule. A large number of data points across substations and feeders were removed due to extended pauses in VVO On / Off testing. Sustained VVO On / Off testing will increase the amount of usable data in the evaluation and improve the precision and accuracy of impact estimates.

    a. Eversource agrees to this recommendation for the 2018-2021 GMP term and will apply it where relevant to the 2022-2025 GMP term deployment.
    b. Eversource will continue to focus efforts in maintaining planned On/Off testing for the 2022-2025 GMP term.
    c. An extensive effort to engage internal stakeholders and maintain equipment and data quality has been an ongoing focus for the Eversource team. This effort aims to ensure the VVO On/Off testing runs according to the schedule.

13. 2021 Recommendation: Consider investigating how to improve outcomes across VVO feeders. The voltage reductions varied across the substations and feeders. Some feeders underwent no

material change in voltage, indicating potential VVO malfunctions, while other feeders exhibited sustained reductions in voltage when VVO was engaged. Both Eversource and National Grid should investigate how to better maintain sustained voltage reductions when VVO is engaged across all substations and feeders.

a. The Company agrees to the recommendation for both the 2018-2021 and 2022-2025 GMP terms.
b. Eversource has incorporated lessons learned from investigating the 2018-2021 VVO stations to the planning of the 2022-2025 GMP stations.
c. An in-depth analysis is currently being completed internally at Eversource to investigate the VVO performance across different feeders. The Company also consulted with the vendor of the VVO software as to how to improve VVO performance. Lessons learned for the 2018-2021 GMP term will be implemented during the 2022-2025 GMP deployment.

14. 2022 Recommendation: Ensure VVO On/Off testing is running according to plan, with limited pauses to the VVO On/Off testing schedule. Across the VVO feeders, one-quarter to one-half of data points were removed due to extended pauses in VVO On/Off testing. For some feeders, this resulted in the vast majority of provided data to be unusable for components of this evaluation (e.g., for estimation of distribution loss and power factor reductions). Sustained On/Off testing will increase the amount of usable data in the evaluation and improve the ability for Guidehouse to provide a comprehensive evaluation of VVO performance metrics.

    a. Eversource acknowledges the recommendation for the 2022-2025 GMP term.
    b. Beginning April 30, 2023, On/Off testing has ended and VVO has been enabled full-time. Eversource will continue to run VVO On/Off testing for upcoming feeders according to schedule unless system conditions do not allow for testing to safely continue.
    c. Abnormal system conditions and/or device failures at times required temporary suspension of on/off testing due to not meeting the device communication requirements necessary to operate VVO. Device failures are unforeseen. Where possible, the Company confirms the schedule throughout On/Off testing with all internal stakeholders.

15. 2022 Recommendation: Confirm adjustments to VVO On/Off testing schedule for any VVO feeders prior to implementation. VVO On/Off testing is designed similarly to a Randomized Controlled Trial (“RCT”), and adjustments to the testing schedule could, potentially, hinder the effectiveness of the testing design and cause biases to evaluation results. Ensuring there is proper balance in the number of VVO on and off hours throughout the evaluation period will allow Guidehouse to provide a comprehensive and accurate evaluation of VVO performance metrics.

a. The Company agrees with this 2022 recommendation and has implemented the recommendation for the 2022-2025 GMP term.
b. The Company followed On/Off testing as scheduled unless system conditions did not allow for VVO to be enabled. The nature of adjustments made to VVO On/Off testing based on unforeseen system conditions does not allow for them to be confirmed beforehand. To the extent On/Off testing can be confirmed beforehand, the Company does confirm the schedule with applicable parties.
c. The Company acknowledges there could be instances where On/Off testing was followed, VVO was considered ON, but VVO did not engage in active voltage reduction due to end of line voltage falling outside allowable system parameters.

16. 2022 Recommendation: Continue to investigate how to improve outcomes across VVO feeders. Many feeders across the EDCs underwent no material change in voltage. Correspondingly, energy reduction estimates were small-to-insignificant. These observations may indicate flaws in the VVO control scheme for these feeders. In order to improve VVO performance, Guidehouse recommends that the EDCs continue their efforts to investigate root causes to shortcomings in the VVO control schemes and work with distribution engineers and the VVO vendors to respond accordingly. If needed, Guidehouse can conduct in-depth case studies at these substations further understand shortcomings in the VVO control scheme.

    a. The Company agrees with this 2022 recommendation and will continue to apply it to the 2022-2025 GMP term.
    b. There have been occasions where On/Off testing was followed by the Company; however, the system did not engage in active voltage reduction.
    c. The Company continuously monitors the VVO system, has reviewed system control schemes and settings with vendor (Eaton) and held training as well. Additionally, the company coordinates regularly with internal departments to address issues withing the VVO scheme. A root cause analysis is conducted on problems as they arise. The Company adjusts as needed dependent on the result of the root cause analysis.

D. Monitoring & Control

1. 2019 Recommendation: Guidehouse should work with the EDCs to implement an updated data collection template and format, using experience gained during the Q2 2019 data collection process, to streamline data collection and make the process more efficient.

    a. This recommendation was made across multiple investment areas. Please see section V.A.1 for the Company's response.
    b. This recommendation was made across multiple investment areas. Please see section V.A.1 for the Company's response.

c. This recommendation was made across multiple investment areas. Please see section V.A.1 for the Company's response.

2. 2019 Recommendation: The EDCs should work with Guidehouse to develop a "case-study approach" to understanding reliability impacts due to M&C investments and help distinguish between how impacts are attributed to M&C vs ADA where these investments are deployed on same circuit.

   a. Eversource mostly agreed with this recommendation made during the 2019 evaluation. Case studies proved to be a useful way to demonstrate the benefits of Grid Modernization investments, and the Company is open to exploring how case studies can be used to measure reliability impacts due to M&C and/or other investments. The process to capture and analyze outage events that directly involves an M&C device or ADA device specifically deployed under a Grid Modernization-funded program is a significant task, as the Company does not have a mechanism to identify or tag a specific device within its operational systems so that it relates to the program responsible for deploying that asset (e.g., Grid Mod programs, base capital programs, large reconductoring projects, or weather-related events). Therefore, while the Company plans to continue performing case studies as part of the evaluation process, the Company does not fully agree it would be essential to seek out specific events on feeders with more than one Grid Modernization-funded device type.
   b. Eversource considered this recommendation in all subsequent years after the recommendation was made and continues to consider this recommendation into the 2022-2025 GMP term. The Company plans to continue to work with Guidehouse to perform case studies as part of the Massachusetts Grid Modernization Report Program Year 2023 Evaluation Report for the Monitoring and Control investment area, which Guidehouse expects to deliver in Q2 2024.
   c. Eversource worked closely with Guidehouse to complete several case studies on ADA and M&C investments in the evaluations after this recommendation was made, and the Company expects to continue that process for the 2022 evaluation. During the 2021 evaluation process, Guidehouse performed an M&C case study on an outage event that involved both ADA and M&C investments deployed under Grid Modernization programs. This case study can be found in Guidehouse's Massachusetts Grid Modernization Program Year 2021 Evaluation Report: Monitoring and Control Section 5.4 Case Study 3. While the case study highlighted the benefit of the Circuit Breaker SCADA program, the case study also involved an underground tie switch from the 4kV Oil Switch Replacement program, which was used to restore power to customers.

3. 2019, 2020 and 2021 Recommendation: The CKAIDI and CKAIFI reliability-related Performance Metrics as defined have deficiencies in measuring the effectiveness of Grid Modernization Investments. Many factors unrelated to the Grid Modernization investments will affect these metrics in any given year, and it is not possible to distinguish among these factors using the metrics. For example, the variation in storm activity between years can cause

significant changes in these metrics, as apparently happened in PY2020. Guidehouse recommends the following: a) Continue to track these Performance Metrics but establish other methods of isolating the specific impacts of Grid Modernization investments; and b) Additional Performance Metrics should be explored to determine if it is possible to capture the actual reliability performance attributable to the investments. Guidehouse notes that exploration could include: i) Reviewing the data and techniques necessary to understand the relationship between circuit reliability and weather conditions, vegetation management cycles and other reliability drivers that are independent of the grid modernization investments; ii) Expanding the use of case studies to cover a greater proportion of the investments—more outage cases examined on more circuits; iii) Leveraging new processes and collecting data to more efficiently perform outage case studies, and perhaps extrapolate these results to a broader set of circuits to understand investment performance with more certainty; and iv) Comparing number of customers out and customer minutes of interruption ("CMI") that occurred, with the number of customers out and CMI that would have occurred without Grid Modernization investments.

a. The Company acknowledges this 2019, 2020 and 2021 recommendation. The Company does have concerns with the accuracy of tracking some of the potential data points mentioned. Other data points, such as feeder length, customer counts, location, etc., are provided annually as part of Attachment B (Data Reporting Template) of this Report. The Company is open to considering other metric options through the currently on-going proceeding regarding performance metrics for the 2022-2025 GMP and AMI Investment Plan. As noted in other recommendations, the Company does not have a mechanism to identify or tag a specific device within its operational systems so that it relates to the program responsible for deploying that asset (e.g., Grid Mod programs, base capital programs, large reconductoring projects, or weather-related events).
b. The Company did not explore tracking the data mentioned in this recommendation beyond what is already provided in its Annual Reports and attachments due to the above-mentioned concern. However, after this recommendation was made, the Company did further leverage the case study approach where conditions could be identified and verified. The case studies also include reasonable calculations of CMI that occurred with the customers out and CMI that would have occurred without the Grid Modernization investment.
c. As noted, the Company further leveraged the case study approach because benefits were verifiable and quantifiable through studying individual outage events involving Grid Modernization devices.

4. 2020 and 2021 Recommendation: The use of currently defined CKAIDI and CKAIFI reliability-related Performance Metrics—which are circuit level metrics—has increasing challenges over time as circuits are re-configured or retired and new circuits are constructed. The comparability of each circuit in the program year to its baseline depends on that circuit not having been reconfigured or significantly changed (e.g., a normally open switch between circuit segments is changed to operate as normally closed, changing the customer counts and outage measurements on that circuit). The number of circuits that are comparable between baseline and program year

is reduced year after year as more circuits change due to ongoing operation of the system. Explore metrics that are robust to these operating changes to help ensure that Grid Mod investment assessment based on these metrics are not misleading, and that they are able to better capture the impact of the investment.

a. The Company acknowledges this 2020 and 2021 recommendation and recognizes that the CKAIDI and CKAIFI reliability-related performance metrics have increasing challenges over time as circuits get reconfigured or retired and new circuits are constructed.
b. As noted in the previous recommendation, after this recommendation was made, the Company did further leverage the case study approach where conditions could be identified and verified. The case studies also include reasonable calculations of CMI that occurred with the customers out and CMI that would have occurred without the Grid Modernization investment.
c. As noted, the Company further leveraged the case study approach because benefits were verifiable and quantifiable through studying individual outage events involving Grid Modernization devices. The Company is open to considering other metric options through the currently on-going proceeding regarding performance metrics for the 2022-2025 GMP and AMI Investment Plan.

5. 2020 and 2021 Recommendation: Current metrics do not provide an understanding of how M&C and ADA investments facilitate easier interconnection, or more capacity, of DER added to the system. This observation has been made previously, and this recommendation was made last year, but bears repeating. Consider developing additional metrics and/or performing pilot projects that utilize the installation of ADA and M&C investments at DER locations to understand the value or benefits that are provided. This would provide actual data on the effectiveness of these investments to support DER integration.

a. The Company agrees that ADA and M&C type investments at utility scale DER locations are required to provide the granular data to be able to monitor and control DER and that such projects are needed to build this capability. The recommendation to develop additional metrics to determine the value of this equipment at DER locations to facilitate easier interconnection is difficult to quantify. The ADA and M&C investments are for equipment to enable better monitoring and control, and the use case to be able to facilitate more DER on the distribution system is to be able to curtail output during specific periods of time.
b. The Company did consider the recommendation to build a pilot project to prove the value. One such project is the Company's investment in Dynamic DER Interface in the 2022-2025 GMP term. This project's scope is to deploy a device at DER facilities to provide the monitoring and control of the DER's smart inverters back into the Company's eECS.

c. The Company is currently planning out the Dynamic DER Interface project and selecting the specific locations to deploy the equipment to monitor and control.

6. 2020, 2021, and 2022 Recommendation: Case studies show detailed functioning and impact of GMP devices, and they are proving to be a useful tool in understanding the effectiveness of the Grid Modernization investments. Based on case studies performed, the M&C investment is yielding reliability and service delivery benefits to customers for each of the Distribution Companies. Guidehouse makes the following recommendations: a) Continue to perform case studies in future evaluations, and increase the use of case studies where practicable, to analyze the mitigation of customer outages and help determine the effectiveness of Grid Modernization investments in improving reliability and service delivery; and b) Continue the deployment of M&C technologies as part of the Grid Modernization Program and continue to monitor progress (including through amended or additional metrics to be determined by the Department).
    a. The Company agrees with both parts of this 2020, 2021, and 2022 recommendation.
    b. The Company continued to work with Guidehouse to perform case studies and plans to continue that process for the 2022-2025 GMP evaluation process. On November 9, 2023, the Department issued a memorandum directing the Companies to make certain revisions to their proposed performance metrics. The revisions included increasing the number of case studies and providing more information on case study selection criteria.
    c. The Company is currently implementing this recommendation through continued M&C investments as part of the 2022-2025 GMP. The Company is also working with Guidehouse to increase the number of case studies performed. The quantity of case studies and selection of case studies will be determined by Guidehouse as the evaluator.

7. 2022 Recommendation: On non-EME days, Eversource circuits with M&C investment showed lower (improved from baseline) average outage duration. Continue tracking and monitoring this investment area to try to verify the impacts (noting that the defined metric does not paint a complete picture as has been previously observed) on circuits receiving Term 2 investments as well as those that have received Term 1 investment (to understand the longer-term impacts of the investments over time).
    a. The Company acknowledges this recommendation, which is similar to some recommendations made in prior evaluation years. In the revised Grid Modernization Plan Performance Metrics approved by the Department on February 1, 2024, the reliability metric related to this recommendation was removed consistent with the Department's directive. This recommendation is no longer applicable.
    b. The Company considered this recommendation until this metric was removed for the reasons mentioned above.
    c. The Company is not implementing this recommendation for the reasons mentioned above.

8. 2022 Recommendation: On non-excludable major event ("EME") days, Eversource circuits with M&C investment showed lower (improved from baseline) average outage frequency Continue tracking and monitoring this investment area to try to verify the impacts (noting that the defined metric does not paint a complete picture as has been previously observed) on circuits receiving Term 2 investments as well as those that have received Term 1 investment (to understand the longer-term impacts of the investments over time).
    a. The Company acknowledges this recommendation, which is similar to some recommendations made in prior evaluation years. In the revised Grid Modernization Plan Performance Metrics approved by the Department on February 1, 2024, the reliability metric related to this recommendation was removed consistent with the Department's directive. This recommendation is no longer applicable.
    b. The Company considered this recommendation until this metric was removed for the reasons mentioned above.
    c. The Company is not implementing this recommendation for the reasons mentioned above.

9. 2022 Recommendation: Continue to track CKAIDI and CKAIFI reliability metrics but continue to perform case studies (for Term 1 and Term 2 investments as appropriate) and explore other methods of isolating the specific impacts of Grid Modernization investments (e.g., frequency of successful device operation).
    a. The Company acknowledges this recommendation, which is similar to some recommendations made in prior evaluation years. In the revised Grid Modernization Plan Performance Metrics approved by the Department on February 1, 2024, the reliability metric related to this recommendation was removed consistent with the Department's directive. This recommendation is no longer applicable.
    b. The Company considered this recommendation until this metric was removed for the reasons mentioned above.
    c. The Company is not implementing this recommendation for the reasons mentioned above.

VI. Company-Specific Reporting – NSTAR Electric

A. Advanced Inverters

In 2023, the Company completed the Southampton dynamic DER interface project, which was also where the Company planned to install advanced inverter technology. Ultimately, following detailed engineering review, the Company did not need to upgrade the existing inverters at Southampton in order for them to communicate and be controlled by the RTAC. Based on this finding, the advanced inverter project, as originally planned at Southampton, is not required to meet Grid Modernization objectives and the Company will not be pursuing this investment during the second GMP term. No tracked GMP costs were incurred.

B. Power Quality Monitoring

a. Detailed description of the technology implementation

The Power Quality Monitoring program will provide remote access and storage of power quality data so that detailed information from disturbance events can be evaluated by the Company's System Planning, Protection and Controls ("P&C") Engineering, and Distribution Engineering teams and shared with customers. Access to this type of information at select substations will provide the Company with a new set of very granular data that will both increase situational awareness of disturbances and provide insights into the downstream effects. Using this information, the Company will determine root causes and potential remediation measures, thus aiding commercial and industrial ("C&I") customers in providing appropriate situational awareness and/or developing mitigation strategies for disruptions that occur outside predefined thresholds.

This will be accomplished via the installation of Power Quality Monitoring devices and corresponding communications infrastructure to enable the collection and storage of power quality event data at the distribution circuit / feeder level. This will be accomplished via proprietary patent-protected SMART Block® equipment that is manufactured by Fischer Block Inc. and capable of waveform and RMS raw data capture via wave iQ™ software infrastructure. This Program specifically targets substations feeding large C&I customers in eastern Massachusetts where there is a record of power quality and disturbance event history impacting sensitive customer equipment. There is insufficient access to power quality information and event data at these substations currently, and this Program installs proprietary equipment that facilitates the collection and storage of this information. The Power Quality Monitoring equipment provides capabilities to capture data from the full duration of disturbance events. The equipment also cross-triggers and records data from all other station devices to provide a more complete collection of event data that can be extremely beneficial post-event analysis.

b. Information regarding data collection and analysis from the technology

The data collected through this investment allows for post-event analysis and evaluation by P&C Engineering to confirm correct protection system operations, and by the System Planning team to develop solutions, if needed, for out-of-specification voltage fluctuations that affect customers, particularly customers with sensitive load requirements. This event data can also be shared with customers to better

evaluate their protection, generation, and building system response to events that occur on the system. For example, the Company will be able to discern on which phase a fault occurred, how it propagated, etc. This data allows for sub-cycle monitoring and recording of events which, when combined with configurable triggering thresholds, provides automatic email notification to the subject matter expert personnel for both awareness and analysis.

c. Description of benefits realized as the result of implementation (including an analysis of the effectiveness of the technology in identifying the cause of the power quality issues of the C&I customers associated with the substation where the technology has been deployed)

The power quality data has helped the Company determine root causes of power quality disturbance events and potential remediation measures, thus aiding C&I customers in providing appropriate situational awareness and/or developing mitigation strategies for disruptions that occurred outside predefined thresholds. The company has gathered data from several disturbance events at station 819 since the installation of power quality metering devices and performed high level analysis. As part of our analysis, we were able to determine if our system operated within the industry standards defined by the Information Technology Industry Council ("ITIC") curve. Additionally, with the availability of power quality data that we previously did not have access to we have started to further analyze the disturbances. This effort will lead to potentially creatin a new threshold and/or determining solutions that will prevent the customers from being impacted.

d. Description of any actions taken to resolve the power quality issues the technology is deployed to detect.

Currently, the implementation of this technology at Station 819 from the 2018-2021 GMP is going through calibration and data collection. Although the Company utilized the data to provide insight into the nature of the event to one customer fed out of Station 819, the complete benefit will be achieved with the collection of multiple events, followed by determining potential remediation measures. Power quality monitoring devices that are included as part of the 2022-2025 GMP will be deployed starting in 2024.

e. Lessons learned/challenges and successes.

The initial development and deployment of the first power quality monitoring system during the 2018-2021 GMP positioned the Company to deploy additional 2022-2025 GMP power quality investments more efficiently. The Company has an existing relationship with the supplier of the monitors who has been engaged for the 2022-2025 GMP deployment. With regards to data collection and benefits, the internal key players and functional area support have been identified as part of the first station deployment and current processes used for the Station 819 deployment are scalable and are expected to be applied once future station monitors are deployed.

Material lead times spiked during initial scope development with the monitor vendor. Although this was mitigated through internal processes, lead times have since reduced to more typical values.

f. Actual v. planned implementation and spending, with explanations for deviation and rationale.

Figure 30 below shows the Company's 2023 capital and O&M spending, plant in-service, as well as projected amounts for the remainder of the term for the Power Quality Monitoring Program. Figure 31 below shows the actual and projected unit deployment. The units are presented as the number of substations.

Since the start of the 2022-2025 GMP term, $0.3 million of capital was spent and $0.1 million was placed into service on the Power Quality Monitoring Program. The updated schedule for the Power Quality Monitoring program did not include placing any units in service in 2023. Planned activities for 2023 included onboarding vendors and progressing through internal funding approvals for the portfolio. Actual expenditures in 2023 were significantly less than projected due to delays associated with modifications to the portfolio. At the start of 2023, two substations were replaced on the project list upon recommendation by The Energy Consortium to provide monitoring at substations that more heavily support their sites. In August 2023, a conflicting project at Industrial Park substation in New Bedford, MA was identified which required removal of the station from the portfolio. Throughout the remainder of 2023, a replacement substation was added following confirmation of benefit and formal vote by The Energy Consortium. To gain efficiency in performing these projects, the execution strategy has been to have a single vendor perform engineering for all Power Quality projects under one contract. The engineering contract issuance was delayed due to the changes to the portfolio but is now moving forward.

Figure 30 Power Quality Monitoring Capital, O&M and In-service Spending Summary (Shown in Dollars $)

Investment Category - Monitoring & Control (SCADA and PQ)						
Preauthorized Device Type - PQ Monitoring						
	2022 Actual	**2023 Actual**	**2024 Projected**	**2025 Projected**	**2022-2025 Projected**	**2022-2025 DPU Authorized**
Captial Spend ($)	64,284	219,563	3,074,000	267,000	3,624,847	
O&M ($)	-	-	88,000	-	88,000	
Captial Spend + O&M ($)	**64,284**	**219,563**	**3,162,000**	**267,000**	**3,712,847**	4,800,000
Plant In-Service ($)	64,284	-	2,608,922	951,641	3,624,847	

Figure 31 Power Quality Monitoring Unit Implementation Summary (Shown in Number of Units)

Investment Category - Monitoring & Control (SCADA and PQ)						
Preauthorized Device Type - PQ Monitoring						
	2022 Actual	**2023 Actual**	**2024 Projected**	**2025 Projected**	**2022-2025 Projected**	**2022-2025 DPU Authorized**
Number of Units	0	0	4	1	5	5

g. Performance on implementation/deployment

Not applicable for year ending December 31, 2023. No deployments occurred on the 2022-2025 GMP Power Quality Monitoring stations by December 31, 2023.

h. Key milestones

2022 Milestones

- May/June 2022 – Portfolio review of targeted stations to confirm applicability with Program initiatives and identify any overlapping capital work.
- July/August 2022 – Development of program level authorization documents and individual station initial funding requests.
- September/October 2022 – Approvals of program level authorization / individual station initial funding requests.
- November/December 2022 – Issuance of request for proposal package for engineering / design support and material services and contract negotiations with Fischer Block to support the entirety of the Program.

2023 Milestones

- January/March 2023 – Approved limited contract to Fischer Block for engineering development at five substations. Meeting held with Fischer Block to review lessons learned from Station 819 PQ Monitoring project.
- April 2023 – Initial development of IT/Communications infrastructure to support new portfolio of PQ monitoring devices at five substations.
- August/October 2023 – Site walkdowns at six substations occurred to review mounting requirements and develop equipment lists. Removed Industrial Park substation from portfolio due to conflicting project. Worked with The Energy Consortium to add K Street substation into the portfolio.
- November/December 2023 – Internal full funding approval. Development of RFP for Protection & Control and Substation Design Engineering services supporting the five projects.

i. Updated projection for the rest of the four-year GMP term

Refer to Figure 30 and Figure 31Figure 31 for the Company's 2022-2025 GMP unit and spending projections for the Power Quality Monitoring Program. The Company is projecting that the Power Quality Monitoring Program will be deployed at five stations by the end of the term and will stay within the authorized budget.

C. Substation Automation (Relays)

a. Description of feeder revisions or substitutions

With station walkdowns and constructability reviews completed in 2023, the project team has revised feeder counts for each station based on the construction feasibility and existing conditions / upgrades associated with non-GMP execution. The below table summarizes the original feeder counts as proposed in the initial 2022-2025 GMP filing submitted to the Department versus the revised feeder counts as a result of the project team's efforts to efficiently spend the capital allocated to the program. As noted in the below table, three (3) projects were cancelled in Eastern Massachusetts due to conflicts with planned projects at the sites which address the functionality of the relay protection scheme and due to the extensive costs required to achieve the upgrades at the station. Please reference the Substation Automation section of this Report for additional information on the cancelled projects. The table has also been revised to include feeders on three projects that commenced during the 2018-2021 GMP and that were placed into service at Stations 831, 53, and 34 in 2022.

Figure 32 Station Automation Station and Feeder Summary

Substation	**Original Units – Feeders (2022)**	**Updated Units – Feeders (2023)**
Silver (30A)	6	10
Amherst (17K)	8	12
Breckwood (20A)	12	18
Framingham (STA 240)	12	8
Canton (STA 470)	15	17
Brighton (STA 329)	30	28
Prospect (STA 819)	34	28
Andrew Square (STA 106)	32	32
Medway (STA 65)	8	0
Wareham (STA 714)	2	2
West Pond (STA 737)	5	3
Industrial Park (STA 636)	7	0
Roslindale (STA 13)	18	20
Commonwealth Ave (STA 36)	20	15
Jackson St, Newton (STA 369)	11	8
Rockingham Ave (STA 468)	11	8
Osterville (STA 913)	3	0
Maynard (STA 355)	5	5
Dedham (STA 20)	9	9
Lexington (STA 34)	0	14
Cambridge (STA 831)	0	8

Boston (STA 53)	0	34
Total	**251**	**279**

b. For each revision or substitution, explanation that it meets the requirements of grid modernization preauthorization, maximizes customer benefits, and is not a business-as-usual investment.

Each additional feeder revision identified above will be replacing the existing electromechanics relay at the distribution feeder level with an intelligent, micro-processing feeder relay per the Grid Mod Substation Automation scope of work to improve reliability, facilitate remote operations, and enable investments for predictive outage detection and adaptive protection capabilities.

Appendix A - Motion for Clarification and Reconsideration

1. Introduction and Background

On July 24, 2023, the Company submitted a Motion for Clarification and Reconsideration in D.P.U 22-40 and D.P.U. 23-49 (the "Motion"). The Motion was filed in response to certain determinations made in the Department's Phase I Order and Interlocutory Order on Scope of Proceeding and Motion to Dismiss issued on June 30, 2023. NSTAR Electric Company, D.P.U. 23-49, Phase I Order (June 30, 2023) ("Phase I Order"); NSTAR Electric Company, D.P.U. 22-40, Interlocutory Order on Scope of Proceeding and Motion to Dismiss (June 30, 2023) ("Interlocutory Order").

With respect to distribution automation costs, the Company requested the Department reconsider its decision to deny recovery of the 2022 distribution automation costs for accelerated cost recovery under the grid modernization factor ("GMF"). With respect to continuing grid-facing investments pre-authorized under the 2018-2021 GMP term and budget, the Company sought clarification that these costs do not deduct from the 2022-2025 approved investment budgets. The Motion remains pending before the Department as of the date of this Report. Because the Motion remains pending, the Company has complied with all directives set forth in the Phase I and Interlocutory Orders in its preparation of this Report, including all financial figures and Attachment B. However, as detailed below, the Company is also providing an alternative view of the costs incurred to-date for GMP investments.

In this Appendix and Attachment A, the Company provides the Department with an alternate breakout of the total Grid Modernization costs incurred by the Company in 2022 and 2023, as well as a cumulative view. Attachment A mirrors the formatting requested by the Department, however, delineates project costs by GMP term in which the Company originally planned and commenced capital spending. This includes an update on distribution automation program closeout costs and non-continuing grid-facing investment types pre-authorized under the 2018-2021 GMP term and budget. Inclusive of all investments pre-authorized under the 2018-2021 GMP, the Company forecasts spending to be well under the total GMP budget authorization for the 2022-2025 GMP term as projected in Report.

2. Distribution Automation

In Attachment A and Figure 33 Distribution Automation Costs below, the Company provides all costs related to Distribution Automation. This includes a total in-service cost of $2.7M as well as $885 thousand O&M incurred in 2022 and 2023 currently disallowed for recovery via the GMF and also excluded from the Attachment B and all financial figures throughout the 2023 Grid Modernization Annual Report. The budget overage on the program was originally expected to be covered by the budget underage on other 2018-2021 GMP investments.

Figure 33 Distribution Automation Costs

Investment Category - Distribution Automation								
Preauthorized Device Type - Various								
	2018 Actual	2019 Actual	2020 Actual	2021 Actual	2022 Actual	2023 Actual	2018-2023 Actual	DPU Authorized
Captial Spend ($)	3,199,810	29,640,184	14,052,735	11,675,378	268,672	194,703	59,031,482	
O&M ($)	378,981	202,184	294,423	608,530	895,847	758	2,380,723	
Captial Spend + O&M ($)	**3,578,791**	**29,842,368**	**14,347,158**	**12,283,908**	**1,164,519**	**195,461**	**61,412,205**	58,000,000
Plant In-Service ($)	1,887,576	28,064,800	13,459,202	11,714,999	3,496,419	389,915	59,012,911	

3. Attachment A

The Company has included Attachment A to provide the Department with its total grid modernization spending through 2023, inclusive of the DA costs and energy storage costs incurred over the energy storage budget. Accordingly, there are two factors driving the difference in the total cost in cell S46 from the Attachment B spending tabs (5a. 2022 Spending, 5b. 2023 Spending and 5e. Cumulative Spend) and the Attachment A tabs (5a. 2022 Spending, 5b. 2023 Spending and 5e. Cumulative Spend). These are costs associated with distribution automation as well as energy storage. In Attachment A, the Company has shown all costs associated with these investment categories, regardless of budget cap or in service date. For example, in Attachment B the Company only included costs on distribution automation work orders that were placed into service by the end of the first GMP term (i.e., through December 31, 2021). In Attachment A, the Company has included all distribution automation costs.

Appendix B – Outer Cape Energy Storage Project Update

1. Introduction

The Company filed a petition seeking to adjust its base distribution rates in Docket D.P.U. 17-05, including a proposal to adopt a grid-modernization base commitment ("GMBC"). The Department declined to adopt the Company's GMBC proposal with the exception of approving the Company's investment in energy-storage system demonstration projects and electric vehicle charging infrastructure, D.P.U. Final Order on November 30, 2017 NSTAR Electric Company and Western Massachusetts Electric Company d/b/a Eversource Energy, D.P.U. 17-05, at 470, 501-502 (2017). Specifically, the Department approved a Martha's Vineyard energy storage project with a phase one budget of $15 million and a Wellfleet energy storage project (now referred to as the "Outer Cape Project") with a phase one budget of $40 million with eligible costs to be recovered through the grid modernization factor established in D.P.U. 15-122. D.P.U. 17-05, at 470.

The Company completed the second and final phase of the Outer Cape Project on December 1, 2022. The Company included the costs associated with the Outer Cape Project in its annual grid modernization cost recovery filings, including the 2022 cost recovery filing submitted to the Department on May 15, 2023 and docketed as D.P.U. 23-49. The Department's June 30, 2023 Order allowed recovery through the Company's grid modernization factor, subject to further investigation and reconciliation, of the costs incurred up to the $40 million budget cap. D.P.U. 23-49, at 25 (2023). The Department further disallowed "at this time" the amounts incurred by the Company that were in excess of the $40 million budget cap. Id. The Company filed a motion for clarification and reconsideration on July 24, 2023 in D.P.U. 23-49. With respect to energy storage costs, the Company requested clarification regarding when the Company should seek recovery of the energy storage costs incurred beyond the $40 million budget cap. D.P.U. 23-49, Motion for Clarification and Reconsideration at 14-16. The motion remains pending before the Department. Accordingly, the Company is providing this update on the additional costs incurred during 2023 that will be included in that future cost recovery. The additional costs incurred during 2023 were incurred for vendor payments and close out items (e.g., punch list items).

2. Background Information

The Company provided a summary of the Outer Cape Project work in its 2022 Grid Modernization Annual Report submitted in Docket No. D.P.U. 23-30. As detailed in the 2022 Grid Modernization Annual Report, Phase I of the Outer Cape Project was completed on May 31, 2022. Phase II of the Outer Cape Project was completed on December 1, 2022.

As detailed in the Company's 2022 Grid Modernization Annual Report, the Outer Cape Project has improved the reliability of the electricity supply at the Outer Cape, a unique area with only one distribution line serving the communities (Circuit 96). The project is also able to supplement the additional load required during the peak summer tourist season.

Eversource has greatly increased its knowledge base and capability to execute future battery energy

storage system ("BES") and microgrid projects. The knowledge harnessed and innovative methodology can be utilized on other types of new and innovative technology projects. The Company has documented many other lessons learned in prior annual reports.

3. 2023 Energy Storage Costs

The Company's 2022 Grid Modernization Annual Report detailed the costs incurred on the Outer Cape Project through December 31, 2022.

The Company incurred costs totaling $1 million during 2023 related to its Outer Cape Project. These costs are due to vendor payments and close out items. Figure 34 below is updated to include the costs incurred through 2023 and projected costs for 2024. The projected costs for 2024 include additional vendor payments and close out items. Costs incurred during 2024 have also included expenses incurred in relation to an on-going system analysis, as well equipment repair and/or replacement costs that the Company is working with its vendors to address. As part of this ongoing analysis, the Company is assessing whether any costs are the responsibility of its vendor and, if so, will reflect that appropriately in a future cost recovery proceeding. Further, as a result of this on-going investigation, the Company has withheld the final acceptance payment from the vendor until all issues have been resolved to the Company's satisfaction consistent with the terms of its vendor agreement. The Company has not, and does not plan to, include O&M charges associated with the ongoing maintenance of the BES beyond 2023. The Company also does not currently anticipate project costs beyond 2024 but notes that this could change as a result of the above-referenced analysis.

Figure 34 2018-2023 Provincetown Energy Storage Implementation Capital, O&M, and In-service Spending Summary (Shown in Dollars $)

Investment Category - Energy Storage									
Preauthorized Device Type - Provincetown									
	2018 Actual	2019 Actual	2020 Actual	2021 Actual	2022 Actual	2023 Actual	2024 Projection	2018-2024 Projection	DPU Authorized
Captial Spend ($)	624,690	1,725,950	15,362,063	22,350,958	11,860,874	1,068,697	1,800,000	54,793,232	
O&M ($)	-	-	-	1,697	1,884	50	-	3,631	
Captial Spend + O&M ($)	**624,690**	**1,725,950**	**15,362,063**	**22,352,654**	**11,862,758**	**1,068,747**	**1,800,000**	**54,796,862**	40,000,000
Plant In-Service ($)	-	-	-	1,662,966	47,784,030	2,993,138	1,800,000	54,240,134	

4. Energy Storage Metrics

The Company placed the BES into service in December 2022. As such the Company submits the initial set of annual reporting metrics on the BES as directed in D.P.U. 15-122, May 22, 2020. The below metrics report data in the calendar year 2023.

4. Defer 13 miles of distribution line through the Cape Cod National Seashore due to BES.

   a. Detailed explanation of the basis for its deferment projection for 10 years due to the BES.

b. Estimates of the avoided cost of constructing the 13-mile distribution line.

Baseline: No distribution line in service, no BES in service.

Results:

a. Detailed explanation of the basis for its deferment projection for 10 years due to the BES.

The Doosan Cape Cod Conceptual Design Report estimated the lifetime of the BES as 10 years, see D.P.U. 17-05 Attachment AG-32-3(c) page 23, hence deferring the need for an additional distribution line for 10 years.[18] Subsequently, this Doosan report was finalized, in D.P.U. 18-50 Attachment CLC-1-5(b) page 35, and estimated the lifetime of the BES at 12 years.[19]

The BES provides a new 25 MVA / 38 MWh supply station in Provincetown capable of carrying the entire radial 4-96-96 line for various durations based on load level. The added microgrid controller and sub-minute auto-restoration capability reduces outage sizes and durations dramatically. The BES and microgrid system address the reliability concerns that would have been solved by a traditional solution. However, the BES solution also allows for the deferment of a second 115kV transmission line as described below.

After filing D.P.U. 17-05, the Company confirmed the need for a new transmission line from Orleans to Wellfleet. This transmission line was driven by the need for increased system reliability in the area. The BES, alongside creative engineering evaluations, has negated the need for an additional transmission line to be constructed. Instead, a project which upgrades existing 4kV and 23kV circuits adds new capacity to the Orleans and Eastham area and relieves major area circuit 4-94A-94A was implemented as an alternative approach. This new 37 MVA circuit (4-83-83) permanently relieves enough load off the 4-94A-94A line that on loss of transmission the BES stored energy combined with the charging capacity of circuits 4-94A-94A in series with 4-94B-94B in series with 4-96-96 can carry all area distribution until the transmission line is restored.

b. Estimates of the avoided cost of constructing the 13-mile distribution line.

The estimated costs to construct a second distribution line in the area served by the BES was $27 million at the time of the initial filing in 2017. These costs are further explained in D.P.U. 18-50 Attachment CLC-1-5(b), page 17.

Separately, the Company is in the process of spending $10 million to reconfigure a distribution line in the same area. By installing the BES and spending $10 million on a distribution project, the Company will be

[18] https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/11338495
[19] https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/9738605

able to negate the need to spend an additional $40 million to construct a new transmission line.

The total cost to construct a new distribution line ($27M) and transmission line ($40M) necessary to achieve the similar benefit to the BES is an estimated $67 million. The total cost of the BES ($54.8M) plus the distribution project ($10M) is $64.8 million. Therefore, savings of avoided infrastructure are greater than the BES driven alternatives.

5. BES to improve reliability - The Company will support the annual reduction in Customer Minutes Interrupted ("CMI") for customers in Wellfleet, Truro, and Provincetown with the following data:
   a. A detailed analysis of any CMI reduction associated with operation of the BES and automated switching.
   b. Report CMI data during the calendar year for each feeder.

Baseline: The baseline for the analysis shall be established as the average annualized CMI for each feeder impacted by the BES for the 2018-2020 and annualized customer outage hours ("COH") for all large reportable events[20] for customers in Wellfleet, Truro, and Provincetown (Averaged from 2012 to 2019).

Feeder	Average CMI from 2018-2020	Average CMI from 2019-2021	Average COH from 2012-2019	Average COH from 2014-2021
4-96-96	659,439	908,364	2,548	6,909
4-96-669	43,626	43,071	379	457
4-675-971 (formerly 4-96-971)	53,234	99,740	457	965
4-675-974 (formerly 4-96-974)	124,868	166,103	557	1,536
4-675-675 (formerly 4-96-675)	127,732	94,148	5,123	5,466

Results

a. A detailed analysis of any CMI reduction associated with operation of the BES and automated switching.

As of December 31st, 2023, the BES has operated four times since commissioning in December 2022. The first event was on May 4, 2023, a blue-sky day. Operating the BES on this day avoided a 42-minute outage for 9,917 customers. Increasing system reliability by reducing CMI due to main line outages the radial 4-96-96 or at source station 976 in Wellfleet was a primary driver of the project. In addition to the blue-sky benefit the Company stated in DPU 17-05, ES-GMBC-1, page 81, the BES operated on a major excludable event day of December 18, 2023. These were the second, third, and fourth operations of the BES which

[20] The Company interprets the Department to be asking for the CMI and COH for the period in the baseline, including all large reportable events.

occurred during that one MED storm. The BES avoided multiple outages for 11,966 customers on that day. There was a 91% reduction in CMI compared to similar events had the BES and microgid not been in service. Similar events in previous years would have created a sustained outage for all of Provincetown, but with the BES in service only a few customers in the immediate area of the damage were impacted (see detailed report). Customers on the BES load island did not even see a momentary outage. Aside from reducing these "loss of supply" outages, the BES and microgrid have no effect on reducing incidental faults and outages that may occur beyond any fused laterals or tapped recloser laterals. These faults and outages make up most of the distribution system outages in this area but affect lower numbers of customers.

A more detailed analysis of these finds has been included in Attachment C of this docket.

b. Report CMI data during the calendar year for each feeder.

Feeder	2023 CMI
4-96-96	95,237
4-96-669	34,672
4-675-971 (formerly 4-96-971)	3,101
4-675-974 (formerly 4-96-974)	1,199
4-675-675 (formerly 4-96-675)	578,414

The BES started to realize benefits in 2022, therefore 2022 has not been included in the data above. Across all five impacted feeders, performance in 2023 was 60% better than the 2018-2020 average CMI and 69% better than the 2019-2021 average CMI. The performance on four out of the five feeders impacted by the BES has drastically improved in 2023. Specifically, in 2023 the CMI for three feeders is 15% or lower than the 2018-2020 and 2019-2021 averages. There is only one feeder that incurred more CMI in 2023 than the respective 2018-2020 and 2019-2021 CMI averages, 4-675-675. However, excluding two large equipment failure events and a lightning event which occurred on 4-675-675, the 2023 CMI of feeder 4-675-675 is 90,124 (lower than the average of 2018-2020 and 2019-2021).

3a. Power Factor Control - To support the metric measuring the annual number of hours the Company can control power factor close to unity for feeders serving Wellfleet, Truro, and Provincetown, the Company shall:

a. Identify capacitors in place prior to commissioning the BES, analyze the effect of these capacitors on power factor close to unity, and explain how this analysis informed the established baseline.
b. Identify the number of days BES was used to control power factor close to unity during the report year.
c. Number of hours the BES controlled power factor close to unity during the report year.

Baseline: The baseline shall be established as the calculated feeder power factor on the day prior to an event in which the BES was operated.

Yearly Average (Mean)	Power Factor[21]
2021	98.9%
2022	98.2%
2023	97.3%

Results:

a. Identify capacitors in place prior to commissioning the BES, analyze the effect of these capacitors on power factor close to unity, and explain how this analysis informed the established baseline.

Capacitor Banks Installed on BES Microgrid Circuits[22]						
Circuit	**Town**	**Pole #**	**Address**	**Control**	**Schedule**	**Size (kVAR)**
4-96-96	Truro	2/24	Highland Rd	Pager	9-9 Base	600
4-96-96	Truro	158/7	S. Hollow Rd	Pager	BASE 2	600
4-675-971	Provincetown	1/72	Commercial St	Pager	INTER 1	300
4-675-974	Provincetown	19/3	Winthrop St	Pager	INTER 1	300
4-675-974	Provincetown	65/3	Ryder St	Pager	INTER 2	300
4-96-96	Truro	36/1511	Rt. 6	Pager	PEAK 1	600
4-675-974	Provincetown	59/2	MacMillan Wharf	Pager	PEAK 1	300
4-96-96	Truro	9255/377	Shore Rd	Pager	PEAK 2	1800
4-675-675	Provincetown	2/79	Bradford Street	Pager	PEAK 2	600
4-675-675	Provincetown	9255/444	Snail Rd	Pager	PEAK 2	1800
4-96-96	Truro	36/1431	Rt. 6	Pager	PEAK 2	600

b. Identify the number of days BES was used to control power factor close to unity during the report year.

The Company has tested the BES for the ability to assist with power factor by adjusting voltage on the circuit. The results of the testing showed the BES is capable of assisting with power factor. In 2023 the Company did not deploy the BES to assist solely with power factor as it was not necessary in 2023. Each event in which the BES was deployed to support the system with energy and capacity it also assisted in power factor.

[21] The data used to provide power factor is based off SCADA data from the transformer at the Wellfleet substation. The Wellfleet substation feeds all feeders related to the microgrid and BES.
[22] The operating schedule is defined in Eversource OG-12B Distribution Capacitor Bank Control Guide.

c. Number of hours the BES controlled power factor close to unity during the report year.

The Company has tested the BES for the ability to assist with power factor. The results of the testing showed the BES is capable of assisting with power factor. In 2023 the Company did not deploy the BES to assist solely with power factor as it was not necessary in 2023. Each event in which the BES was deployed to support the system with energy and capacity the BES also assisted in power factor.

3b. System Loss Reduction - To support the metric measuring annual reduction in feeder line losses due to the operation of the BES, the Company shall:

a. Identify feeder line losses during the report year.

Baseline: The baseline shall be established as the feeder line losses under pre-BES conditions.

4-96-96 Line Losses[23]		
	2021	**2022**
Load Level	**loss (kW) & %**	**loss (kW) & %**
Heavy Load >17 MW @ 22MW	1822kW (6.27%)	1827kW (6.39%)
Mid Load 5-17MW @11MW	1007kW (7.59%)	1456kW (11.13%)
Light Load <5MW @ 4.5MW	686kW (7.00%)	756kW (7.9%)

Results:

a. Identify feeder line losses during the report year.

4-96-96 Line Losses	
	2023
Load Level	**loss (kW) & %**
Heavy Load >17 MW @ 22MW	1804kW (6.26%)
Mid Load 5-17MW @11MW	1548kW (11.71%)
Light Load <5MW @ 4.5MW	837kW (9.00%)

Line 4-96-96 was operating close to a unity power factor before the BES was installed and placed into

[23] Lines 4-96-669, 4-675-971, 4-675-974, 4-675-675 feed out of line 4-96-96. Line losses for all feeders are included in the calculations.

service. As of 2023, system conditions have not changed in a way that would require a need for the BES to control Power Factor.

3c. Peak Time Power Reduction - To support the metric measuring the annual reduction in feeder peak demand due to the operation of the BES, the Company shall provide:

a. Circuit ratings for all BES-impacted circuits.
b. Occurrence of feeder peak demand conditions (number of times and number of hours) and when BES was operated during these times.
c. Maximum Amps injected into the system to relieve the overload conditions.
d. The number of MWhs discharged by the BES during operation.

Baseline: No baseline as this metric measures a new BES-enabled value.

Results:

a. Circuit ratings for all BES-impacted circuits.

Feeder	2023 Feeder Capacity Rating (MVA)	Annual Peak Load (MVA)
4-96-96	36.53	21.09
4-96-669	1.24	0.19
4-675-971 (formerly 4-96-971)	4.91	1.93
4-675-974 (formerly 4-96-974)	4.07	2.07
4-675-675 (formerly 4-96-675)	15.80	12.44

More data related to these circuits can be found in Attachment B, '3b. Feeder Status-2023'

b. Occurrence of feeder peak demand conditions (number of times and number of hours) and when BES was operated during these times.

The Company has tested the BES for its ability to assist with peak demand on multiple occasions. The results of this testing showed the BES is capable of assisting with peak demand. In 2023 the Company did not deploy the BES to assist with peak demand as it was not necessary in 2023. If the need arises, the Company can deploy the BES.

c. Maximum Amps injected into the system to relieve the overload conditions.

The Company has tested the BES for its ability to assist with peak demand on multiple occasions. The results of this testing showed the BES is capable of assisting with peak demand. In 2023, the Company did not deploy the BES to assist with peak demand as it was not necessary in 2023. If the need arises, the

Company can deploy the BES.

d. The number of MWhs discharged by the BES during operation.

The Company has tested the BES for its ability to assist with peak demand on multiple occasions. The results of this testing showed the BES is capable of assisting with peak demand. In 2023. the Company did not deploy the BES to assist with peak demand as it was not necessary in 2023. If the need arises, the Company can deploy the BES.

Glossary of Acronyms

DA – Distribution Automation
ADMS – Advanced Distribution Management System
ALF – Advanced Load Flow
AMI – Advanced Metering Infrastructure
APS – Accounting Policy Statement
BES – Battery Energy Storage System
BTM – Behind the Meter
C&I – Commercial & Industrial
CAIDI – Customer Average Interruption Duration Index
CAIFI – Customer Average Interruption Frequency Index
CKAIDI – Circuit Average Interruption Duration Index
CKAIFI – Circuit Average Interruption Frequency Index
CMI – Customer Minutes of Interruption
CVR – Conservation Voltage Reduction
DA – Distribution Automation
DAC – Data Analysis Cycles
DDR - Data Disturbance Recorder
DERMS – Distributed Energy Resource Management System
DER – Distributed Energy Resource
DMS – Distribution Management System
DOER – Department of Energy Resources
DSS - Distribution System Supply
FERC – Federal Energy Regulatory Commission
eECS – Enterprise Energy Control System
EDC – Electric Distribution company
EMA – Eastern Massachusetts
EME – Excludable Major Event
ENGO – Edge of Network Grid Optimization
GIS – Geographical Information System
FAN – Field Area Network
FCC – Federal Communications Commission
FLISR –Fault Location, Isolation, System Restoration
FTE – Full Time Employee
FTM – Front-of-Meter
FTP – File Transfer Protocol
GHG – Greenhouse Gas
GMF – Grid Modernization Factor
GMP – Grid Modernization Plan
IT – Information Technology
ITIC – Information Technology Industry Council
LTC – Load Tap Changer
M&C – Monitoring and Control
O&M – Operation & Maintenance

PAF – Project Approval Form
PF - Power Factor
PLF IDE - Probabilistic Loadflow Integrated Development Environment.
PMO – Project Management Office
P&C – Protection & Controls
RCT – Randomized Control Trial
RFI – Request for Information
RFP – Request for Proposal
RTAC - Real-Time Automation Controller
SCADA – Supervisory Control and Data Acquisition
SOW - Statement of Work.
TCP –Transmission Control Protocol
TVI – Television Interference
VAR – Volt-Amps Reactive
VVO – Volt-Var Optimization
WMA – Western Massachusetts